2022 specification
first exams in 2017

Workbooks

for OCR Cambridge Nationals L1/L2 Tech Award

R050: IT in the Digital World

Publish your own work... Write to a brief...
Register at **publishmenow.co.uk**

Follow us on Twitter **@ZigZagComputing**

Contents

Teacher's Introduction

This resource has been written specifically for the OCR Cambridge National L1/L2 (2022) *IT*, M/618/6129, Unit R050 IT in the Digital World. Every part of the specification has been covered.

Great care has been taken to produce the four booklets:
- Topic A: Design Tools and Human Computer Interface
- Topic B: Data and Testing
- Topic C: Cybersecurity and Legislation
- Topic D: Digital Communications and the Internet of Everything (IoE)

Each of the booklets, provided in both A4 and A5 format, is designed to be photocopied for each learner and provide:
- Detailed course content with relevant examples
- Recap questions (write-on format with answers provided at the end)
- Discussion points that could be discussed in pairs or small groups
- Research tasks that can be completed at home to further the learners' knowledge and understanding

The booklets and tasks should appeal to, and are accessible to, all learners. The wide range of discussion points and research tasks endeavours to cater for learners who enjoy novelty and variety.

You could implement these within your teaching:
- By setting one or more booklets to read and complete the tasks as homework during the teaching
- By setting specific discussion points throughout your lessons; as starters to recap teaching from the previous lesson, or as plenaries to your current lesson
- For learning and reinforcement or revision purposes leading up to the exam; to identify gaps in knowledge and refresh learners' knowledge of the topics

I hope your learners enjoy these booklets as much as I enjoyed producing them.

July 2022

Workbook A: Design Tools and Human Computer Interface

Name: ....

Topic 1: Design Tools

Topic 1.1: Types of design tools

Put simply, design tools are methods and techniques used to develop
ideas. These methods can be hand-drawn and/or facilitated by compu
Each design tool has a specific purpose. A number of design tools are

Flow charts

We represent the steps that processes take from start to finish using a
creator to show how the system works. Flow c... s ow individual p
there are only two possible outputs (e... /e r...), and the flow of dif
However, it is hard to represe... ... ...plex systems with flow chart

Flow char... a ... used to represent loops, where parts of the sy
example, ... the next record, file or data for processing until all of
or to run parts of the process over and over until the necessary result

We use the following main symbols when drawing flow charts. But th
used. Remember to label each part of a flow chart, except arrows that

Category	Description
Terminator	Terminators represent the start and end of the process.
Arrow	Arrows connect each component and show the order/direction.
Data	Incoming or outgoing data from and to each process, e.g. from a file or database, human input.
Process	Something that is han... ...ii ...s part of the cycle, e.g. data is being ...ed, processed or altered.
Decision	A diamond shape is used to represent a decision point in the cycle. There are only two possible outcomes from a decision, usually yes or no (or true/false).

In Microsoft Word, a wider set of flow chart symbols can be obtained f
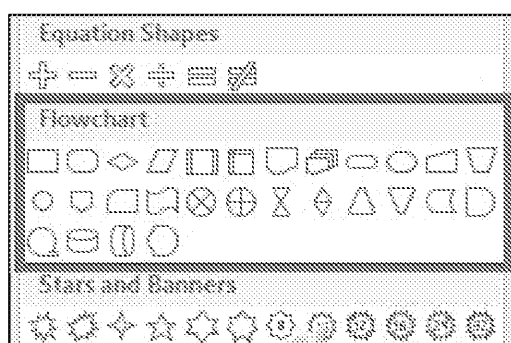
However, professional flow charts a͟re ͟ommonly drawn using sp
software, such as Lucidchart.

This softv͟͟n ͟͟ns all the necessary shapes and connectors, and t
automatic͟͟sized and aligned, and parts are 'snapped' together. T
manipulating the individual shapes in a word processor.
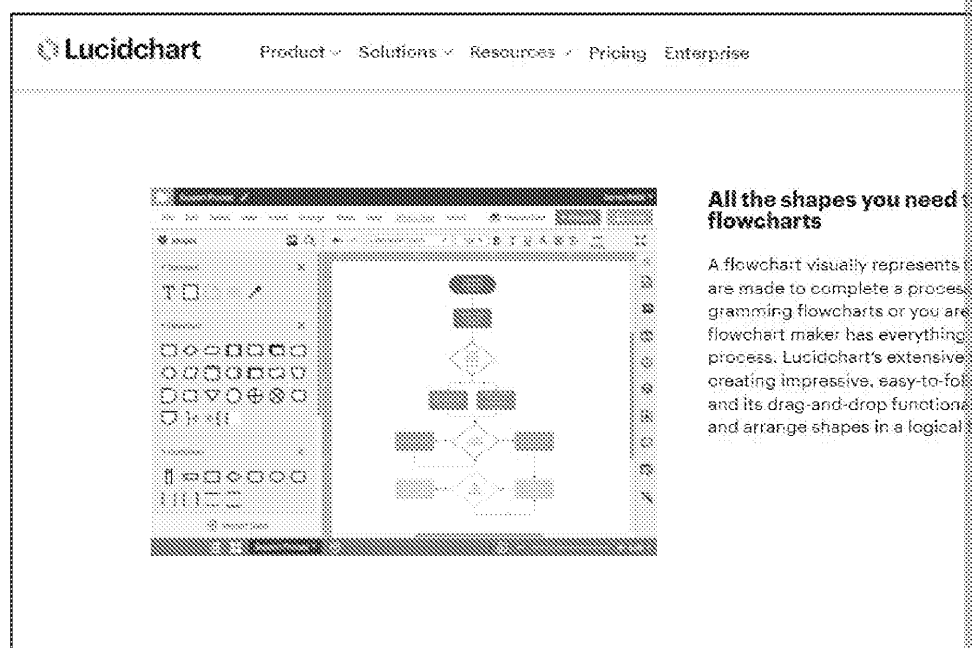
Taken from **https://www.lucidchart.com**

There are lots of examples of similar sof͟w͟re ͟͟͟ ͟here – have a look
you can find.

Task 1

The flow chart below shows the process of troubleshooting a non-work[...] be improved.

a. Add the missing 'Yes' label.
b. Add a decision to create a loop for if the lamp is plugged in as a[...] the troubleshooting and still doesn't work.
c. Add a decision to create a 'No' arrow to 'Buy new lamp' if the bu[...] and the lamp still doesn't work.
d. Add end terminators to the two decisions that you created.

Lamp doesn't work

Lamp plugged in? → No → Plug in lamp

Bulb burned out? → Yes → Replace bulb

No

Buy new lamp
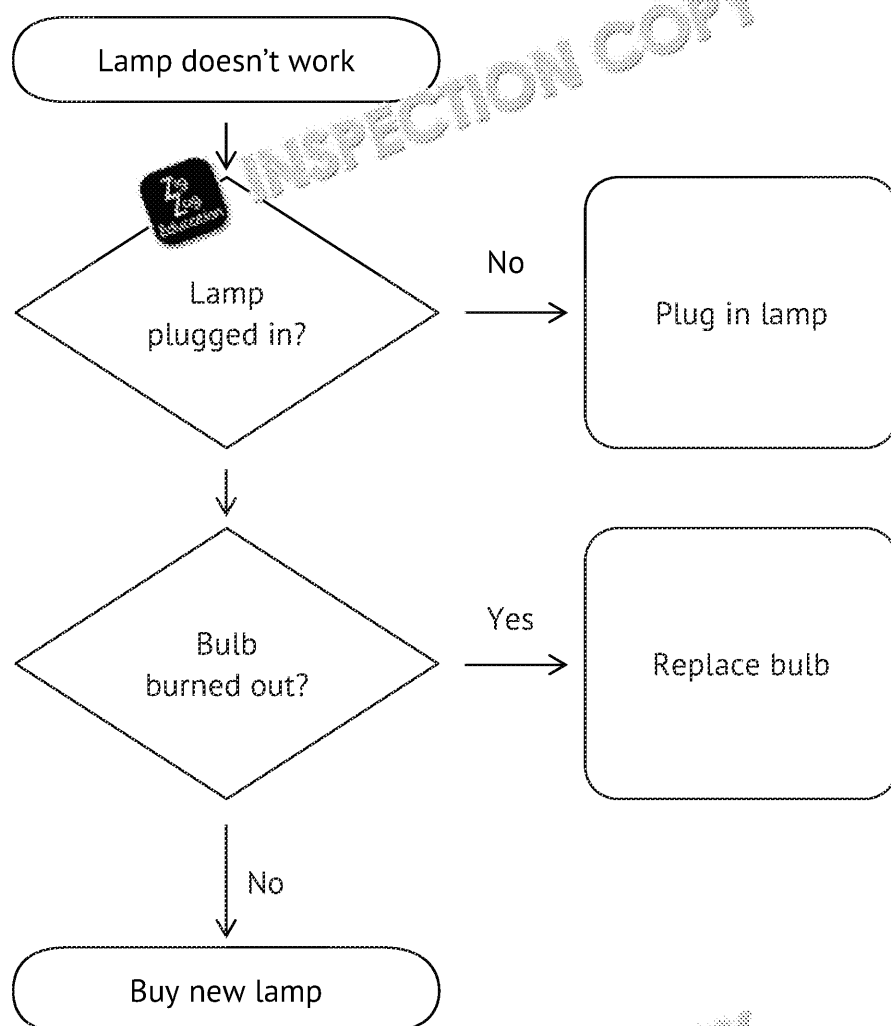
Task 2

Draw a flow chart to represent the following traffic light sequence:

* The sequence should start with a red light (indicating *stop*) being d
  after which point an amber light (indicating *get ready*) should app
  for a further 5 seconds.
* A green light should then be displayed for 30 seconds (indicating
* An amber light should then be displayed for 5 seconds (indicating
* The sequence should then restart.

Mind maps

You will have drawn and seen mind maps in many places. Perhaps yo
drawn one out to illustrate a topic, or for revision purposes. They are
and business settings to break down an issue, concept or topic into its
and are designed to replace text.

Here's an example of one which lays out the ideas on how to draw them
the centre, with branches outwards to different subtopics. As you can s
styles, with the line thickness decreasing towards the outside as the de
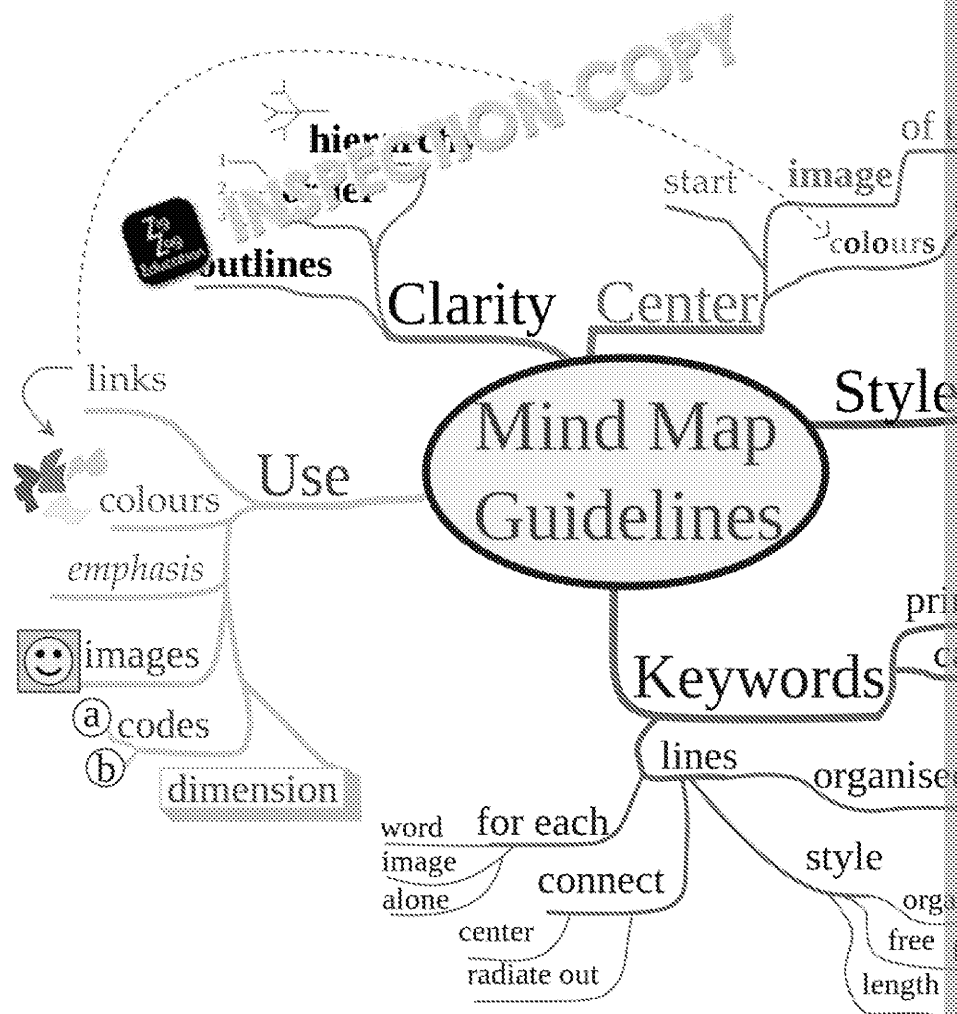
In a business setting, there are thr... types of mind map, each wi
* **Library**: For storing an... ...ng to knowledge, and explaining a t
  is similar to th... ...ple above.
* **Tunn... ...line**: For achieving successful desired outcomes within
  milest... ...s and problems to solve are included as next actions. Th
  the closer you are to reaching the desired outcomes for the projec
* **Presentation**: Used in large audiences and presentations – with th
  the centre point – for example, a problem that the audience need
  outwards, further detail is provided, and the map can be seen as a
  spur on staff to take actions.

Task 3

To find out more about these three types of mind map, see
https://duffill.blogs.com/beyond_crayons/2004/11/three_basic_ty

Can you find examples of each online? Make notes below.

....

....

....

....

....

....

It can be great fun to draw out mind maps by hand, choosing colour-c
clarify a topic within your head. But remember, don't spend too long
is precious. Some people find mind maps useful, while others don't.

Again, there are lots of different software packages that are designed
for you. You can also use a word processing or desktop publishing sof
longer than using dedicated software because the specialist software
tools at your fingertips and you can easily add extra boxes and text –
resized and rearranged on the page.

Task 4

When you have covered one of the topics on this course, sketch out a
software package or web app. For example, you can draw one in yo
https://www.mindmup.com

How easy is the software to use?

Visualisation diagrams

A visualisation diagram is produced early on in the project. The desig
the client or their project manager – they might h several different
there might be several refinements made a a e t of discussion wit

Visualisation diagrams in e s tcnes of how a product might look
software product g layout, graphic design for a cover or box a
graphics, ts fonts, colour schemes, logos and image placemen

Each component of the diagram is labelled (annotated) to explain wha
should look and perhaps what it does. The design team refer to this d
working on the project.

Visualisation diagrams are usually hand-drawn, but could be created dig
such as an iPad with a stylus, or a dedicated graphics tablet and speciali
are typically presented on a single page, utilising colour, font, images, g

Task 5

Take a newspaper or magazine front cover and make a quick sketch in order to recreate what its visualisation diagram would have been.

Or if you prefer, make a visualisation diagram of a product that you'⌇ it out on paper, or create a digital drawing.

Or you could buddy up with a partner. Each of you could produce a ⌇ same type of product – see how the diagrams have similarities and d⌇ judge which is better.

Wireframes

Make sure that you don't conf⌇⌇⌇ ⌇ ⌇⌇rame with a visualisation diagra⌇⌇ ⌇ ⌇⌇⌇rame shows the intended ⌇⌇⌇⌇ c⌇ ⌇⌇⌇en, such as a web page, user inter⌇⌇⌇⌇ document. Wireframes are drawn early on in the project. They are often drawn by hand with a pencil and ruler (often on squared paper) – a box to represent the page borders, with labelled boxes for titles, images and logos. Lines of text are represented by horizontal lines. They might be digitised, which is useful as they are easy to share and modify with the design team.
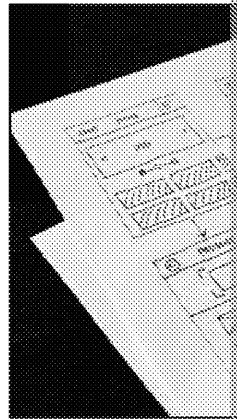
Wireframes are used later to produce a more detailed mock-up.

Task 6

Instead of designing a wireframe from the ground up, have a go at c[...]
might have looked like for a website or software package that you a[...]
example, you could have a go at creating one for the BBC home page[...]
you have a search online, you'll probably find the wireframe exampl[...]
Facebook and YouTube – take a look at these to see how they work. [...]
paper, or drawing or word processing software.
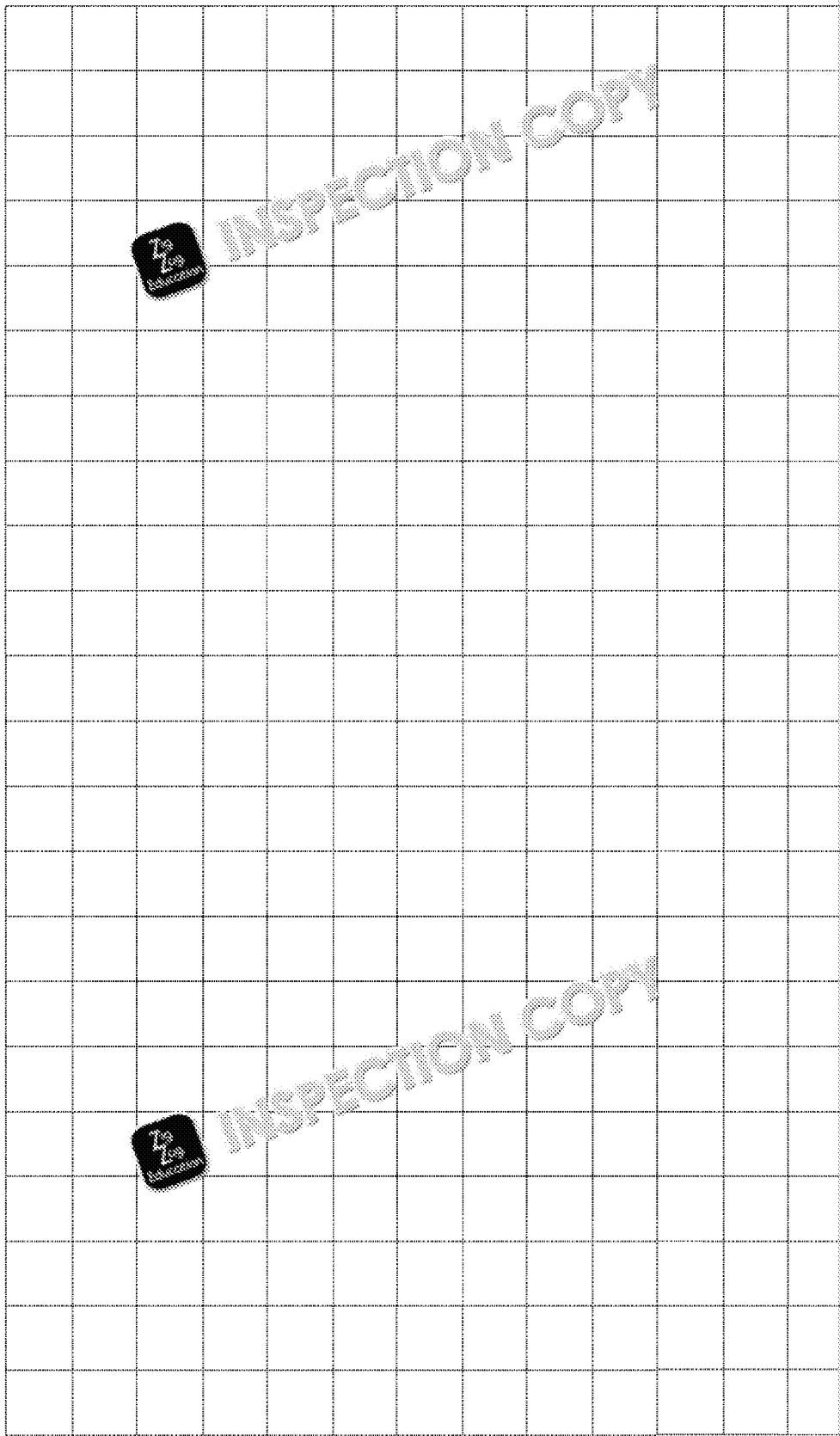
Topic 2: Human Computer Interface (HCI) i

Topic 2.1: The purpose, importance and use of HCI in

The human computer interface (HCI) is the way that we (humans) control a
interface) with machines (such as computers). But we're not just talking ab
computers. In the next few pages, you'll get to see specific examples gear

You will probably have interacted with machines already today. For ex
alarm clock or a phone to wake you up this morning. You navigated a
to set that alarm last night, such as the time an e er you wanted i
The machine made an irritating noise t v e u up, and then you ha
press snooze for 10 more prec es in bed, or to turn off the al
swiping. While you a you may have then scrolled through
your socia ia your phone or tablet, interacting with web p
tapping, o d on the TV by pressing buttons on the remote. When
phone, it probably gave a little buzz to let you know that it
had registered each press. You may have used your voice to
ask Siri or Google or Alexa what the weather will be like, and
have it read out to you. You might have used the microwave
by turning a dial, and it would have beeped at you when the
time was done. By now you may have sat down at a computer
and logged in, by typing in a username and password, and
moved a pointer around the screen and clicked on stuff with
the mouse.

Looking at those examples above, we can see that we interact
with machines using:
* Screens and printouts (including touchscreens)
* Audio
* Voice
* Tactile feedback (e.g. vibration)
* Keyboards and mice/trackpads
* ... and we'll mention gestures later.

Today, you're really lucky to use modern technol the interfaces h
Can you imagine using a computer witho ut r se? Or using a comm
and graphics on the screen, ju ? ed to open a program? Back
type in its name and p . Need to copy a file to external storag
done by ty c ile.doc b:oh, and don't forget the file nam
characters efore the extension − so you would have needed to b
file names. Now we don't need to remember commands − we just see
covered in icons and pictures that we click on and drag, and files can h

Banking

Banking includes managing and accessing your money, making payme
examples of HCI in the banking field:

- Online banking – through a web browser on a desktop or an app on
  your accounts – their details and balance – and view/download you
  transfer money between the accounts and pay other people. This is
  to go to a branch or write a cheque, and the sites and apps are usua
  due to security requirements, when paying someone you often need
  texted to you or use a card reader. If you press the back button on y
  logged out, and, unless you tell the site not to, you're automatically
  minutes of inactivity – annoying, but good if you accidentally leave

- Cashpoint (in America it is usually called an ATM – automatic
  teller machine). This is a machine for withdrawing money,
  checking your balance and making other changes. You first insert
  a debit card or ATM card to identify yourself to the machine.
  There is a screen and a keypad to enter your PIN and the amount
  of cash you want to withdraw. The screen shows a series of
  menus – and a series of buttons to the sides of the screens that
  line up with each menu. The menu changes after each press, and
  the same buttons correspond to the new menu. Most of the
  output is on the screen, but the machine beeps to tell you that the
  cash is ready to be collected, and reminds you to take your card. Y
  slip of paper with a receipt printed on it. The series of menus can
  especially if the buttons on the side don't quite line up with the o
  are added, they become more maze-like. Once you are familiar w
  to use, and much more convenient than queuing inside the bank, a
  banks are closed.

Discussion Point

When did you last visit a bank or building society in person? If you d
services do you use to manage your money?

PRACTICE

1. Explain one advantage and one disadvantage of the user inte
   cashpoints (ATMs).

   Advantage: ....

   ....

   Disadvantage: ....

   ....

Embedded systems

An embedded system is a microcomputer that forms part of a larger de
control the system and provide an interface for users to interact with i
found in a wide range of specialist and consumer devices, each with b
software interfaces.

Common examples of embedded systems that you
encounter on a daily basis include microwaves, washing
machines and GPS systems.

Another example of an embedded system is th trols
in an aeroplane cockpit. Lots of switches lights, displays
and levers – fantastically com to use and
interpret, and requiring very expensive training.
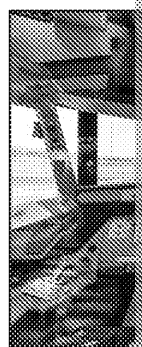
Entertainm

With so many types of entertainment, the examples are endless. Here
* Games consoles are plugged into a TV and use a specific gamepad w
  bumpers and triggers to play the games and navigate the on-screen
  be very complex to navigate and are not always intuitive. Once you
  it can be hard to switch to a different system. Small handheld cons
* Smart TV and tablet user interfaces make extensive use of icons to
  applications, as well as buttons and horizontal and vertical menu b
  banners for advertisements. Users are able to interact with the int
  technology, or using a conventional remote control. Some devices
  in, allowing users to use the system via voice commands – Alexa i

---

PRACTICE

2. Give one example of entertainment you have recently used. H
   HCI experience?

   ....

   ....
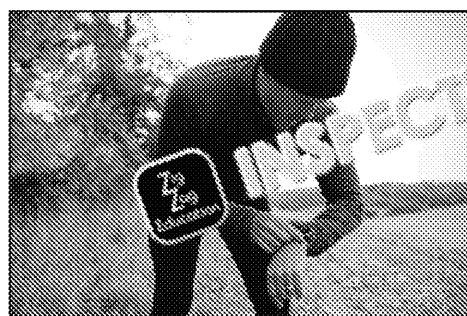
Fitness

ab technologies such as fit
onitors are now mainstream. Th
smartwatches or specific hardware
using Bluetooth. The complement
be used to view data and graphs, a
to improve your fitness. Some can

Discussion Point

Do you use any fitness trackers or apps? If you do, how easy are the

Home appliances

Wow, these have become complicated over the years! Many now have
control. We'll discuss their role within the Internet of Everything later

Take a look around your kitchen and see how you interact with each o
Perhaps you turn on the hob – if yours is electric or induction, it will p
to indicate which rings are on or hot, and a series of (touch-sensitive)
ring and adjust the temperature. It might beep when you press each b
definitely pressed it. Your oven will probably have a series of buttons
grill, etc. and to set the timer. There will probably also be a display to
temperature, etc., and a beeper will be installed. ve the kettle will
indicate that it is on – and that's probably the most basic of all applia

A good test of how easy a appliance is to use is discovered when you
to get out ns ion manual to use the oven, don't worry, it's not
symbols, a ctions might not be in the order that you expect.

Discussion Point

What types of appliances do you have in your home? Which are the
to use? Are any of them 'smart'?

PRACTICE

3. Why can home appliances be difficult to use?

....

....

Retail

Just like in leisure, there are lots of different examples, such as:

*   Websites and apps for browsing and ordering online, or setting up
    deliveries, click and collect, etc.
*   Ordering food and drink from the table of a restaurant using an ap
    ordering via a large touchscreen.
*   Using coffee/drinks machines.
*   Browsing and ordering from an elec ro ic catalogue.
*   Remember that the staff n e the till (often a touchscreen
    items and custom: ens), barcode readers, card payment
    take c o computers, etc.

Task 7

Over the next few days, make a note below of each of the different
Write down what parts of the interface you liked, and which bits you
about how each could be improved.

....

....

....

....

....

....

Discussion Point

After you have made a note of the different examples of HCI you ha
can make them up on the spot), discuss why each input and output met
advantage and disadvantage of the method.

Topic 2.2: Hardware considerations

Display

Types

There are many different types of display, and each one is suited for a
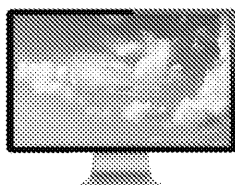
Colour LCDs (liquid crystal displays) are now the displays that you will see. They are the flat-scree televisions, laptops, computers, smartphones and an increasing number of appliances.

The screens on phones, tablets, smartwatches in some laptops are touchscreen (they are both input and output devices). You can press buttons, or swipe and scroll with your fingertip or sometimes a stylus. They use a membrane, often built into the glass, which turns the movement of your finger into a digital signal. Some are resistive displays, which feel like plastic. They are less sensitive but can be used with gloved hands and often many styluses, making them useful in industrial settings. Many are capacitive screens which are made of glass – but you need to touch them directly with your finger (the type most common in your smartphone).
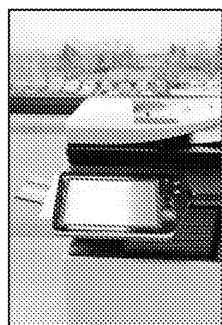
Small black and white (or monochrome) displays are such as printers, central heating systems, ovens and matrix or segment display, like older watches. If you motorway, you may see large LED (light-emitting dio monochrome to indicate messages and warnings to as advertisement displays.

Some e-readers use black text on a white backgroun simulate a paper book. They use a special e-ink whi screen is refreshed.

You may very rarely see the older type of TV and computer screen (especially sought after by computer gamers as there is no input lag) – the large CRT (cathode ray tubes which fire electron beams onto a glass tube coated with phosphor) that come in a big plastic or wooden box – hence the expression 'What's on the box tonight?', and probably club in YouTube. They were phased out because they were heavy and bulky and sometimes poor resolution, and could flicker and cause eye strain.

Task 8

Make a list of all of the screens in your home and what they're used f[...] centimetres or inches (if you don't know, measure them diagonally fro[...] right corner). Next to each one, comment on the type and size – woul[...] screen was bigger or smaller? Why?

....

....

....

....

....

PRACTICE

4. Explain why some screens need to be in colour, but some don't

....

....

....

....

Sizes

Apart from at the cinema, the largest display that you regularly see will probably be the television screen in your living room. As prices of large LCD displays have decreased, we've bought bigger and bigger television sets, and many homes now have UltraHD 4K sets. Such large and high definition sets are rarely required to watch TV or films, or for gaming, but the[...] just make for a better viewing experience. Fift[...]e[...]s ago, a 40" TV was considered massive; now th[...] [...]ta[...]ing size, with 60" models being common.

The next [...]st screen is probably on your desktop PC – probably 2[...] also attach[...] to your laptop. These sizes are great for general office applications, and for watching video and gaming.

The next smallest screens are on laptops and the larger tablets, betw[...] 17". While portable, they are not ideal for spending all day on office t[...] office use, video calling and web browsing.

Smaller displays are found in tablets, smartphones and smartwatches. websites and apps are customised to include a mobile version – using bigger text, big buttons, etc., and the sites are designed to be used by tap in a text box, the on-screen keyboard automatically appears, and t options appear. Most websites now have a mobile version, which is a browsing on a phone or tablet. Most phones are about 5" – there's a to fit a phone in your pocket, hold it in your hand and easily reach the versus the easier viewing on a larger screen.

The image below shows how the same interface can be designed to d screen sizes, such as a 24-inch computer moni... 1 -inch laptop sc 5-inch smartphone.

The smallest screens are often used in embedded systems and calcula or two across. They show specific information about the status of a de settings. A printer display may only have room for one or two lines of printer is ready, printing, or low on ink/toner. The displays are quite

---

Discussion Points

* What ...o ... ourite screen sizes for: watching TV, media and such a ...osoft Office and Apple's Pages app, and surfing the
* Examples of embedded systems include the output panel on a cer status panel on a printer. How many examples of embedded sys display types do they use?

  For example, you could discuss the evolution of the car dashboard and radio tuner, to modern cars which have a large console with Bluetooth pairing.

Task 9

Visit a web page on your phone that has a mobile version. Navigate
some text. Now turn off the mobile view (there is usually an option to
How does the experience change – can you read the text without zoo
navigate between pages? Make notes below.

....

....

....

....

....

....

PRA

5. Why is screen size an important part of HCI?

....

....

....

....

Did you know?

Many modern consumer displays use the 16:9 aspect ratio (the same a
professional displays are slightly taller at 16:10 – they are well suited
for a timeline. Tablet PCs use the squarer 4:3 aspect ratio, meaning th
– for an important HCI reason: that there's room for the on-screen key

Resolution is the number of horizontal and vertical pixels. The higher
things look on the screen. Running a small screen at a high resolution
uncomfortably small. But run a large screen at a low resolution and e

You may also be able to tilt your computer screen o make it portrait v
this means that you can fit more text on the screen at once, great for w
processing, coding and web browsing. However, because displays hav
rectangular pixels, small text can appear blocky because the thinner
are now thicker than they should be.

The Xerox Alto computer, pictured (the first graphical user interface),
used a portrait screen to simulate a sheet of paper.

Task 10

If you can, change the resolution of your computer screen. How does
suboptimal resolution – blurry, pixelated? If you can, increase the res
change the size of the icons?

Resources

Let's look at the impact that hardware resources such as memory (RAM
on HCI. You've probably experienced the frustration of using an old s
to run a modern operating system. The larger and more complex the
needs to be to make the experience enjoyable and without crashing a

The early personal computers used a command
line interface (CLI) such as DOS. This was
because they had very slow processors (maybe a
thousand times slower than today's machines) and
only a tiny amount of RAM – maybe less than
megabyte. There were precious few r
free to run applications, or e
interface (GUI). Progr
time to m
– unlike t
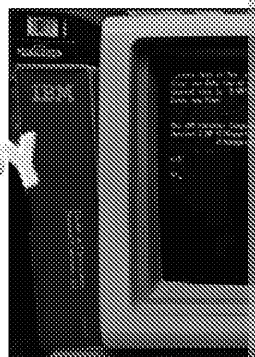
A command line interface is challenging to use, but very light on syste
runs fast on old or limited hardware. There are no icons or pointers on
an instruction manual, and, of course, your memory. You must learn d
with the appropriate syntax and switches. Early IBM PCs used to come
their own ring binder – you can see one of the manuals in the photo. (
system administrators because they provide a fast way of sending instr
can also make mistakes – a mistyped command could accidentally del

You still see CLIs very occasionally, in industrial processes and back-e
financial systems. You may also see CLIs still used by legacy systems
that are kept around because they're still useful without any need to u

---

Task 11

The CLI is still very much alive in Windows, macOS and Linux. Take a
prompt or PowerShell in Windows, or the terminal window on a Mac
file (or search online) to work out how to perform a basic task such as
navigating between different folders (directories) and listing the files.
task compared with when using the GUI?

P
r
you are more familiar
rface and the desktop metaphor
as a desktop where you can leave p
folders), or tools such as artist mate
There are icons for the things that
as a wastepaper basket (the recycle
can click on the icons to open them
afterwards. You can move things a
folders. Much easier to use, but req
power and more RAM.

Microsoft's Windows operating systems are the most commonly used o[...] they have always used GUIs. The name 'Windows' was chosen because applications to run in separate windows on the screen.

Task 12

Find out how much RAM and processing power your device has. This i[...] on the 'About' page. How does this affect the speed of your machine[...] the first IBM PC 5150 released in 1981(which ran a CLI)?

....

....

....

PRACTICE

6. Explain why most modern systems use a GUI.

....

....

7. Explain why we still use a CLI in some circumstances.

....

....

Did you know?

The first GUIs were developed by Xerox in California in the early 1970s and 1980s and ran on computers such as the Alto and Star. These were revolutionary machines, but the hardware struggled with the black-and-white bitmapped display, and the machines were phenomenally expensive. Apple produce_ a _ _ aper line geared to businesses and consumers, wi'h 's ' _intosh released in 1984 (a successor to its firs+ ____ n ____ne, the Lisa). These were some of the first _ _ _ _ _ to use a mouse, which we'll cover later. But ____e c _ _ _ _rs were resourceful – the first Macintosh only has 1____ RAM – the screen was monochrome 9" with a resolution of 512 × 342 pixels! That's a big difference from the colour 1920 × 1080 screens we use today.

Topic 2.3: Software considerations

Operating system

Today the most common operating system on desktop/laptop comput
Windows 10, followed by Apple's macOS. There's no doubt that you w
either or both of these.

Linux is a free alternative and has a good following with computer enth
distros are geared to be accessible to consumers with a GUI, it has a rep
use with more frequent use of the terminal. If you're interested in tryin
installing a popular distribution (distro) such as Mint or Ubuntu either a
live boot (a live boot doesn't install to your hard drive) – both can be bo
manager such as VirtualBox. If you've got a Raspberry Pi, you'll probabl

In fact, Linux was written clone (by Linus Torvalds and others – he
operating system called Unix, originally written by the American telep
Labs in the 70s. An off branch of AT&T Unix was 'Berkeley Unix', de
Berkeley in California. Today, you can download a free version called
many operating systems. Take a look at some of the differences betwe
https://www.softwaretestinghelp.com/unix-vs-linux/

Google has released a specialised Chrome OS, based on Linux, used on
Chromebooks, which rely heavily on the Chrome web browser and clo

Android (from Google) and iOS/iPadOS (Apple) are two dominant playe
smartphones and tablets. Modified versions of these user interfaces a
TV/streaming devices – examples include Apple TV, Google TV (Chrom

There is significant overlap in the design and core feature sets betwee
over the years there have been lawsuits over these similarities. If you
you will pick up another fairly quickly.

A key difference between these systems is the types of software. Softw
specific operating system and is then ported over to another. Some so
written for one system, especially if the software is written either by A
very small developer.

As you can guess, you interact with a desktop in a different way from a
these differences later.

Task 1

Take a look at which are the most popular operating systems in the U
https://gs.statcounter.com/os-market-share/all/united-kingdom – lo
desktop and mobile operating systems. How does this compare to the
do you think the UK statistics differ from the global data?

PRACTICE

8. Suggest why there is similarity between operating systems.

....

....

Digital platform

Below are four digital platforms that are used to interact with comput
with them in different ways.

For example, databases and spread ... a... typically viewed and use
computer with a large scre.. (p.. ...y a touchscreen). Mobile apps a
a phone or tablet (... .. ru..ning in an emulator), and websites are vi
some with ... us.. or touchpad to scroll, and others touchscreens wit

Databases are large stores of data – they can be huge, maybe storing
details of every customer that has used a supermarket and all of the it
that they have purchased using a loyalty card. We can then process ar
extract data so that it provides us with useful information. We can ha
single-table database (flat) or link together several tables for a relatio
database. Databases can run on a local PC, such as Microsoft Access, o
on a server (such as SQL).

We use some specific terminology – such as a *table* which is made up
which are several *fields* (*separate pieces of data, in columns*).

Let's go back to the supermarket – each time the cashier rings up an it
over a barcode scanner, this is recorded in the database. This allows th
computer to know how much stock is available and to automatically or
you swipe your loyalty card, the computer automatically records that y
allows the retailer to build up a better picture of who their customers a
also they can send money-off coupons for some of the items purchased

But databases can also be manually updated –
for example, if you were to phone up a busi... s
and put in an order over the phone ..
customer services rep will br..iu ..jorm
(example fields fr... .. ..al lab form are
pictured) ... t.. ... uatabase and type in the
details, an... ...up your account if you've never
bought anything from them before. Databases
can also be updated, added to or altered by
typing in commands.
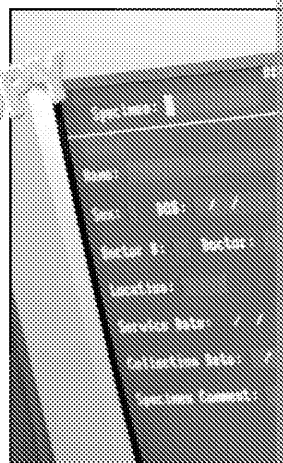
Databases allow lots of different users to input and extract data at the
spreadsheet. But they need lots of RAM and fast data access times.

Databases are incredibly powerful tools when *queries* are run to extra
could select data based on time, location, names, etc.

Databases that contain the names and addresses of customers can be
letters and mailings. When letters/mailings are created, the address fi
from a database. This is called *mail merge*.

Reports allow you to go even further and use queries to answer questi
profitable stores, or weekly takings.

Spreadshee~~ ~~re ~~ ~~ sic flat files and are more limited in size (esp
allow you ~~ ~~ ~~ ~~ually type in or copy in tables of data (often numerica
perform ca~~ ~~ations using small commands called *formulae* typed into
values in the spreadsheet cells change. More complex formulae can b
conditional formatting – when you change the colour, for example, whe
You will probably have used spreadsheets such as Microsoft Excel to r
by summing it up, calculate averages, input results and produce charts

Within each *workbook*, you can set up different *worksheets* – they shov
Each worksheet can contain unique data, but also data can be linked b
tell the spreadsheet in what format to accept and classify the data – s
dates, plain text, etc.

36				
37				
38				
‹ ›	Sheet1	Sheet2	Sheet3	⊕

READY

PRACTICE

9. Explain two w~~ ~~ ~~ ~~h databases and spreadsheets differ

....

....

....

....

Mobile apps have to be designed to run on a small screen and with finger input for scrolling, tapping and typing on a small on-screen keyboard. A Bluetooth keyboard and mouse might be compatible with the application. Therefore, the text size and layout will need to be tailored to the smaller screen. The buttons will need to be larger than on a desktop to allow a finger to tap on them.

Some versions of Microsoft Office are designed as on tablets and is much more basic than the desktop v ic there can't be many ic there is not enough room. So developers may remove features from reason. Typing on a tablet might be difficult on a small on-s wouldn't on phone for day-to-day office tasks such as typing

Discussion Points

* How does the mobile version of office suites compare to the deskt
* When playing games on your phone, how do the controls and ove that of a desktop or dedicated gaming console?

Websites may be viewed on any number of devices – including your s desktop, laptop, tablet and phone. You will often find that the page s screen. On tablets and smartphones, a mobile version might be show much simpler layout, and larger text and buttons.

Task 14

Try opening a web page on a desktop or laptop. BBC News is a grea size of the browser window several times. How does the page layout Does the number of menus change? Does the page turn into more of a

Topic 2.4: User interaction methods

We will now look at the actual ways that we interact with devices.

Gesture

There are a lot of different 'gestures' that we can use, which may be specific to a certain device. Gestures can be specific hand movements on a touchscreen or trackpad – such as pinching to resize or zoom, or using combinations of fingers, or holding or swiping from certain areas such as the top or bottom or corners. They can be used as shortcuts and to perform complex tasks.

On my Android phone, I can swipe down from the top to access a menu bar, swipe from the bottom right corner to bring up the camera, and even shake the phone to turn on the torch. Common gestures (and touch) can be seen on the diagram.
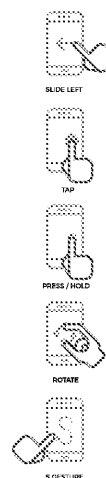
Some gesture input may also use a specific glove, sensor or camera to tr

Did you know?

Microsoft introduced gestures called 'charms' into its Windows 8 oper
innovative, Windows 8 was poorly received by customers. The tablet-
system with its tiled interface did not work well and Windows 10 was
desktop systems.

Task 15

Look at the manual for a smartphone or tablet that you own. Find out
Did you learn something new? A new way to activate the camera or

---

Keyboard

Keyboards are one of the main ways of inputting data into computers and phones/tablets. A keyboard is either a device with rows of buttons called keys, or it shows up on the screen when you tap into a data entry box. It includes the letters A–Z, the numbers 0–9, various symbols (!"£$%^&*-_=+'@#~/?.>,<`¬), and other keys. Pressing the Shift or Caps Lock key gives capital letters and activates the top symbols, numbers and symbol keys. Turning on Num Lock activates the separate number keypad to the right (if present), and some keyboards, especially laptops and short versions, include a function key that activates a virtual number pad.

Additional symbols not on a standard keyboard can still be inserted in
an insert symbol feature in software, or by typing in a special combina
key depressed.

Accessing symbols on a phone or tablet can be trickier – with less spa[...]
often separate menus used to access them.

The arrow keys can be used to navigate through the screen (and Tab c[...]
execute) instead of using the mouse. This is a quicker way of using a [...]
less hand movement. If you're a PC gamer, you will be familiar with th[...]
system which is a fairly recent diversion from the arrow keys.

Our computers in the UK use the standard QWERTY layout by default, [...]
typewriters. However, the layout can be changed within the operating[...]
keyboard if you're more familiar with a differer[...] [...], or a different [...]
is designed to speed up typing by putt[...] f[...]ntly used keys togeth[...]

Task 16

Try resea[...] a[...]ernative keyboard layouts such as Dvorak. You co[...]
how you g[...] with it!
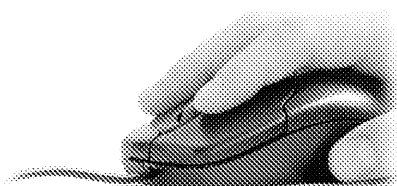
Mouse

A mouse is a pointing device. Movi[...]
desk with your hand, wrist and arm[...]
movement of the pointer (such as a [...]
cursor) on the screen. If your mous[...]
desk, you can pick it up and put it d[...]
pointer stays in the same place on t[...]
mice have a left and right (alternate[...]
swapped in the OS if you're left-han[...]
navigate through pages and docum[...]

A single click of the left mouse button selects whatever the mouse is [...]
clicking can open an application, holding down the button while drag[...]
holding the button down over selected objects moves (drags) them fro[...]
right button may bring up a context menu. If the mouse doesn't have [...]
click can be simulated by holding down a button on the keyboard.

Task 17

Try to interact with a comput[...] [...] using the mouse. For exam[...]
keys, and Alt+Tab to [...]ween applications. How easy was it?

PRA[...]

10. Suggest which is more important for input – the keyboard or m[...]
different tasks)?

....

....

Did you know?

One of the first computers to use a mouse was the Apple Macintosh in
Macintosh keyboard did not include arrow keys because the mouse wa
instead. This was very frustrating to many users, especially when ente
Later Apple keyboards included the arrow keys.

Also trackpads are available (especially on laptops) where you move y
Trackballs are similar to the old ball mice, just upside down. Instead o
you just spin a ball around with your fingers and the ball stays in the s
are also fitted with a small rubber nub in addition to the trackpad.

Touch

We have already mentioned t... ... ... touchscreens in tablets, smartp
some laptops, includi... ... ...ve and capacitive types. Hand moveme
by one or ... fi... ...

Voice

Because everyone talks differently, computers have had a very hard
time understanding us, especially if we have a strong regional accent.
In the early days of computing, voice control was used to dictate
documents because talking can be faster than typing and you didn't
have to hand a cassette tape to a secretary (but you had to have your
own office to avoid being overheard). However, the technology was
still in its infancy and you had to train the software to recognise
different words. You may have played games where you controlled
characters on the screen with a limited repertoire of commands.

Nowadays, a lot of the voice interaction with machines is done throug
smart speakers. We can ask them simple questions where they will lo
answer, or access apps and services you have installed. We can ask th
calendar, to set alarms and reminders, to order a product online, or to
example, I can ask my phone what the weather will be like today – it
an online weather service. Using a computer voice, the answer will be
can be done hands-free.

Even though the technology has advanced, and ... ...e services may use
cloud, voice recognition can still be hit ... ... Even if the software c
it might not understand what ... ...ing is.

Task 18

Try out voice recognition on a smartphone or smart speaker. Ask seve[...]
complexity. For example, a simple maths question, a simple fact, dow[...]
or the nearest supermarket, or why the sky is blue. Did it miss any wo[...]
your questions understood? Did it just recite part of a Wikipedia arti[...]
information useful?

Note down below what you searched for, and whether the words or p[...]

....

....

....

....

....

Discussion Point

Which methods of interacting with a computer or smartphone do you [...]

PRACTICE

11. Suggest a reason why some people turn off voice recognition o[...]

....

....

Workbook B: Data and Te

Name: ....
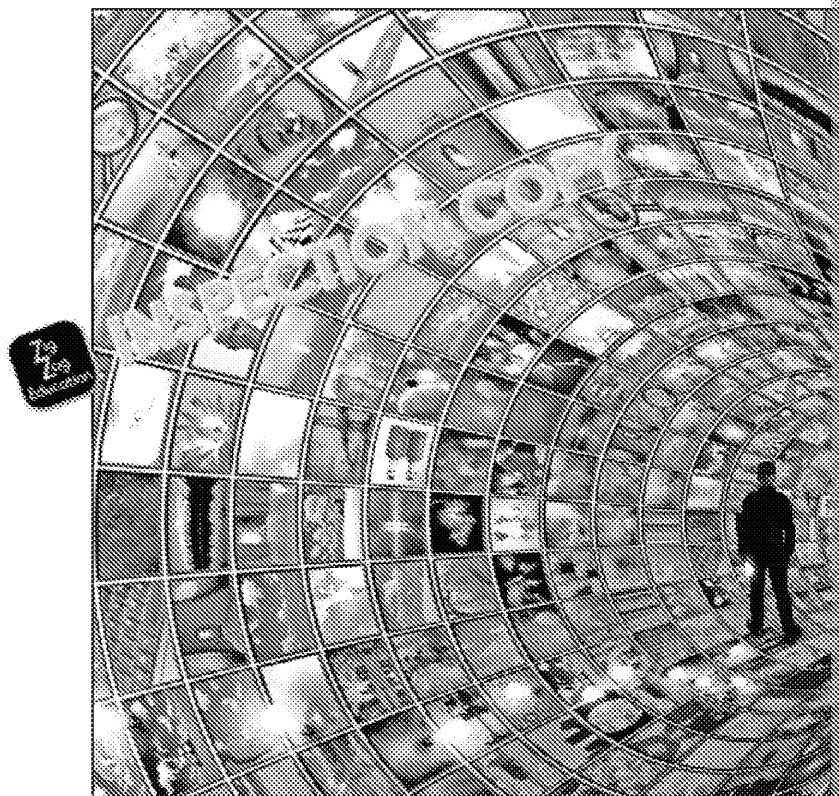
Contents

Topic 3: Data and Testing

Topic 3.1: Information and data

Data

We misuse the term 'data' all of the time, including interchanging it w

Data is just meaningless, unprocessed facts on their own. I could give
doesn't have any meaning or context (although you could probably gu
C13S015633 or 19810812?

As you can see, data can be made up of numbers, letters and symbols,

Information

Information is data that has structure, c nt xt and meaning.

Structure is the form of pr nta i n, e.g. from the examples above, 1(
numbers) although t s a year, you might be asked to input this i
structure 1 12 could be YYYYMMDD, i.e. it is 12 August 1981.

Now for so context in a different scenario. The data above shows
Now the context is that LQ-300+ is a model of printer, and that C13S0
spare part number for the ink.

The meaning of this is that if that's the printer I own, then I need to o
the ink dries up.

PRACTICE

1. How do 'data' and 'information' differ?

   ....

   ....

Data vs information

To turn data into information, we can use the formula:
information = data + [structure] + [context] + meaning

However, we might not need all of this if it's clear what the data relat
have a simple spreadsheet listing all of the printer models, the ink spa
number of spare cartridges in a business. Because there are headings
enough by looking at the table what the data show (i.e. that we shoul
for the HP LaserJet P1005).

Notice that because the different m tu rs use part numbers in d
would be difficult to stand se

Printer ke odel)	Cartridge manufacturer's no.	
Epson LQ	C13S015633	3
HP Deskjet 1000	CH561EE#UUS	7
HP LaserJet P1005	CB435A	0

Discussion Points

* Give five examples of data, then see how you can turn them in to
* Why do we misuse the terms 'data' and 'information'? Can you th
  we use the term 'data' (e.g. mobile data network, Internet data, e

Topic 3.2.1: Use of data types in different contexts

Depending on the types of data that you need to store, we can categor
that in Excel you can specify the type of data in each cell or column, et

---

Task 1

Open up a spreadsheet and type in some data including words, numb
(some starting with zero), dates, etc. Try changing the format from
general to text, number, date, currency, etc. See how the data chang
format, e.g. if you type in 01 in 'General' format, it will delete the ze
If you type in 01 when it's changed to Number fo   it will change t
1.00. If you type it in as Text, then the zer   m   as, but the number
to the left of the cell and not to the

Alphanumeric

Contains   (alpha) and numbers (numeric). Some definitions also
include symbols and spaces, which would make it similar to text,
although the spreadsheet might delete the zero if a number starts wit
zero when inputted as alphanumeric. You could store all sorts of data
in this style such as postcodes, part numbers, shelf details in a store
room, etc.

Boolean

Use Boolean when you only have two possible choices, such as yes/no
0/1 or on/off. For example, you might be storing details about wheth
equipment is in or out of service, or an interview respondent answers
yes or no to a question.

Date

The date that is today, or when something happened or is scheduled t
might keep a spreadsheet of when you installed updates to a system (
you can reverse the update), so you would input today's date, and sch
run the task. For example, you could use a format such as dd/mm/yyy

Numeric

Numeric data contains numbers – but we can subdivide this further:

* **Currency** – to store financial information such as in a sales databa
  company balance sheets, etc. e.g.   00.
* **Decimal** – a number with a decimal point, e.g. 4.82 – there are m
  appropriate when storing specific details about a product such a
  output   a calculation.
* **Integer** – any whole number (positive, negative or zero) – to be u
  possibility of a decimal point or fraction, etc. – you could say the
  5.5 or 5½ days.
* **Percentages** – any number with a % sign after it, which could be a
  used in many contexts, such as a breakdown of how you spend yo
  the discount in retail.
* **Real** – any number, can have a decimal point; for example, a mea
  world, such as the weight of an iceberg.

Text

This stores any kind of text data (letters, numbers, symbols and spaces). used for storing data that requires no calculation – for example, a nam number. When data is entered as text into a spreadsheet, it will be ig even if the data only includes numerical data. You would not use the numerical data that you want to perform calculations on or manipulat

Discussion Point

Think of at least three examples of where you should use text input in

PRACTICE

2. The number 7.3 cann̶ ̶ ̶ ̶ ̶ ̶ ̶ed as an integer. Explain why r of another w̶ ̶ ̶ ̶ ̶ ̶ data could be stored.

....

....

3. Suggest two types of number that might be included on a fina

....

Topic 3.2.2: The difference between validation and v[...]

Data validation is a way of making sure that the data that is inputted [...] obviously wrong, i.e. if it appears to be valid and in an expected forma[...] entering mobile telephone numbers, the system might check that they [...] typing in dates of birth, there shouldn't be any letters.

Data verification is slightly different. It is a check that the data is corr[...] the data is initially entered (e.g. if you need to change a password you[...] check both instances match) or as a further check later on (for exampl[...] contact details on file remain up to date). Sometim[...] we verify that d[...] copy it, by comparing the copy to the origin[...]

In the next two sections w[...] ove[...] ways of validating and verifying dat[...]

> **PRA[...]**
>
> 4.   Sum[...]se the difference between data validation and data v[...]
>
>   ....
>
>   ....

Topic 3.2.3: Data validation tools

Data type check
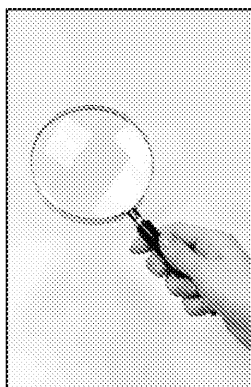
Checks whether the data entered is of the corre[ct]
entered into a date or age box, or that only num[...]
numerical fields. This would indicate that data [...]
wrong fields in a database, for example. Checks
is inputted, or a query can be run on a database [...]

Format checks and input masks

Checks of whether the data entered is in the cor[...]
expected combination of [...] or numbers. Th[...]
mask – using a [...]e. of characters to determine
number[...] c[...]ers entered.

The check[...] a [...] up whether too many or too few characters a[...]
there are [...] where numbers should be, etc.

For example, you could check that a postcode is entered in the specific
are not always the same length, it's possible to use different characters
for this, e.g. Bristol postcodes start with BS and Birmingham is just B. [...]
character must be a letter (which applies to all postcodes), and the sec[...]
a letter (e.g. Bristol) or left blank (e.g. Birmingham). The input mask w[...]
/ letter or blank (l) / number or blank (9) / number (0) / number (0) / let[...]

Task 2

Now that you know the difference between L, l, 0, 9 for input masks, [...]
– a letter or number, and a – a letter or number or left blank. Write [...]
masks; for example, for entering a car number plate (old and new st[...]
birth, etc.

....

....

....

....

....

....

Length ch[eck]

Checks eit[her th]at the exact number of expected numbers has been
inputted, or that the number of characters within a specific range has
been inputted.

For example, if you were measuring something where the answer is a[...]
would be for anything other than three digits. But for something like [...]
have either 5 or 7 characters, that range should be allowed. In reality[...]
characters for the check as people will usually put a space in the midd[...]
some won't, so the minimum still needs to be 5.

Limited choice

When there are only a few (most important) options that can be selected for quicker input, and standardise the answers for someone looking at th[e] online surveys, questionnaires and forms, and when making purchases o[r] selecting card expiry dates and checking the box to say that you have re[ad]

Here are three types:

* **Drop-down lists** – for example, when entering dates you will have numbers 1–31, Jan–Dec and several years as dropdown. Addresse[s] might have a list of counties or countries.
* **Radio buttons** – only one of several options can be selected. If yo[u] try to select a second option, the first i[s] deselected (think of an ol[d] radio or TV with physical butt[on]s – if you change the channel, the[n] the previously sel[ect]ed button pops back up).
* **Tick li[sts]** wh[en] you need to select two or more options. The first option[s remain] selected, unlike radio buttons.

Task 3

In the box below, sketch out what drop-down lists, radio buttons and t[ick lists]

[empty box]

Lookup

Lookup is a function in spreadsheets such as M[icr]osoft Excel which is [used to automatically add a val[ue i]nto [a c]ell from somewhere else in t[he] example, to retrieve the [price] of [an] item from a list stored in a differe[nt] This saves a l[ot] o[f time a]nd reduces the chance of errors from copying value onl[y need]s to be updated once if a mistake is found or an updat[e] used lookup functions in spreadsheet software are VLOOKUP and HLO[OKUP]

* HLOOKUP allows you to search a data range that is arranged *hori[zontally]* are located in a row across the top of a table of data
* VLOOKUP allows you to search a data range that is arranged *verti[cally]* located in a column to the left of the data you want to find

The Microsoft website has some really useful videos and examples sh[owing] work – go to **https://support.microsoft.com/** and type in 'VLookup'/'H[Lookup']

Presence check

This just checks that something is entered into a mandatory field (but doesn't check the validity of the actual data). When you use online for asterisk (*) next to some fields to indicate that some input must be en mandatory field, then the page won't let you continue when you click usually inform you which field you need to complete in order to conti

Range check

This is a check to remove data that might be incorrect because it falls range. Maybe you made a typo or used the wrong units. For example form and said I was 150 years old that would b. s. de of the expecte

Sometimes you may just be c' ... arning when entering data so th you've entered. Let's ... you are entering your family tree into so expects s... e ... marriage to take place when they are between you've got ... at aunt who married at 60. The software would flag u that this is outside the expected range in case you meant to type 30. because this is still possible. Being 150 years old isn't!

Discussion Point

Is a presence check on its own a good idea, or should there be a range

---

PRACTICE

5. Give two checks that could be used to make sure a password

   ....

   ....

6. Why might some questions in surveys use radio buttons to sele use tick boxes?

   ....

   ....

7. Give two fields in a data entry form that ... it use a presence

   ....

   ....

Topic 3.2.4: Data verification tools

Here are two ways of checking that the data inputted is correct.

Double entry

Simply typing in the same data twice and checking that the two sets match, or getting two people to type in the same data independently and checking for a match. If the data doesn't match, then the data will need to be entered a third time. But as this takes at least double the time, so does the data entry cost for the business. This reduces possible errors such as typos or human error.

Here are some examples:

* When you change ~~y~~ ~~s~~word you'll need to type in the new or made ~~ta~~ ~~ves~~ you needing to reset it again.
* When ~~g~~ in hand-written data sets – to make sure there are n~~o~~ data source.
* Captchas – when you're asked to prove you're not a robot, some o~~f~~ known to the computer to be correct. If 10 people mark an image a good chance that it is.

PRACTICE

8. Why can double entry verification be expensive to implement?

....

....

Task 4

There are lots of different projects online that allow volunteers to help old records. Because this is voluntary, there are fewer costs involved system. Some of these projects made the news asking for volunteers d lockdown when people suddenly had more free time.

Take a look at **https://www.zooniverse.org/** Th s me images and people to classify or type in – if sever~~al~~ p or agree, i.e. make the the same data, then the comput~~er~~ cc this as the correct answer. don't worry if you make ~~a~~ ~~str~~ke, as someone else will be shown the

Manual checking

A laborious and time-consuming task. Another person checks the dat

- This resource will have been proofread by an expert in the Englis
  typos and grammatical errors – the stuff that spellcheck misses, a
  meaning of the text is clear). Simple errors are corrected automat
  that is unclear, or obviously wrong, this will go back to me, the au

- An expert in the field will also be asked to read this work to chec
  their feedback and recommendations. In the academic world, this
  journal articles are published, they are given to several experts to
  arguments or methodology. This means that journals are accurate
  be as correct as possible.

- In business and government – doc..me t., .orms and IDs are chec
  they are sent out to the c...... .. if you get a prescription from y
  chemist will have .... of initials. One set from the dispenser,
  pharm.... w ... .iecks that what's in the box is what the doctor p
  prove

- Sometimes businesses will contact customers using alternative de
  that their records are up to date. This may be done when letters a
  emails bounce. For example, the business staff might phone up t
  email address.

PRACTICE

9. Give one advantage and one disadvantage of manual checkin

    ....

    ....

Topic 3.3: Data collection methods
Primary

Primary data is collected for a spe[...] *company.* Let's say that you wen[...] and measured the depth of river[...] went shopping. You did new, ori[...] specific purpose. Let's say that y[...] customer feedback, or is gauging[...] product launch.

In these cases, you have full control and ge[...] d [...] de what you need [...] going to get it, and how you're goir[...] [...] [...]yse it, and test whether th[...] your hypothesis.

Primary d[...] m[...] at a price – it can take you a long time to collate [...] business, t[...] money.

Let's look at several ways that you could collect primary data.

* **Email** – if you've got a customer database or the email addresses [...] email is a great way of asking respondents to agree to be intervie[...] questionnaire. If you ask the questions directly in the email, you [...] them into your spreadsheet or database software later.

  Unlike the postal service, where you need to pay for paper, printin[...] paid return envelopes, email is free or has negligible cost, even w[...] people. But remember that your emails are unsolicited so might [...] response rates could be low. Remember – anything online autom[...] who doesn't own a computer, smartphone or tablet or Internet co[...] much less common).

Discussion Points

* Have you ever received email marketing or invitations to complet[...] remember agreeing to receive the emails?
* What primary data have you collected at your school? What did[...]
---

* **Interview** – a formal discussion be[...]en [...] *interviewer*, who asks[...] notes on answers, and th[...] [...]ee, who responds to the questi[...] *qualitative*, i.e. w[...] [...] than numbers (*quantitative*). This mea[...] time-[...] m[...] [...] transcribe or input, but the level of detail and [...] Interv[...] an be conducted in person, via webcams, or just over [...] few people because of the high costs and long process. Here are [...] interviews are appropriate:
  o Undertaking *detailed research* to gain better depth. Interview[...] less rigidity than a form or survey, allowing further questions [...] The interviewer can build up a rapport with the interviewee, a[...] able to gauge whether the interviewee understands the quest[...] and changing later questions as necessary.

o A *job interview* – while paper forms, CVs and cover letters are
   dozens or hundreds of candidates to the few most promising o
   always part of the hiring process. Sometimes there is a teleph
   followed by a face to face. A business will spend a
   lot of money training you to do the job, so they want
   to be sure that you are capable, honest and
   trustworthy (and will hopefully stay with them for a
   few years). Interviews allow the candidate to
   elaborate on what they've said on their CV and
   impress the hiring manager. But job interviews work
   both ways – the candidate gets to ask questions too,
   to find out exactly what the job involves and to get a
   feel for the company and its culture.

Task 5

Take a look at some common job interview questions online for a job
might be interested in working in. Can you work out why those questi
qualities are the companies looking for? Make notes below.

....

....

....

....

....

....

PRACTICE

10. Give an advantage and a disadvantage of interviews.

....

....

* **Online questionnaires and surveys** – customers, or anyone who has
  are sent links to online forms to fill in. These can be created and dis
  platforms such as Microsoft Forms or Survey Monkey. Sometimes th
  such as the chance to be entered into a prize draw, as compensatio
  asked to take part in a customer satisfaction survey when you dine
  are often printed on the receipt and the business uses your feedbac

  Surveys might be shorter and less detailed than questionnaires an
  contain more closed numerical, binary or limited-choice questions
  there will be a few open questions, such as an optional box asking
  other comments. Questions may include ranges (e.g. on a scale of
  being very dissatisfied and 5 very satisfied). Writing questions wit
  can be tricky, and you may want to consult with an expert and tes
  questions on a few people before you go out and do the survey to
  that they understand the questions.

Task 6

Next time you're at a restaurant or supermarket, look at the receipt an
survey to complete. Work out what the survey is for, and whether ther
do it. You may need to ask your parents or guardian to actually fill it

Secondary

Secondary data is collected by someone else for their purpose (which might not be the same as yours). Someone else may have already analysed the data, or it might be available as their raw data. You can use secondary data to contrast with and compare ag??nst your findings. But beware, the data might be old ?? ?? ?at?d or irrelevant to your study, or a flawed or differe?? ?? a ??????tion method that you might not know about may h?? ?? ?? ??used. On the plus side, the data is readily avail??? ?? ??c??mes free, or at a minimal cost. It doesn't us? ta ????g to collect or input – with any luck, you'll pro spreadshe?? ??r the Internet. By doing some research into who colle to judge how reliable it really is. If you're researching something com be any relevant secondary data! Here are some common secondary s?

* **Books** – a wide range of published material including data tables, qualitative study. Sometimes you might use the other person's co yours. Sometimes you might need to spend more time doing som consuming) – for example, you might be looking at climate chang scientist written 200 years ago.
* **Government reports/statistics** – a wide range of statistics are avai usually be trusted. You can usually download spreadsheets or CS? and sometimes summaries are also included. Websites usually ha? you can easily find the most relevant data.
* **Magazines and journals** – including periodicals and scientific liter? performing a literature review to see the research that's already b? duplicating something) – PhD students spend a whole year doing? you about other researchers' methodologies and results. Appendi? of the data that was collected.
* **Websites** – beware of the age, bias and validity of the data. Anyor you're probably safer getting data from a site such as that of a uni?

Task 7

Take a quick look to see what types of ?a?? ??? available at **https://?**

Discussion P??t?

What sec??? ??urces have you used at school? Were the sources problems (??? irrelevant, out of date, poorly collected)?

┌─ **PRACTICE** ────────────────────────────────────
│ 11. Why are some secondary sources more reliable than others?
│
│ ....
│
│ ....
└

Topic 3.4: Storage of collected data

We can store data either on a server (either in the cloud or on a busine
our personal device or an external drive that we plug in to our devices.
disadvantages.

You probably have a fair bit of digital data by now – photos, emails an
schoolwork. In 50 years' time, just think how much you'll have. Busin
terabytes of valuable data – they'd go out of business pretty quickly if

Logical storage locations

Logical storage locations are in the cloud, or on a server at your schoo
or company. These services can be accessed by many people at the
same time, and may be accessible worldwide.

The cloud is a name for all of the servers that are collectively
accessed through the Internet. Servers are often located in highly
secure buildings dedicated to nothing else – called server farms. If
you have a Dropbox, OneDrive or Google account, the data you save
with them are stored on a server that the company owns. From a data
point of view, it doesn't matter where that data is stored; it could be in
your city, or across the world – either way you can access the data
anywhere that you have an Internet connection.

This is great for accessing your data from anywhere, 24/7/365, and sha
working on the same files with others at the same time. The cloud all
and employees to work from home.

You may be able to work on local files which are 'synced' to the cloud.
able to automatically backup photos and messages to the cloud.

But there are downsides! You don't have control over where the data
hosting company to maintain their servers for a high up-time, to have
data from hackers, and to back up your data. If the remote server or y
down, you lose access (unless a local copy is synced to your device). T
inconvenience to you, but could be catastrophic for a large business w
without access to their work. You also have an ongoing data storage f
within the free limits (usually 2 or 5 GB), increasing or decreasing the
number of users, is easy, meaning that the service scales up and

---

Task 8

Take a look at different cloud storage costs. Which is the best value
able to find a comparison website.

Discussion Point

Do you store any data in the cloud? If you do, what do you store? If
particular reason why not?

Network drives are the shared folders on file servers maintained by the school you attend, or the business you work for. On a home network, you might have a small NAS (network attached storage) device. The permissions over which shared drives you can access are determined by your role and ultimately your username – you won't normally have to access shared drives from other departments.

These servers allow anyone on the private network to access the files at once), and sometimes via the Internet. This is a good set-up for acc connection required), but the business is resp... e or purchasing, m its servers, which can be expensive an... ia... on-site IT technicia the cloud. Many businesses ... igrating their data to the cloud

---

PRA

12. A ...cial services company needs more storage space. It ha the UK. Would you recommend that they store their data in th the data on-site? Explain your reasons.

....

....

....

....

Physical storage locations

Each laptop, computer, tablet and phone has **internal storage**. That st by that device to hold the operating system, program files and local st the device. The amount of internal storage, e.g. on the *primary hard d* if all of our data is stored on the cloud, or on removable media.
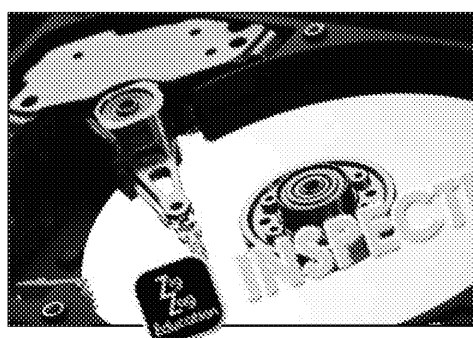
All desktop and laptop computer (called HDDs – *hard disk drives*). coated di... ia spin very quick r... ...i...ead hovers above th ...large capacities, up to several have a reasonable read-write sp they get full). However, they ca electricity, and wear out mechan dropped. Some mechanical drive small amount of flash memory t

Nowadays, *solid state drives* (SSDs) are rapidly replacing the older HDD technology – especially in newer and more expensive devices as SSDs are becoming cheaper and now larger capacities are available. Data access is much faster than with HDDs, meaning that the device boots up faster and applications are more responsive (especially when plugged directly onto the motherboards (M.2 drives)). They are more reliable because there are no moving parts, they are silent, they use less electricity and they don't mind being dropped so much. Howev... th? flash memory (after relatively few writes. For this rea:¬n, t'. a good idea to keep ple¦ drive so that the drive can au*....¦ ...ly reduce wear by writing to the

---

Task 9

Find out w┊┊⌐type of hard drive is in your laptop or desktop. Try rur¦ as CrystalDiskInfo **https://crystalmark.info/en/download**

How does yours compare to the drive below, which is a 1TB M.2 SSD │

	Read (MB/s)	Write (MB/s)
SEQ1M Q8T1	3382.40	2500.6:
SEQ1M Q1T1	1352.76	2150.5:
RND4K Q32T1	244.32	160.5:
RND4K Q1T1	36.83	85.8:

Tablets and phones always use flash memory, usually a smaller amount┊

Servers still typically use mechanical drives he┊┊┊┊ f their high capa┊ drives are more robust, are vibration-r┊s st┊nt┊.d spin faster (maybe ┊ desktop drive may be half of ┊┊┊)

If you onl┊┊┊┊e y┊┊.ata internally, there is a chance that the data w┊ responsibl┊┊acking up your own data. Unless you share the data ┊ the cloud, others can't work on it, and may duplicate the work.

Discussion Point

If you were buying a new laptop, would you buy one with an HDD or ┊ need to consider before you made that decision?

You can also connect **external storage** to your device through USB. E×

- **HDDs** – you can use small 2.5" mechanical drives externally. Ideally higher, or USB C because of the faster speed than USB 2.0. These ca between local PCs, or as a backup – but they can still fail mechanica dropped or damaged. HDDs also require defragmentation to keep in available; these have faster read and write speeds and are not prone having fewer moving parts). They also do not require defragmentati

- **Flash drives (thumb drives)** – a common way of transferring files t have seen many of them around. Easy to lose and a target for viru banned them.

- **Flash memory cards** – small, thin cards used t transfer photos an Some devices have an internal card reade for SD cards. Devices t the right card reader, wil use   USB card reader to use them. Th add storage to m   ces, and effectively act as the hard driv Raspb   i.

- **Optica   ia (CDs, DVDs, Blu-ray)** – for about 20 years, nearly ev internal CD (and later DVD) drive. Not any more, especially on the USB drives can be bought cheaply if you still need to read from ar computers use Blu-ray, but they store a lot more data – great for l plastic disks which are read by, and sometimes written by, a laser. and write speeds, many can only be written to once (although usir have a relatively small capacity, and they can get scratched easily cheap and easy to share – almost a disposable form of storage.

Again, you are responsible for ensuring the safety of your data on extern
- Keep frequent backups in case the storage media fails or is lost
- Encrypt removable media containing private or confidential data i
- Keep storage media safely stored so that it doesn't get lost

NAS drives (network attached storage) plug into a network, so that file devices on the network, either wirelessly or over Ethernet. The drives disks, which can be set up in a way that if one disk fails, the data rema drives use power 24/7, and are connected to the Internet (perhaps unk are at risk of being discovered by hackers if security flaws exist. In sch may be familiar with the use of a **network drive**, which is mapped to th

One other wireless form of data storage s   r able wireless drive**. S photographers, and also have   t n SD card slot to download phot While convenient, the   wbacks; they are limited to the speed some hav   n   eries with a limited run time between charges.

Discussion Point

Are there any types of external storage that you used to use that you are, what did you replace them with?

Task 10

When did you last back up the data on your laptop, desktop or remo
is never, write out a basic plan of how you could do it, the equipment
often you think it is necessary.

PRACTICE

13. Explain **two** disadvantages of using local storage.

....

....

....

....
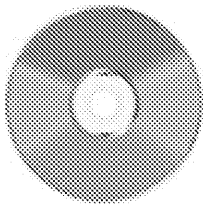

Task 11

Identify the following types of storage media. The last one is a bit ha
motherboard mounted – they'll become a lot more common over the n

Topic 3.5.1: Importance and purpose of testing

Testing is simply checking that something works as expected. For exa

- That a database query returns the correct data
- That the formulae in a spreadsheet are performing their calculatio
- That a computer program is working as expected (for example, it
  process data that is clearly invalid)
- That a computer system remains stable after software updates or after
- That a computer game doesn't crash or that there are glitches in t
- That a driver works without crashing the system
- etc., etc.!

Testing can take a long time to comp~ but is best when done in sta
writing a program. This w~ the c s only a small amount of code that
each time.

Software o ontains errors in the code (often called bugs). The mo
more errors that there will be. When a company finally 'ships' softwar
fixed all or most bugs (especially the 'showstopper' errors that cause t

---

Discussion Point

Why are some bugs more important to fix than others?

If bugs and other issues, such as security flaws or vulnerabilities, are f
release updates.
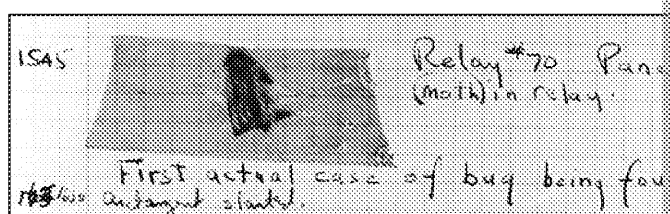
We call errors 'bugs' because of a moth found inside a computer at Har
1947 which had caused errors on the computer. It was preserved in th
This is where we also get the phrase 'debugging', i.e. to find and resolv

If a program is not tested, or not teste c gnly, it may crash when
cases such as Windows, bugc i s or updates can make internatio
may avoid specific ve i n perating systems or software, or stop p
software rs gether. The company will have increased suppo
even requ nds and purchase software from a rival company.

If you were writing software for a company, it's likely that before you s
out acceptance criteria. The client will then test that software to ensu
requirements. If not, then the software will be returned for fixing – ar
over time and budget. The client may not order repeat business from

Task 12

The release of Windows Vista in 2007 did not go smoothly. Take a lo
https://www.zdnet.com/article/the-top-five-reasons-why-windows-vista-failed

Explain how extra testing might have solved some of the issues.

....

....

....

PRACTICE

14. Gi......o ......is why we test.

....

....

15. Give two disadvantages of testing.

....

....

Topic 3.5.2: Test data

The aim of testing is to try to break the system or software in as many
what happens. We feed three different types of data into the system t

Before entering the test data into the software, it should be formulate
determined – to be checked against the actual output. This is a test p
expected, then the bug(s) need(s) to be found and fixed.

Extreme (Boundary)

Sometimes referred to as boundary data, extreme data is impossible d
from the expected range. Let's say you were testing payroll software
Insurance payments and entered the weekly data as £100 billion, or
software might only accept a few thousand pounds, and only positive
should be programmed to refuse these numbers. If it accepts the num
issue must be fixed.

Invalid (Erroneous)

Sometimes referred to as erroneous data, invalid data might be in the
the software was just expecting a number, but 'six hundred pounds' w
the program is working, it shouldn't be able to process it, and should s
try again. If the program accepted the answer and gave an incorrect o
to the next data without question, the affected code would need to be

Valid

Valid data is acceptable data that the system should accept and give t
For example, if you typed in that your weekly salary was £500, then th
Insurance were calculated correctly, then the program would appear t
value would need to be compared against the expected value.

Task 13

Imagine that you have written a simple program that calculates peopl
Users just have to type their date of birth in the format DD:MM:YYYY,

You have **not** accounted for dates before 1910.

You **have** accounted for leap years.

To obtain today's date, the program uses the time set on your comput
displays the correct date and time.

Suggest at least one example of each test data that you could enter
and valid cases.

Extreme: ....

Invalid: ....

Valid: ....

PRACTICE

16. What is the difference between extreme data and invalid dat

....

....

Topic 3.5.3: Types of testing

Testing is carried out by the design team (e.g. incrementally and when finished), and by the clients. Detailed test plans, test cases and use cases will be developed and tested against. Functional testing checks that the program works as expected. Non-functional testing makes sure that the program works without crashing, etc.

Technical (Alpha) Testing

Testing by the software developers before the software is given to the clie[nt] called alpha testing.

Alpha testi[ng] che[cks that] the software features work as designed and [is easy to] use. Any [bugs th]at are found are logged and reported. Every new ver[sion is] documented along with the bugs and their fixes.

Alpha testing is good because a lot of the bugs are fixed before the so[ftware] giving the client more confidence in the software. The downside is th[at it is] tested in the same environment as the client, and that the testers may [not test] every way that the software might be used.

User (Beta) Testing

Once the initial alpha tests have been completed, then the software is [tested] that it performs as expected. This is called beta testing. At first, only [a few] might test the software. If the software passes the tests, it will be for[warded] to all staff or may be given for public release.

Beta testing allows for better testing from an end-user perspective. T[he user of] the software, has the best understanding of what the[y a]re looking for. [Any bugs can] be resolved. However, bugs found at this s[tage] c[an] damage the reput[ation] and cause the client frustration.

When the so[ft]wa[re is roll]ed out to everyone, there might be a lot of u[sers,] users with [differ]ent systems and network set-ups, users who click in u[nusual ways,] unusual str[in]gs of data that weren't part of the testing, etc.

Testing updates to an operating system can be very difficult and there device can be tested. For example, Microsoft releases updates every m Windows 10, an incredibly large and complex piece of software. Ther hardware set-ups, software installations and languages in use on the software. Companies who only allow their software to run on specific Macintosh) can do more testing on that hardware before releasing upd

Some users volunteer to test Windows, and get new builds and updates early – this is the 'Windows Insider Program'. They give feedback to Microsoft, allowing bugs to be fixed before general release. Sometimes even after release, an update will cause issues, so Microsoft pulls the update from its download site, and tests and releases a new version. Users who are affected by the update may remove them.
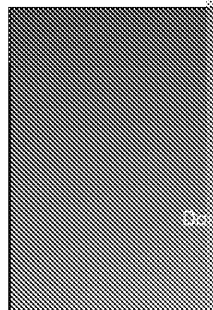
Task 14

Take a look at the Windows Insider Program:
https://insider.windows.com/en-us/about-windows-insider-progra

Give at least two advantages and two disadvantages of joining it.

....

....

....

....

Task 15

Pick an item of software that you use regularly. See whether you can online – there should be a web page that outlines all of the new featu been fixed.

Task 16

Take a look at what it takes to become a software tester. Do you thin that you would be interested in? Take a look at **https://www.totaljo tester-job-description** or similar.

PRACTICE

17. Wh_____e____cal testing happen before user testing?

....

....

....

....

Workbook C: Cybersecurity and

Name: ....

Contents

Topic 4.1: Threats

Computer systems are vulnerable to attack because they often contain accidental security flaws and 'bugs', which a hacker can find and exploit. Operating systems, for example, are incredibly complex – Windows 10 has about 50 million lines of code – so could contain many potential exploits. When bugs are found, whether they are currently being exploited or not, they are patched – that's why you should always apply the monthly or periodi... ... ...s. I found this out the hard way back in ... w... n my machine was infected by the Blaster ... ... machine, running an unpatched copy of W... ... ... would constantly reboot – Microsoft ... ... a patch the previous month that would hav... ed this vulnerability.

Attacks can cost billions of pounds to recover from – for example, bus departments have been effectively shut down across the world, and n is a relatively new phenomenon. We'll cover types of malware later.

Task 1

Find out which malware outbreaks or attacks have cost the most mone and ILOVEYOU. Find out how the attack spread, and which organisati

....

....

....

....

....

....

Systems are attacked for a variety of reasons such as:

* **Fun/challenge** – while attackers don't inte... ... c use disruption seeing how much access to a syst... th ... ... obtain. They may g hacking forums on the da... ... ... ut starting this way could lead the case with Mar... ... ...ins.
* **Indust... ... sp... ... ...** – attempts to steal valuable electronic prope such ... ... e secrets, formulas, plans and recipes. For example, h state fu... ded) attempted to steal trade secrets about the COVID-19 such as Pfizer.
* **Financial gain** – hackers attempt to breach company and governm information to sell. A growing trend is to also infect a business wi encrypted and can only be retrieved either from a backup, or by p extorting money from the victim.
* **Personal attack** – for example, an attack on a previous employer, partner who the attacker holds a grudge against.

Denial of service (DoS)

Denial of service is exactly what it sounds like – denying legitimate u[...]
service such as a website or server. Typically this is achieved by floodi[...]
so that the network connection becomes too busy to support normal u[...]
and goes offline. The amount of traffic directed to a server might be s[...]
sent from thousands of devices controlled by the hacker (a botnet). Ho[...]
that taking a system offline through a virus outbreak, a worm, or encry[...]
ransomware attack is a denial of service. The services are likely to be t[...]
administrators while the attacks are being investigated and the server[...]

Denying a service is designed to cause financi[...] ge to a business[...]
* Bringing down public platforms and o[...] opportunities
* Reputational damage
* Lost staff produ[...] ernal systems are disrupted

Denial of s[...] attacks are often aimed at large corporations as puni[...]
company value that the hackers oppose. Attacks may also be political,[...]
the site of a political party that you oppose.

Denial of service attacks can be difficult to stop because all of the req[...]
IP addresses and it's difficult to know which requests are malicious.

Task 2

Take a look at several large DoS attacks. Can you work out why each[...]
Take a look at **https://www.cloudflare.com/en-gb/learning/ddos/f**[...]
other online resources.

Hacking

There are three types of hacker:

* **Black** hats – who hack maliciously for financial gain or to ca[...]
  illegal) – these are the hackers that we tend to hear about on the[...]

* **Grey** hats – who hack into systems looking for bugs and repo[...]
  necessarily malicious, but still illegal)

* **White** hats (AKA ethical hackers) – wh[...] ked or paid to t[...]
  product in order to find flaws and [...] they can be exploit[...]

Some hackers start o[...] hats, and may later see the error of th[...]
hats, and [...]e [...]ited by a major cybersecurity company, or a gov[...]
to be whit[...], so they learn the skills legally.

You may remember that in 2017, the NHS was attacked by the ransom[...]
turned white hat hacker called Marcus Hutchins from Ilfracombe in De[...]
spread of the worm by registering a domain that the malware tried to [...]
was working remotely for a US security firm Kryptos Logic, who recrui[...]
posts, with him having started hacking aged 14. In May 2017, he was a[...]
arrested at the airport by the FBI in August 2017 while travelling hom[...]

conference DEF CON. DEF CON is the world's most famous hacking co[...]
attended by law enforcement agencies such as the FBI. The arrest wa[...]
application that Hutchins had previously written called Kronos. Over t[...]
spent time in prison, before having some charges dropped, and was e[...]
initially under close supervision.

Discussion Point

Marcus Hutchins has said that he made a lot more money working leg[...]
than as a black hat. What do you think is the appeal of working as a [...]

Not all hacking is illegal – we need trained se[...]ty experts (white ha[...]
exploits, bugs and loopholes bef[...] [...] are discovered by the black [...]
Because their hacking is [...]ing [...] to solve problems and they don't tr[...]
sell on any d[...]a, [...]ions are 'ethical'.

White hats [...] invited to attempt to hack into a network or website, e[...]
by the owner of the system. This allows weaknesses to be discovered [...]
patched. This service may be very expensive. A company or governme[...]
may even invite large numbers of hackers to breach their network for [...]
financial rewards or employment opportunities. Examples include the [...]
companies such as Microsoft, Google and Facebook, where a 'bug bou[...]
first one in the 1980s gave away a Volkswagen Beetle, which is nickn[...]
the trust and integrity of the hackers.

Grey hats don't have any intention of stealing or looking at personal d[...]
into a company without permission, so their actions are still illegal. T[...]
their findings to the company, at the risk of being sued. Sometimes th[...]
findings public if the bug is not fixed within a set time frame.

Task 3

Find out more about which companies offer bug bounty programmes. [...]
these companies? Summarise your findings below.

....

....

....

....

....

....

Malware

Malware is the generic term to describe malicious software, designed to cause damage and/or disruption to a computer system:

- **Adware** – shows advertisements in order to make money for the creator by showing pop-ups; for example, through software and often injected into a web browser.
- **Botnet** – a network of infected 'zombie' computers across the Internet that are listening for commands sent by the hacker to do things such as perform a DDoS attack or send out spam email.
- **Ransomware** – malware that encrypts some or all of the files on a fee in a cryptocurrency such as bitcoin to decrypt the files. After a may become unavailable or the fee increases. However, if the user machine or its files, the user could just reformat the hard drive and avoiding needing to pay the ransom.
- **Spyware** – software that 'spies' on the user – for example, it could details to log into your online bank. It could also inject fake web browser, or cause the browser to redirect to other sites.
- **Trojan horse** – malware that pretends to function as a useful appl antivirus product. Once installed by the user, it can deliver a viral corrupting data, or open up a back door so that more malware can
- **Virus** – attached to files that run and spread to other computers w may delete or overwrite files and cause the system to be corrupted sent as an email attachment.
- **Worm** – a program that self-replicates and opens many copies of a user to open it. A worm slows down the computer and network sends itself to other computers. It may have other malicious tasks machines or causing equipment failure. Worms could infect any vu network by making use of software vulnerabilities and open ports.

PRACTICE

1. The terms 'worm' and 'virus' are often used interchangeably, b Explain one way in which they differ.

   ....

   ....

Files that are downloaded from the Internet shouldn't be trusted unles a reputable and have been virus-scanned. For example:

- Files such as documents and spreadsheets could have viruses atta
- Software downloads could be fake or malicious (e.g. Trojan horses with copy of a real program (with malware injected).
- The download could be a form of malware such as ransomware.

Discussion Points

- Have you ever experienced a malware outbreak? What type wa[s] that your computer was infected?
- Which types of malware are the most destructive?
- Some governments have suggested that paying the ransoms shoul[d] because paying increases the number of ransomware attacks (if n[o] would be no point creating them), and the money generated may[...] serious crimes. Do you think that paying the ransom should be illeg[al]

PRACTICE

2. Why should you always be careful when cli[cking] on email links a[nd]

....
....

Social engineering

In the 1980s, not many people were familiar with the concept of socia[l] to phone up IT departments or reception desks pretending to be empl[oyee] asking for their passwords. Nowadays, passwords are much more secu[re] But social engineering is still widely used in different ways.

Social engineering tries to take advantage of human behaviour and pe[rsonal] mistakes in order to obtain information. Examples of social engineerin[g]

- **Baiting** – cybercriminals attempt to obtain information such as lo[g] under the promise of free goods such as movie downloads (that a[re] malware). Sometimes the bait is physical – for example, a virus-ri[d] flash drive left in a public place that will automatically install the[...] as soon as it is inserted into a computer. Never rise to the bait, or [...] an unknown flash drive into your computer.
- **Phishing** (fishing for information) – emails, texts and phone calls [...] to be from someone or an organisation that the victim knows. Son[e] are very convincing as they look real and sophisticated due to the[...] They are aimed to get you to click on a malicious link, to divulge y[our] details, or to steal money.

You might get a message purpo[rting] to [b]e from an IT department [or] technical support saying [tha]t [your] account has been compromise[d] immediate actio[n], a [re]corded message claiming to be from a te[...] or the [gover]n[me]nt. I have recently received text messages claimin[g] provid[...]ying that a payment didn't go through, that I needed t[o] that an iPhone was just purchased through Amazon, and received [...] that my National Insurance number has been used in criminal acti[vity] Always be wary of any unexpected messages, and never click on t[he] if others have reported the scam, or make contact using the officia[l] still not sure. If the email appears to be from someone that you kn[ow] if they sent it (and advise them to change their passwords if they [did])

- **Pretexting** – the scammer tries to get your personal details by ask
pretending to be from an organisation that you trust and asking fo
account number, etc. To be sure that you are actually talking with
organisation, you should call the organisation back using their off

  Did you know? It's recommended that you wait at least five or ten
  back, or call from a different phone number if they're calling on yo
  the line might remain open until the caller hangs up or a timeout
  just play a dial tone down the phone at you to trick you into think
  but you end up talking to the same scammer. This feature allowed
  handset and pick up another in a different room without the calle
  Many phone companies have reduced the time period to help s

- **Quid pro quo** – similar to baiting, but the attacker offers a service
exchange for personal information, passwords, etc. The service mi
support – the scammer may log in to the victim's computer remot
access to your computer unless you have a problem you're trying t

- **Scareware** fake programs, such as fake antivirus packages, send
the computer is infected by a virus to falsely scare the user into ac
convinced to pay a fee using their debit card to download even mo
software to fix the non-existent issues, believing that the software
remove scareware by uninstalling it, and run a scan with
legitimate antimalware software.

- **Shoulder surfing (AKA shouldering)** – watching someone type
in their password (looking over their shoulder) or PIN at a
cashpoint. Usually done at close range, but could be done
through binoculars. This is why you should always shield the
keypad at a cashpoint or card reader when you type in your PIN.

PRACTICE

3. Every employee should be made aware of the dangers of so
If that is true, why does social engineering still work?

....

....

....

....

4. Why do you need to be careful when downloading material

....

....

Discussion Points
- Which of these attacks are the most dangerous? Which are the e
which could be avoided?
- Have you ever received a phishing email, text or call? How did yo
- Do you know anyone who fell for phishing or another form of soci
What happened?

Topic 4.2: The impacts of a cybersecurity attack on i[n]
and/or organisations

An external threat originates from outside a business or government.

* Attackers may specifically target an attack towards a business, a g[?]
  (such as the Stuxnet worm, which targeted Iran's nuclear enrichm[ent]
  DDoS attack, or a social engineering attack targeted at a company[?]
* Or attackers may not specifically target a particular company or o[?]
  organisation is vulnerable to the attack (e.g. the NHS was not an i[?]
  but the system was vulnerable to it because security patches hadn['t]
  systems running Windows 7 – which means t[?] he problem cou[ld]

Task 4

Research why the N[HS] [w]a[s] [v]ulnerable to the WannaCry attack in 20[?]
points of [?], [?] [h]ow could the IT system have been improved? T[?]
https://w[?]ronis.com/en-gb/articles/nhs-cyber-attack/ for mor[e]

....

....

....

....

....

....

A system could be breached by an outside hacker directly targeting th[?]
An insider could steal or leak data or create a security hole. Once data[?]
others, there is no knowing how many copies there are or where the d[?]

Data can either be copied, deleted or modified slightly so that it is no[?]
may not be detected for months or even years, depending on the leve[l]

However the system is breached, there are many financial repercussio[n]
cases, the business may even be forced to close if [i]t [c]annot financially[?]

Data destruction

Any data that is deleted (o[r] [en]cr[y]p[t]ed by ransomware) since the last b[?]
lost forever, includ[ing] [cu]s[to]mer orders. The company would have to r[?]
was impo[?] [i]f [th]at was possible. This is a cost because staff have s[?]
and would [ha]ve to go through the whole process of creating it again.

If staff don't have access to servers, files, intranets and web pages tha[?]
they will have to work offline temporarily, possibly on paper or on a b[?]
that their work may take longer (lost productivity), and they have to m[?]
the normal system is back online.
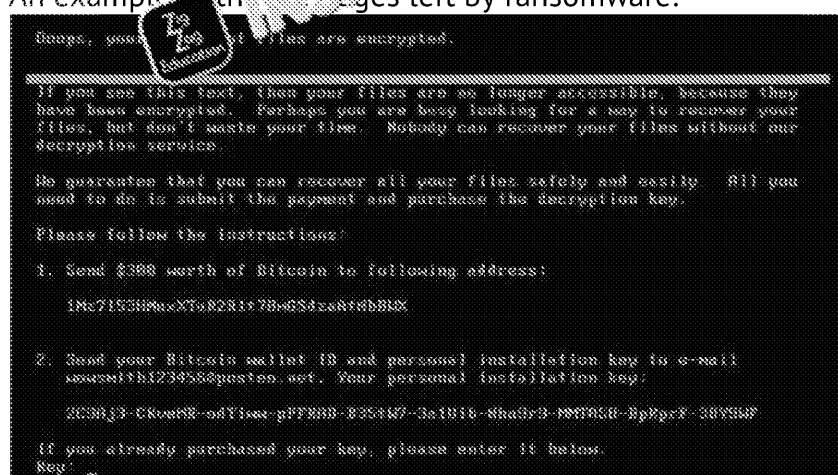
A business could easily fail without access to its data. If your personal data, such as thousands of photos and messages, were suddenly lost, h would it affect you?

Many home and small business users are now buying small hard disk devices called NAS boxes (network attached storage boxes – an exam is shown in the photo) that contain several hard drives linked togethe Files can be accessed by any devices on the local network, and also ov the Internet if configured that way. If users don't keep their firmware u date to patch vulnerabilities, these devices can also be a target for ransomware attacks. For example, a ransomware attack called Qlocke infected thousands of NAS boxes made by a comp ny called QNAP in 2021. The vulnerability had been fixed t e week before the attacks sta applied the patch, or hadn't e   al s u that the drives were attache

An example of th   ges left by ransomware:

Data manipulation

There are so many ways that data could be edited by an attacker. For e or political website, or social media account could be defaced by hack activist) in order to slander the business or   v   ich attacks are usu because of their public nature. Of c   a hacker or malicious inside company-owned spreadshe   or a   nts – such attacks might not be employee could alte   n t y finances, and poor business decisions o

Task 5

Find three examples of websites that have been attacked in the past. each company and a short statement about why the attack occurred.

1. ....

2. ....

3. ....

Data modification

Data modification is similar, but may be financ[...]
gain. For example, an employee could alter th[...]
bug, allowing for them to be paid extra, or an [...]
bank balances and move out the money.

Data theft

Data can be intercepted during transmission, or when it is simply bein[...]

* *Data in Transit:* when data is being transferred across a network or[...]
  data could be obtained using a man-in-the-midd[...] attack, and we[...]
  can be unencrypted. However, most of our n[...] o k traffic is now e[...]
  encryption to keep the contents s[...] e[...] intercepted.
* *Data at Rest:* if a drive or d[...] is stolen (such as a flash drive, ha[...]
  unencrypted data c[...] accessed by hackers or competitors, an[...]
  threat [...]ti[...] curity.

When pers[...]data is breached, the company may be required to tell [...]
data was stolen. This damages public image. In large breaches for wel[...]
the breach is covered on national news channels and in newspapers a[...]
customers may move to a rival company, and new potential customers[...]
joining the company. A good example is the telecoms company TalkT[...]
made national news when the unencrypted details of 157,000 custom[...]
100,000 moved to a different provider, although they still had million[...]
The share price of TalkTalk dropped by 11% as a result.

Discussion Point

Do you know of any companies that have recently suffered data bre[...]
affect the way that you see a company? Would it put you off being [...]

Task 6

Did hackers really try to steal secrets about the COVID-19 vaccine? F[...]
been attacked, and who is accused of carrying out the attacks.

Denial of service (DoS) to authorised others
The website or a server in the company is taken
down (legitimate users are denied service) to
cause harm to the company through lost sales
and damaged reputation. A botnet is used to sen[...]
requests to the server or Internet connectio[...] t[...]
exceeds the capacity of the Intern[...] ction
so that the legitimate req[...]s c[...] t get through.
The attacker migh[...] a grudge against the
company, [...]r[...] e of the services it provides,
or try to e[...]money for blackmail purposes.
Sometimes the attack could damage equipment
so that it has to be reinstalled or replaced if the
firmware is corrupted.
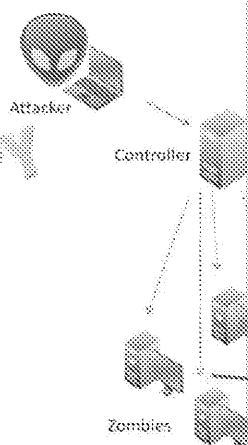
* Sometimes websites are taken offline due to thousands of people t[...]
  In November 2020, when a new tier system was announced for CO[...]
  page became unavailable as people tried to access it to find out wh[...]

- A server may be taken offline by the attack, or switched off while
  deleted, corrupted or modified, then the data has to be restored fr
  important data might be restored first, it could still be several day
  are fully back online.

Hackers could try to stop a business from operating normally, causing
could either be through setting up a virus to infect machines and dele
the network with a worm, or by taking a company server (e.g. web serv
offline using a DDoS (Distributed Denial of Service) attack by flooding
requests from a series of controlled computers.

PRACTICE

5. A web server belonging to a large online retailer is targeted
   Suggest why the company might be attacked.

....

....

Identify theft

Theft of data such as identity, addresses, credit card information and p
on the dark web to other criminals for identity theft and fraudulent cre

Identity theft can be devastating to an individual. Can you imagine the
someone took out a credit card or mortgage in your name and you we
Sorting out identity theft can take a very long time and can affect your
physical health. You could even lose your job over it if you have to tak
credit score could be temporarily affected.

In the business world, scammers try to take on the identity of a real co
to invest money or pay for services, or to extort money from victims. T
companies'. For example, scammers might send emails or set up a fake
bank, or a debt collection company. You should always check the com
report suspected clone companies to the authorities, such as Action Fr
that industry – such as the Financial Conduct Authority for anything re

---

PRACTICE

6. Give two consequences of identity theft.

....

....

Discussion Point

For each of the following scenarios, work out who might want to attack
- A government server
- A server owned by a large company such as Coca-Cola or KFC
- A website owned by an oil company
- A company with millions of registered customers
- A server owned by the FBI or a military institution

Task 7

In March 2021, Microsoft released an update to their on-premises Exc
thousands of servers around the world. Hackers exploited four separa
(meaning that there was no time between the security update being re
starting), gaining access to thousands of email servers around the wor

a. How the attack took place – who was attempting to hack the serv
b. Why did the attack take place?
c. What were the effects on businesses as a result of the attacks?
d. How was the threat eventually mitigated?

....

....

....

....

....

....

Under the Data Protection Act of 1998, companies could be fined for b
Under this act, TalkTalk was fined £400,000 for its data breach. In the
out by the Information Commissioner's Office – this was the largest fi
out. For more details see **https://ico.org.uk/about-the-ico/news-and-e
how-the-ico-investigation-unfolded/**

However, TalkTalk were probably lucky. Had the breach occurred a few
have been covered by the Data Protection Act 2018, which significantl
the size of fines that could be dished out. For the most serious breach
the larger of £17.5 million, or 4% of global turnover from the previous

In 2020, the ICO fined British Airways £20 million after the theft of det
passengers. The hotel chain Marriott International was fined £18.4 mill
millions of records were accessed six years previously, and this occurre
acquired the company that was responsible for the breach. The fines co
they were initially set at £99 million for Marriott, and £183 million for

PRACTICE

7. Which impac... ... ... breach are the most severe to a com

....

....

....

....

Topic 4.3: Prevention measures

Physical

The most basic form, physical security, comes down to a lock and a me
whole building can be locked at night, as well as specific floors and de
The server room will also be locked at all times, and only a specific fe
of staff will have a key.

Physical keys are cheap and widely available, and will act as a small d
but still have a lot of vulnerabilities. They could be lost, stolen or borr
copies could be cut. A thief could still break in at night and break ope
flimsy doors with a sledgehammer to steal valuable items.

However, there are other forms of security. For example:

* CCTV, monitoring patrols (remote or on-site) and intruder
  alarms (which could be linked to a security agency) that are
  used to detect forced entry to the building. However, the thief
  could escape before security arrives.
* Locks for the specific equipment – e.g. laptops and desktops
  can be locked to immovable objects and desks using steel
  cables, using either a key or a combination lock. This may also dis
  remove the hard drives. But the locking cables can be surprisingly
  per cable.
* Small devices can be locked in cupboards overnight, or installed i
* Paper and confidential files can be locked in filing cabinets or cup

Biometrics use a personal, unique attribute for authentication – for
example, fingerprints, retina or iris scans, voice patterns and facial sha
etc. This may replace the username and password approach entirely. F
example, you can log into some laptops with just your face (using a 3D
camera), or log into laptops and phones with a fingerprint. A laptop
fingerprint reader is shown in the photo. Sometimes the readers are b
into the power buttons or home buttons on smartphones. They are bu
into the keyboards on the 2021 Apple iMacs.

These can be more secure than using a password as you physically hav
to work – anyone could log in with a stolen password. These systems
recognising a person and not being fooled, but there are always conce
hacked. Some users are also concerned over their privacy and don't wa
copies of their fingerprints, etc.

Firewalls and **secure backups** mainly use **logical protection** (security fe
as opposed to physical security), but they should still be physically sec
firewalls should be secured in the server room with limited access bec
with or bypassed. Backup media such as disks and tapes should always
a fireproof safe, or in a secured offsite location such as a safe, vault or
theft and destruction.

Discussion Point

What's your view on the use of biometric data? Are you for or agains

---

Keypads (with a PIN to open the doors), swipe cards (magnetic strip) o
all alternatives to traditional locks. But they are still vulnerable – an i
card or watch someone punch in the PIN.

Task 8

Take a look at how the equipment in your school is physically locked d
Write a brief summary below.

....

....

....

Discussion Point

How secure do you think your school's location is, based on the surrou

---

PRACTICE

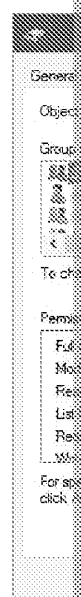8. How effective are physical locks at deterring theft?

....

....

....

....

Logical

Access levels – You have probably seen in the movies that employees in some companies or government age ... s carry access cards that can be used to access spe ci r a rts of a building (usually with a villain att m n g to access the parts that they shouldn't). Thi   c of many organisations – only a few trusted sta   ave access to the server room, while a regular er   e might only be given the code to the front door. They may have a card that only allows them in during their contracted hours, and new starters may not be given the door code for several months until they are trusted.

You may find this when you go to college or university – for example, [cut off]
allow you to enter your department building, specific libraries, or your [cut off]
Unless you've been granted 24/7 access, your card may only work unti[l] [cut off]

But access is also restricted to computer system resources such as drives, f[i] [cut off]
* Payroll and HR may be the only departments with access to salary [cut off]
  information (e.g. on a shared drive)
* Only IT administrators will have access to company servers
* Only network administrators would be able to make substantial ch[anges] [cut off]
  website infrastructure
* A regular employee might only be given read acc[e]ss to some shar[ed] [cut off]
* System functions such as new software ins[tall]a[t]ions, access to the [cut off]
  prompt, etc. could be disabled en[tirel]y

These settings can b[e] [im]pl[e]mented in various ways. For example:
* Only [creating?] ce[rt]ain staff admin accounts that allow them to access [cut off]
* Only a[llow]ing access to specific usernames
* Setting appropriate file permissions, including based on username [cut off]
* Setting Group Policy on the server to automatically block certain a[ctions] [cut off]

Task 9

On a Windows server, certain things can be set or disabled through o [cut off]
Policy. Find out what Group Policy could be used for, and how it coul[d] [cut off]
from compromising a computer system.

....

....

....

....

....

PRACTICE

9. Why might people try to gain more access t[o] a system than th[ey] [cut off]

....

....

Antivirus – [sto]ps the download, installation and running of
viruses and other malware. The software also detects malware
that is already installed on the system, through regular scans
and constant monitoring. In the past, this could slow down a
computer, but nowadays, the performance drop is minimal.

Antivirus does this by looking for the characteristics of the files, their [cut off] the system against a set of known malware signatures or definitions. I[cut off] attempt to remove the infection, delete the file, or stop the file from r[cut off] protected 'quarantine' area. Antivirus software is essential for laptops [cut off] recommended for smartphones and tablets.

This means that the antivirus must constantly update its definition of [cut off] software manufacturer by downloading the files from the server sever[cut off] from Symantec, MacAfee, Sophos and Microsoft, etc. Each time a new [cut off] to the company, a new definition is made. Because this set of definitio[cut off] antivirus software is designed to have an active Internet connection w[cut off] It can make checks against a much larger o[cut off] database as the down[cut off] contain common and recent definit[cut off]

But as there are thou[cut off] is of new malwares created each day, there is [cut off] definition [cut off] re[cut off]ed. Therefore, antivirus software tries to detect un[cut off] suspicious [cut off] viour such as self-replication or high CPU usage.

Antivirus is often preinstalled with the operating system (e.g. Microsof[cut off] downloaded for free (e.g. Avast, AVG) or paid for (e.g. Norton, MacAfee[cut off] usually have an annual subscription fee for the product to keep workin[cut off]

Discussion Point

Occasionally, an antivirus program stops a legitimate program from r[cut off]
a false positive. Why might this happen, and why could it be a proble[cut off]

PRACTICE

10. Summarise the purpose of antivirus software.

....

....

Two-factor authentication (2FA) uses two ways of checking that it's re[cut off] something you know, and something that you physically have (or are). [cut off] able to provide both.

The most secure systems require th[cut off] more ways of checking – fo[cut off] and time.

A usernam[cut off] p[cut off]sword is not two-factor authentication even throu[cut off] both are s[cut off]ing you have to know. We call two things that you kno[cut off] 'two-factor'. Back in the 1970s and even in the 1980s, hacking was ve[cut off] businesses didn't set even basic passwords!

Let's look at some examples:

* Using a cashpoint – you require your physical bank card and your
* Transferring money online or logging into accounts – requires a c
  registered mobile phone and entered into the website, not just cu
  or phrases, etc. In some cases, you may also need to use your card
  type numbers into the reader and type the resulting code into the
* Using a specific USB dongle, a smartcard, or a code generator to b
  computer, in addition to your username and password
* Clicking on a link sent in an email to either proceed or
  authorise a transaction
* Using biometrics in addition to a username
* Using a fingerprint reader in addition to a username
  or password
* Logging in from a specific address, internal building
  or country
* Logging in during specific set hours

While it's possible that a hacker could still fool the system (for exampl
messages or have stolen your bank card), two-factor authentication is
should use it wherever possible. Most types of attack can be stopped u
authentication, including three quarters of attacks targeted at an indiv

Two-factor authentication can inconvenience some people – it takes l
there's the possibility that you may have lost a card or don't have your
you (or the battery might have died). But the security benefits outweig

PRACTICE

11. Why does two-factor authentication have a security advantag

....
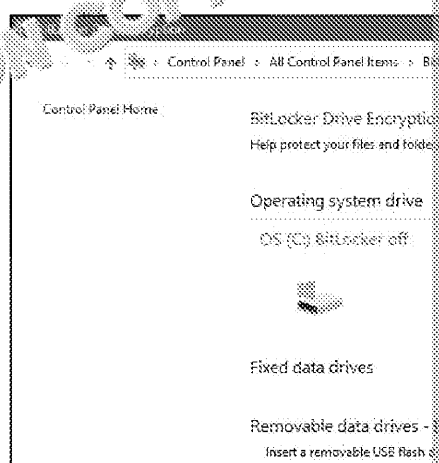
....

Encryption – data storage

Encryption is a technique used to
ensure the security of data in transit.

The original (plaintext) is
converted (encrypted) into cipher text
using an algorithm and one or more
'keys', which are often very long
numbers. This means that even if the
data is intercepted during
transmission, it cannot be read without
the key(s) needed to decrypt it.

In addition to encrypting data in transit, we can also encrypt stored fil‌
drives using a password or an algorithm. This is very useful when takin‌
flash drive is less of a problem if it's strongly encrypted. We can also e‌
password files – theft of unencrypted data or drives from a company s‌
data breach and large fines can be imposed.

Encryption – data transmission

We can also encrypt data as it is sent across a network and the Internet‌
using encryption keys. This means that if somebody intercepts the data‌
a man-in-the-middle attack), it is harder for them to read the contents.‌
use a lot of different methods of encrypting data, for example:

* We set Wi-Fi passwords that encrypt the connection to the router
* We use HTTPS when sending data across the Internet (including online banking, shopping and email, and social media)
* We use tools to form an encrypted network tunnel across public netwo‌
* We use encrypted communication platforms, such as WhatsApp an‌
* We use apps that encrypt all of their network traffic

Discussion Point

Do you use any encrypted messaging systems? If so, have you specifi‌
encryption, or do you just use them because that's what your friends u‌

PRACTICE

12. Why is encryption an essential part of modern life?

....

....

....

....

A **firewall** simply allows some network traffic to pass through, but blo‌
other traffic. This allows us to specify which traffic is legitimate, and
helps block hackers from gaining access to the system by blocking the‌
ports (doors) that can be exploited. To determine which traffic is
allowed to pass through and which is blocked using a series of 'rules'.
We can block or allow certain ports, IP addresses and domains, etc.
Firewalls usually come with common, predefined rules, but network
administrators can change (configure) these rules to meet the needs o‌

Firewalls nearly always filter incoming traffic – this is to help prevent‌
internal network. Some, but not all, filter outgoing traffic generated w‌
This is useful because the firewall can sometimes be used to stop a m‌
'phoning home', or uploading files to the remote hacker. Firewalls tha‌
outgoing traffic are 'two-way' firewalls.

There are two types of firewall:

1. A <u>hardware</u> firewall is a physical device that plugs into the entran[...]
   example, at the bridge between the public Internet and the privat[...]
   passes through the device, and most of the network infrastructure[...]
   be controlled and configured through a web interface. Hardware f[...]
   purchased with several years' worth of support, but that must be r[...]
   the device may no longer be supported and the company must up[...]
   sometimes with an upgrade discount.

2. A <u>software</u> firewall can be built into the operating system, part of[...]
   or a stand-alone application. It is a second line of defence after th[...]
   helps prevent a compromised computer or [...] internal network fr[...]
   across the system.

Task 10

Check wh[...] you have a firewall installed on your computer, either [...]
system, or [...] separate program. If you do, take a look at the settings [...]
any). Does it only block incoming traffic, or does it block some outbou[...]

Backing up and recovering data – If you've ever lost
an important or irreplaceable file because you've
lost access to the device, it's crashed, or it's been
hacked or fallen victim to ransomware, you'll know
all too well the importance of backups. A backup is
just a copy of the data that can be restored from if
the original files are deleted or damaged. Most
backup systems are automated – they are set to run
on a schedule and all the staff need to do each day
is to insert a new tape (there are also robots that can
do this automatically).

Businesses pay meticulous care and attention to their backups and spe[...]
equipment. Most businesses rely on having access to data, so would te[...]
halt without it, and could easily fail if their data was permanently lost[...]
business and thousands of staff were about to arrive to work without a[...]
documents, databases and customer contact detai[...] at they need to [...]

There are lots of different ways of [...] up data. For example:

- To cloud storage
- To local hard [...] tape
- Manu[...] pying data to a drive or removable device

If backups are made on local media (hard drive and tape) they will usu[...]
safe on-site. One or two copies each week will also be stored off-site.[...]
building burns down or the on-site copies are destroyed in a natural d[...]

A business will have a set schedule of how data will be backed up and for example, a full exact copy every day or week, or just the data that's backup (incremental). The most important files might be backed up m would be the first to be restored following a system failure or breach.

Full backups take longer each day (physically copying the data to phys the cloud), but are much easier to restore from than incremental backu

Passwords – There's no doubt that you'll have to u a few passwords you more secure ones (e.g. a random string , letters, numbers and symbols) remember. When you set a password, there are usually complexity requir eight characters, a an a letter, a number and often a symbol. This is be (e.g. pet's could be guessed either by someone you know or by a b software tr ousands of passwords one after the other. Many systems this attack by locking out the account when, say, three incorrect passwor

Passwords are used to identify someone to a system in combination w should always use unique passwords, and if you change one, make sur password with just a different number on the end (password recycling reasons for this.
1. If you have the same password for all of your services, and if that pas hacker could log in to all of your services. If they get into your email, password that isn't protected by two-factor authentication and lock y
2. If a hacker knows that your password was Hello1 and that you've e that they'll try is Hello2 because many people just change the num

There are ways that you could have secure passwords and make them mnemonic to remember it, or by storing passwords in a password man

Passwords are used in combination with a **username** which identifies y username must be unique (unlike passwords – several people on a lar chosen the same password). When you go to school or work, the IT adr have set this for you. A username is usually part of your name, such as third Smith with the initial J), and may have details like the year you jo Sometimes you get to choose your own, especially en you sign up t You'll be asked to choose a different usern if already exists. Son email address as the username inst which will be unique.

Task 11

Compare lowing examples of passwords – giving at least one disadvant or each.

Password	Advantage	
ben123		
password1		
uB@TXy71f!		

Applying a combination of the measures above is called device harden[...] for the actions that make a device such as a laptop, desktop or even s[...] theft or hackers. By installing antivirus and a firewall, you are hardenin[...] be harder for a hacker to breach it and install malware. By locking the[...] overnight, you are making it is harder to steal.

There are lots of other ways that a device can be 'hardened' both phys[...] and settings.

For example:
* Apply all software patches and security updat[...] [...]mediately
* Uninstall unnecessary software (e.g. pr [...] [...] software that yo[...] all software is still supporte[...]
* Run your computer i[...] [...]ard mode with less access to system[...] administ[...]to[...]
* Use G[...] o[...]cy or equivalent to restrict unnecessary functionalit[...] update[...]d access to unnecessary network access
* Encrypt stored data (and data during transmission)

Task 12
Write down all of the ways that you (or someone else you know) have

....

....

....

....

Secure destruction of data
Before a company discards or reuses any storage media that contain p[...] the data must be permanently removed for legal and ethical reasons. [...] will not be reused, then the device will be destroyed. If the device or s[...] or resold, then only the data will be destroyed, not the device itself.

Sometimes, the data might be hidden – some print[...] and photocopie[...] and even hard drives, meaning that those d[...] s [...] st be wiped durin[...] process because the printer memor[...] [...] [...]ain recent documents se[...]

Data sanitation is [...] [...] [...]al term for permanently destroying data so[...] Below are [...]al [...]ays that the drives and equipment can be sanitise[...]

Data erasure
Simply deleting data isn't enough because the data remains on the drive (the space where the data was is just reallocated as free space without actually removing the data). Data recovery tools can be used to restore deleted files and drives that have been formatted.

To erase the data permanently, it must be overwritten with zeros or rand
original data can't be recovered by criminals using data recovery tools. A
be repurposed or resold. This process can take a long time on slower me
check that the entire drive has been erased afterwards. The time is offse
reuse or resale, and the environment is helped out too because the drive

Magnetic wipe (degaussing)
When the media is stored magnetically (older hard drives, tapes and fl
removed using a powerful electromagnet as the magnetic field jumble
on the surface of the media. Some media can be reused, but not hard d
metadata about the disk which is also destroyed.

Magnetic wipe doesn't work with optical and flash-based media (non-
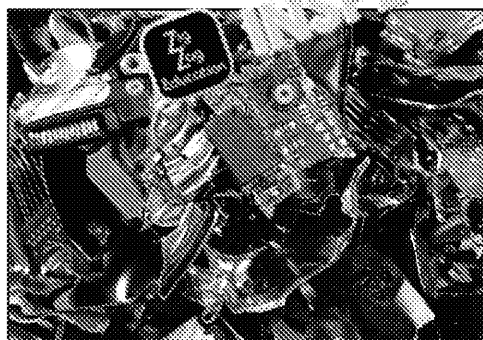
Physical destruction
Any type of media can be physica
(paper, disks, tapes, flash memory
holes through it (e.g. hard drives)
permanent. All of the waste gene
recycled afterwards.

PRACTICE

13. Why are drives usually sanitised before they are discarded or

....

....

Task 13

In 2010, the UK government scrapped a project that developed ident
data was sanitised. For more details, read this article:
**https://www.gov.uk/government/news/national-identity-register-d
consigns-id-card-scheme-to-history**

Which method(s) was/were used to sanitise the data? Write a summa

....

....

....

....

Discussion Point

Solid state drives (SSDs) are more expensive than magnetic hard driv
sanitisation might you use on these drives? Say why.

Topic 4.4: Legislation related to the use of IT system

Computer Misuse Act 1990 (with amendments)

In the very early days of computing, there were no laws against hacking, meaning that it was difficult to prosecute hackers using the existing laws – sentences were typically light, if charges were possible. However, the law has since caught up with hackers.

The first laws were introduced in 1990 in England and Wales with the Computer Misuse Act (1990) with separate provisions in Scotland. This law made three things illegal punishable through fine

1. Unauthorised access into a computer system
2. Unauthorised access into a computer system with the intention to
3. Unauthorised modification of files

Since 1990 the offences have changed slightly and the penalties have legislation has been introduced – now up to 10 years in prison and lar were the Police and Justice Act (2006) and the Serious Crime Act (2015

Under these amended acts, the following are now crimes:

1. **Unauthorised access** into a computer system (finding weaknesses gaining access)
2. **Unauthorised impairment** of a computer system (including modify the system to crash)
3. **Making, supplying or obtaining materials to use in acts of compute** selling and buying hacking tools and malware)

Fighting cybercrime is difficult – many crimes committed go unpunish are difficult to locate. They may not be located in the UK, so prosecute authorities across the world.

PRACTICE

14. Why does cybercrime legislation need updating over the year

....

....

Cybercrime costs businesses billions of pounds each year, which is billion be 2015 and 2020) – through breaches, malware and ran security implementation. Even the smallest businesses are targeted be weakest defences or the least IT knowledge, so are likely to be some o and the most likely to pay the ransom.

That figure doesn't include the fraud targeted at individuals – everyday and phishing emails, and who have malware installed on their compute current computer legislation doesn't cover the current crimes sufficient

Businesses must ensure that they are able to detect intrusion attempt̄
firewalls and antivirus software. All employees should be warned agai̅
for hacking (usually in the organisation's acceptable use policy), and t̄
penalties are.

Task 14

Your home Internet Service Provider (ISP) will have an acceptable use̅
expected to follow. Take a look at yours and find the clauses about h̅
and copyright infringement.

For example, Virgin Media at **https://www̄ ̄ ̄ ̄ ̄media.com/shop/̄**
use-policy and BT at **https://www̄ ̄ ̄ ̄ ̄ ̄̄s/acceptableuse.htm̄**

Discussi̅ ̅ ̅ ̅

* What ̅ ̅ ̅ e reasons that criminals hack into computer systems?
* Can you remember how malware can spread?

Task 15

Research who wants to have the data protection laws changed. What̄
suggested changes? What changes do they want?

PRACTICE

15. What are the real costs of cybercrime?

....

....

....

....

Copyright, Designs and Patents Act 1988
Intellectual property (IP) is anything that a business ̄ ̄vns that it make̅
probably spent time and money developing ̄ ̄ s̄ ̄ ̄ ssets – so it shoul̄
money from them. IP can be in the ̄ ̄ ̄ ̄ f:
* Trademarks that identi̅ ̅ ̅ ̅ specific brand
* Patents (a nov̄ ̄ ̄ ̄ ̄ ̄ ̄n or way of doing something)
* Text, ̄ ̄ ̄ s, ̄ usic and video, and information (including copyriḡ
* Also c̄ ̄ ̄ trade secrets

IP is crucial for businesses – it's how they make their money. A car co̅
manufacture cars without the blueprints to make them or if another c̄
spending years on research and development, or a software company ̄
code base.

Trademarks

You've probably seen the ™ or ® (registered trademark) symbols to sh⬛ protected (registered), meaning that others shouldn't copy the brand, ⬛ could be sued (or at least receive a letter asking them to stop using th⬛ next to company logos as the logo is used to identify the brand, and tr⬛ specific colours. In the UK you can search company names to see what they own – take a look at **https://www.gov.uk/search-for-trademark**

Discussion Point

Brand names are often so widely used and recog⬛⬛⬛, we may say ⬛ name to represent a product – e.g. you sa⬛ ⬛⬛ ⬛⬛ are going to 'ho⬛ house' or 'do the hoovering', or ref⬛⬛ ⬛ ⬛⬛. vacuum cleaner as a 'Ho⬛ even though it's not made ⬛⬛ ⬛⬛⬛ ⬛⬛pany. Or you might say 'google rather than 'search t⬛ ⬛ ⬛⬛ ⬛⬛ for that'.

How man⬛ ⬛ things that you say in everyday conversation are ac⬛ brand names or trademarks?

Patents cover <u>novel</u> concepts and designs (although not a simple impr⬛ already exists). They give protection for a limited time in one or more ⬛ else from using that new design (unless they pay you licensing fees). T⬛ pounds and several years to register (with later annual renewal fees) a⬛ to make as much money as you can before the patent expires. After 2⬛ copycat product. But that patent could make you millions of pounds in⬛ excellent value for money.

Copyright

The text on this page you are reading is owned by ZigZag Education and⬛ is protected automatically by copyright. The © symbol at the bottom jus⬛ reminds you of the fact – all text and artistic works are automatically covered by copyright unless released into the public domain.

Each type of work is covered by slightly different rules depending on⬛ where and when it was published. To further complicate matters, a song has two separate copyrights – one covering the composition and⬛ lyrics, and one covering the actual performanc⬛⬛

Time was spent creating the ⬛⬛⬛⬛⬛⬛ ⬛⬛⬛⬛ and arranging it on this page so. It is, therefore, int⬛⬛⬛ ⬛⬛ property. Your teacher is allowed to ma⬛ because o⬛⬛ ⬛ic⬛ ⬛ ⬛greement in place, but they are not allowed t⬛ school. Li⬛⬛, another publisher couldn't steal the content and sell⬛ plagiarism – if you go to university, your coursework might be checke⬛ copy and paste in sections from the Internet.

Where you use ideas and material from other sources, you will need t
example, in the text you might write 'Smith (2021) suggested that stu
for lunch'. At the end of the essay you would provide a list of referenc
such as a book or journal, or a web page.

Similarly, any words and images in a book are not owned by you (unle
the copyright has expired – e.g. the author died more than 70 years a
you own the paper and ink, but not the words. I once saw an imaginat
book that read 'To have and to hold, but not to copy'.

The same is true for software that you paid for. You're really just pay
on a specified number of devices, sometimes for a set time period – th
and sign an agreement. The actual program is also protected by copyr

---

PRA

16. How would you protect your work from being used by others?

....

....

....

....

Data Protection Act 2018

If you read books about IT from perhaps 40 years ago, they would say
were stored on a handful of computer systems. That's probably hundr
computer systems are connected to the Internet, potentially allowing
The more places that the data is stored, the greater the chance of a br

Your personal data is valuable because it can be sold on the dark web
could use data for identity theft and other fraud. Identity theft is parti
criminals could take out credit cards and loans in your name and it ca
consuming to convince banks and debt collectors that you didn't set u
could receive more scam calls, junk mail and phishing emails.

Because of the danger of hacking, and the importance of keeping pers
legislation in place to help protect it – for example, the Data Protecti
Data Protection Regulation (GDPR) in the UK. These acts protect how
used and protected.

The new legislation was stricter than the old, and gave citizens greate
correcting the data held on them, consenting to the use of their data,
removed in some cases. Just before the new legislation came in to for
emails from dozens of companies that they'd signed up to over the pa
permission to retain their data. Companies are no longer allowed pre-
receive marketing emails, for example.

The penalties for non-compliance and for failure to protect data (e.g. breaches) became much more severe. GDPR set the bar high – the maximum offence was the larger of €20 million or 4% of global turnover in the past year. In the UK, the euro price was converted to £17.5 million, and fines are handed out by the ICO – Information Commissioner's Office.

Below are the general principles of the Data Protection Act 2018 / GDP previous Act of 1998). The UK was still in the EU ~~~ ı GDPR came int the UK as well.

Lawful processing
The person who is i~ ~~ a~ charge of the data and sets how it is proc The empl~~~ w~ ~ use the data on a day-to-day basis are the data pr that the d~~~ used (processed) only as instructed by the data contro ensure that the processing has a 'legitimate interest' to the business, a data is about (the data subject) has given consent for their data to be u

Collection for a specific purpose
The data collected must only be used for the purpose that it was colle company chooses to collect data, it must decide what data to collect, a necessary. If a company wants to use that data for a different purpose consent again.

Only necessary collection
The minimum amount of data should be collected – only what is abso sufficient and relevant for the study. If you are a volunteer taste-testir there's no reason why the company would need to know your mother's National Insurance number. But they might legitimately want to know gender because that would inform their target audience for marketing particularly well received by a certain demographic.

Accuracy
The real world is complicated and changes frequently. For example, w get married (and may change surnames), have childre ı, etc. The data r and up to date) when it is collected, but afte~ ~ ~~ m~nths, or years, i

This could allow inaccurate c~ ~ ~ ~~ng data, or incorrect decisions t data. Under the legis~~ ı ~~~ nesses should be very clear about whe from (so i~~~ ~e ~ ı ~~ed) and make checks on the accuracy if necess to be inco~~~ r inaccurate, it must be corrected (or deleted) as soon

Only kept as long as necessary
In most business settings, except for archiving and statistical analysis, will need to keep your personal data indefinitely. If you've bought son details for five years after your last purchase probably isn't necessary. should annually or periodically check that its data is still relevant and anything that's no longer necessary. The company may also have a sta informing the data subject how long their data will be held for.

Data subject rights

Remember that the data subject is the person who the data is about. T
the rights to (be):

- Informed – about how and why their data is being collected, the p
length, etc.
- Access – anyone can request to see a copy of the data that is held
free and within a month of the request.
- Rectified – any incorrect data to be corrected, and any incomplete
- Erasure – in some cases, you may request that a company deletes d
you – e.g. if the data is inaccurate, used only for marketing, is being
- Restrict processing – stop the data being used for some purposes (a
- Portability – take a copy of the data to another service (previousl
- Object – stop the data being processed in certain circumstances, e
- Automated decision-making/processing – e.g. important decisions
without taking personal circumstances into account. The data sub
person to look at the decision made and potentially overturn it.

Protected

All of the personal data must be adequately protected from hackers, d
misusing the data – the business must have sufficient equipment (e.g.
software, encryption, measures and policies in place to prevent breach
is safe. After the data and its media are no longer necessary, the data
shredding paper and tapes, magnetically wiping hard drives, etc.

Companies risk large fines if their systems are breached, or their prote
must inform the ICO of the breach within 72 hours of discovery, as pre

Not transferred to countries with less protection

Not all countries have the strict protection laws afforded by the Data P
international flows of data are essential to our modern life.

This is why when you try to access some websites – for example, whe
United States you are blocked from access. Companies that operate ac
data centres in specific countries and not transfer that data to others.
(where Facebook holds a large data centre) ordered Facebook to stop
EU citizens to the US.

While companies may have agreements that any data transferred will
protection EU-US Privacy Shield is no longer valid at the time of
not a suitable way of transferring data to the US. Does this mean that
example, is not currently legal in the UK?

Task 16

Find out whether Facebook is currently allowed to transfer data betw

---

Task 17

Find out whether the EU-U.S. Privacy Shield is currently valid – has it b
businesses transfer data between the EU and the US?

Discussion Point

Why would you want to correct information that others hold about yo

PRACTICE

17. Why is privacy protection important?

....

....

....

....

Freedom of Information Act 2000

The Freedom of Information Act 2000 ensures that public authorities (su
departments, local authorities and the NHS or police, etc.) allow the pub
certain information that they hold. This is either through releasing mate
documents and images published directly or reported by the authority, o

Sometimes you'll read a news article and it will say that the data was o
freedom of information request by the journalist or their employer. Bu
data (your request will be denied, for example, if you ask for personal i
someone else) – the act is designed to allow transparency (openness)
and to help earn the public's trust.

Task 18

Find out how easy it is to make a freedom of information request.

Discussion Point

If you make a request for information under the act, you don't need to
authority must provide that information unless there 's a specific reaso
such as your local council, suggest three thin~~ ~ n. you could request i
things that would be denied if you ask

Health & Safety at W~ k v 74

This is the la at helps keep you safe at work. The organisatio
for must le make sure that there are sufficient measures in place fo
sufficient training, use of PPE (personal protective equipment), safety e
and risk assessments, etc. must be carried out. For example, when you a
equipment, you will be required to use gloves, safety glasses and perha
protection. You will be taught how to lift heavy boxes correctly, and the
can carry, if that's what your job involves. When you start a new job, or
will receive the appropriate health and safety training, usually with an i

You are responsible for following the rules and making sure that your actions don't cause harm to others – if you were setting up some computer equipment, you wouldn't leave wires trailing across the floor, overload sockets, or pile up the empty boxes in the fire escape. You are also responsible for reporting any problems – for example, if there's a loose carpet tile on the floor that could cause somebody to trip and fall.

PRACTICE

18. Why are staff required to be respo̶̶ ̶le̶ ̶ ̶ r ̶ollowing the he̶

....

....

Think of your school science lab as an equivalent that you are familiar on practical tasks, you'll probably wear a lab coat and safety glasses a might have to do some experiments in the fume cupboard. The teache safety briefing first and reminded you of the health risks. They'll also f for the electricity and gas supplies.

Even office workers are subject to the act, but some of their protection Screen Equipment (DSE) Regulations 1992 to cover desktop and lapto smartphones, etc. (not surprising as typewriters still reigned supreme that staff have a comfortable working set-up with the desk, chair and and adjustable to ensure good posture and help prevent repetitive str Staff workstations will be regularly assessed to ensure compliance (es desks with other people (called hot-desking)). The company even has ask for one, and possibly glasses too.

Task 19

Take a look at a summary online of the Display Screen Equipment (DS Make a note of three specific requirements that the screens need to m

1. ....

2. ....

3. ....

Discussion Point

Your school computer lab doesn't need to meet the requirements of th (DSE) Regulations 1992. Do you think that your school computer lab w if it needed to? For example, can you adjust the height of the screens,
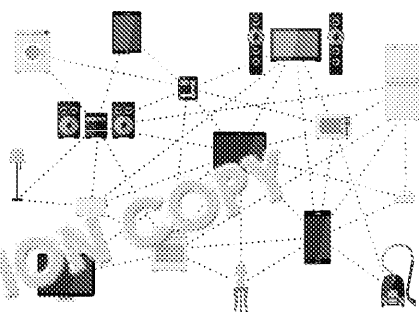
Workbook D: Digital Communications an Everything (IoE)

Name: ....

Topic 5: Digital Communications

Topic 5.1: Types

There are many different ways that businesses communicate with us, the customers, and internally within the office and amongst branch offices. As companies adapt to new ways of working post COVID-19, digital communications will play an increasing role in the lives of remote and hybrid workers who need to 'touch base' with the physical office.

Type	Example & Use	Advantages	Disadvantages
	Example: Podcasts **Use:** Audio programmes downloaded or streamed to a smartphone, tablet or desktop; they are usually series and are often released on a schedule, e.g. weekly, fortnightly. They provide public entertainment and information, can be used to sell the brand; some are paid for. Many are recorded by individuals.	• A growing audience. • Can listen to them anywhere, or while doing other tasks (unlike reading). • Can add brand loyalty. • Good for SEO (search engine optimisation).	• Can take a long time to source material, record and edit – so an extra expense for business, but a hobby for individuals. • Podcasts are often listened to by a younger audience, so your message may not reach older generations.
Audio	**Example:** Radio commercials **Use:** Short (30 seconds or 1 minute) commercials to make potential customers aware of your company and brand, and increase sales.	• Radio has a wide audience throughout the day, some listen to radio in the car, in the shower, while cooking, etc. • Reasonably cheap for local stations. Can advertise on local stations –	• Only 30 seconds to get your point across, including mentioning the brand several times. • Adverts might come across as cheesy or cringey if you're not careful.

Type	Example & Use	Advantages	Disadvantages
Collaboration tools	**Example:** Document sharing, instant messaging, project planning, e.g. Slack, Teams **Use:** Platforms designed to allow teams to work in the office, with other offices, or remotely, to share ideas, communicate on the project, share files, set tasks and visualise project milestones.	• All workers use the same platform to work and share documents online – it doesn't matter where they are in the world. • Can replace more traditional services such as email and on-premises file sharing with instant messaging and voice communications, sometimes several people work on the same file, good for version control. • Can set tasks and actions, see what's been achieved, whether milestones are being met.	• Can take a while to master the platform. • Some specialised project management tools can be expensive.
Leaflet	**Example:** Leaflets and flyers for tourist attractions, takeaways, and other services **Use:** Provided at stands in tourist areas and information centres (attractions); often posted through letter boxes (takeaway menus, local businesses, etc.) in order to promote the business.	• Good at grabbing attention – that piece of paper has to be dealt with, maybe put in a drawer for future use. • May help direct website traffic (for tourist attractions). • Can send through the post instead of organising local delivery.	• Many of the flyers that are expensive to produce will be immediately thrown away – a waste of paper and ink. They are seen as unsolicited junk mail; some people put up 'no junk mail' signs on their post boxes. • Costs of the delivery to letter boxes

Type	Example & Use	Advantages	Disadvantages
Infographics	**Example:** Used on company websites, brochures, posters and marketing material **Use:** B[...]wn complex processes into easy-to-und[...]d visual representations with key details, ar[...]s, numbers, percentages and other infor[...]ion.	• Visually attractive and often engaging. • Help with understanding com[...] processes or issues without ne[...] paragraphs of dense information that is harder to read.	• Require staff or an external agency with good design skills, and can take a long time to create.
Newsletters	**Example:** An[...] l newsletter to investors, termly newsl[...] to parents from your school, online marketing o customer mailing lists **Use:** Provide inf[...]ation about past and future events to st[...]eholders and investors, used in marketing, [...]c. Published online, sent via email or on pap[...]	• Help to retain stakeholders without the hard sell. • Make customers aware of new products. • Keep stakeholders interested in a brand, especially if the newsletter is entertaining, visual and light-hearted. • Online/email delivery is very cheap.	• May be immediately discarded or deleted. • May end up in junk folders.
Presentations	**Example:** PowerPoint/Ke[...] note presentations delivered at a wide variety of conferences, in business pitches, in classrooms and lecture theatres, etc. **Use:** For education, marketing and selling to other companies. Audiences can be very large,	• Highly engaging, talk to a wide audience. • Can be very persuasive and leave lasting impressions if successful. • Conversations can be both ways – allowing audience participation and	• Need [...]e right person to lead with confidence and public-speaking experience – a presentation can go wrong very quickly (you may have noticed this on *The Apprentice*). • Need to be engaging throughout or

Type	Example & Use	Advantages	Disadvantages
Reports	**Example:** Annual company reports, project reports, etc. **Use:** Provides technical details of the state of a company or on a specific project. Will often have sections including an introduction, main chapters, a conclusion and appendices. Will usually contain tables, charts, illustrations and diagrams to help explain the text.	• Often written by experts who have worked on the project to provide the knowledge that other teams might need. • Highly technical and provide everything you need to know. • Can be published online to save paper and printing costs.	• Very time-consuming to write, factually check and proofread, etc. • Can be very long – it's unlikely that people will read every word. • Complex language and the large size can be intimidating.
Social media	**Example:** Facebook and Twitter (older), TikTok, Instagram and Snapchat, etc. (newer) **Use:** Brand promotion to followers in order to provide product updates and offers. Both through business pages and targeted advertising.	• Huge audience – about 45 million people in the UK use Facebook. • Highly targeted marketing to specific demographics (such as age groups – see Topic 5.5) on the platforms, can be cheaper than traditional methods. • Drive traffic back to the company website. • Customer communications, time-sensitive offers and promotion of products. • Can be good for brand loyalty.	• Can take a dedicated team to create posts and respond to customer queries. • Can be hard to measure the impact of social media compared to traditional media forms. • Negative feedback / complaints may be publicly visible, users can tag the company in complaints. • Many users are in the younger demographics (especially platforms such as TikTok and Snapchat with very few users over the age of 40).

Type	Example & Use	Advantages	Disadvantages
Video	**Example:** Company overview, product demos and guides, YouTube channels, added to online platforms such as Amazon. **Use:** Adds a personal touch for new and potential customers explaining how the business works or the services that it offers. Can be used to promote new products by outlining product features and new developments, and provide instructions on how to set up, build or use the product once purchased.	• Clear and accessible, able to visually see a process or step-by-step instructions. • Can host on major video sharing sites for free or small cost, and embed video frames onto the company website.	• Can be expensive to film. • Requires specialist software (and skills) and can take a long time to edit.
Voice over Internet Protocol (VoIP)	**Example:** Teams, Skype, Zoom, IP phones and handsets, etc. **Use:** Used by internal employees within offices (with an IP phone system), as well as remote staff, and for conference calls. Sometimes to speak directly to customers.	• Often very cheap to implement, just need a headset attached to your existing computer (if there isn't a built-in microphone and speakers already). • Calls can be free, including internationally. Outgoing calls from a phone system are cheaper than normal landlines. • Very flexible – easy to add new users. • New IP phone systems have lots of features and functionality.	• Quality depends on the speed and latency of both Internet connections – may not be as clear as a normal landline or mobile call, or may drop out. • Setting up a new phone system can be expensive. • May need an upgraded (more expensive) Internet connection to cope with increased network traffic.

Type	Example & Use	Advantages	Disadvantages
Websites	**Example:** Business website, sales or video platform, personal website. Contain text, images, video and links, social media, etc. **Use:** Provide full details about the company, and the products and services that they offer, often with an online sales platform built in. Used for promotion, help desk and virtual assistant and contact details; often the first point of contact with a new business. Personal websites may be set up to provide information, blogs and posts about a hobby or interest, or for showing a portfolio of your work and achievements that you can direct employers to when submitting a job application.	• Publicly accessible from anywhere in the world 24/7/365 (even when the office is closed), rich content using styles such as CSS. Customers expect businesses to have a website! • Can set up customer logins / extranets for customers to access additional services. • Good for brand promotion, and can be updated on a regular basis. • Online web builders are easy to use and provide good support for creating mobile versions. • Advertising revenue on some sites such as news outlets to offset hosting fees.	• Need to employ SEO (search engine optimisation) to rank at or near the top of search engine results, e.g. Google. • Can be time-consuming to maintain and update; may require expensive redesigns to stay current, and experts to create. • Need to renew domains before they expire, and pay for hosting. • Could go down, be subjected to a DoS attack or defaced by hackers, email addresses contained could be abused by spammers. • Users can use ad blockers, bypassing some revenue generation.

Discussion Points

- Which podcasts do you listen to? Are they hosted by individuals o
  been put off by paid-for podcasts? When and where do you liste
- Do you listen to the radio? Do you find that radio adverts are hard
- What do you think makes a good infographic?
- How many types of presentation can you think of? How many hav
  watched online?
- How many adverts do you see on social media? Do you take any
  follow any brands?
- How many big brands do you notice on video-sharing sites such a
- Which do you prefer – speaking on a landline or mobile phone, or
- How often do you visit a. corporate websit**e** **e** b. personal we**b**

Tasks 1–3

1. Try turning the s.... o.. during TV adverts – do you pay closer a
   Is this ....m. as radio adverts?

2. Search online to see how many collaboration tools you can find. J
   available and price per user if you can find that information.

   ....

   ....

   ....

   ....

   ....

   ....

3. Look at the website of a large global company – it doesn't matte
   or Apple, Coca-Cola or Nike, etc. Note down each section displa**y**
   sidebar and explain what the purpose of each one is – for exam**p**
   in looking at that page.

   ....

   ....

   ....

   ....

   ....

Tasks 4 and 5

4. Make a note of all the leaflets posted through your letter box over
   them and what your family did with them – threw them away or kep
   (e.g. takeaway menus), but throw the others away (e.g. estate agen

   ....

   ....

   ....

   ....

5. Make a note of all of the adverts that you see on social media pla
   Do you think it is specifically targeted at you or your demog

   ....

   ....

   ....

   ....

   ....

PRACTICE

1. Explain why the type of distribution channel must be chosen ap

   ....

   ....

   ....

   ....

2. Explain why internal and external communication channels var

   ....

   ....

   ....

   ....

Topic 5.2: Software

Desktop publishing (DTP)

Back in the day, you needed to go to a print shop to get anything typeset or laid out on paper for printing. This all changed in the 1980s when graphical computers such as the Macintosh and laser printers became affordable, and a desktop publisher became available for most systems.

Nowadays, it's easy to use desktop publishing software in an office environment, but many designers still use Macs. It's now even possible to use some software through a web browser. The output can be published online as a PDF file, or emailed to a print shop for bulk professional colour or black-and-white printing on many types of paper and

Examples of desktop publishing software include:

* Adobe InDesign
* QuarkXPress
* Canva
* Microsoft Publisher

Task 6

Take a look online at the features for one of these desktop publishers, their promotional material, or find a video online.

Desktop publishing allows you to create professional reports, documents, advertisements, magazines and newspapers, etc. with a lot more tools as Microsoft Word. If you only use text and need basic image tools, a w instead. Word processors allow you to be highly creative with laying o graphics, and creating specific images and colour schemes. It is possib that your style and margins are consistent.

Desktop publishing, like a word processor, uses the same page layout WYSIWYG). It is possible to zoom in on sections on the page while you majority of the screen will be your document, but there are menu bars sides offering the basic tools and functions. Some packages allow you the cloud for sharing, and are bundled with cloud storage.

Learning to use desktop publishers can take a long time – there a features available to you, but you'll probably only use a small subset o day. On-screen and online help functions and online forums can be ve starting out, and when learning new tools.

Desktop publishers can be very expensive to purchase, and some have annual subscription. Only a handful of specialist graphic designers ma on their machines. An annual subscription for InDesign currently costs subscription service, you automatically have access to the newest vers sometimes impossible for files created in a newer version of the softw version – so everyone in the company must be on the same or latest r

---

Task 7

Take a look online for jobs in your local area that want the candidate desktop publishing (e.g. InDesign). What do the job involve? What's t

---

PRACTICE

3. Why do business staff who can use desktop publishing

....

....


Standard office applications

Standard office applications can be used across many operating system

The most common office application suite is Microsoft Office, which c applications including Word (word processor), Excel (spreadsheet), Pov Outlook (email client) and Access (database), etc. Until relatively rece installed applications designed for use on PCs/laptops; however, onlin are being increasingly, e.g. Google's equivalent office applications, wh their cloud storage platform, Google Drive. These online versions cate devices such as smartphones and tablets.

Using such a popular set of applications is a big advantage – most new staff will arrive at the business with experience of using the software (less training costs), and it's much easier to share files with other businesses who use the same software.

> File name:
> Save as type:
> Author:
>
> de Folders

Each application can save in several format types to allow compatibility with other software, including other Microsoft products, older versions, and free software. It is possible to open file types saved by other software within the Microsoft Office suite, especially when saved in the open document format. On the right you can see the types of files you can save with Microsoft Word.
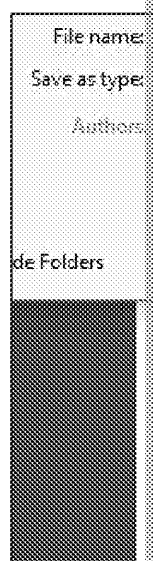
Discussion Point

How familiar are you with the Microsoft Office package – are there you know more about?

Traditionally, Microsoft's office suites were stand-alone installations on each machine, with 10 years of security updates for each release. Microsoft is now pushing users towards a subscription service (through shortened support cycles) where you automatically get the latest version, online versions and cloud storage (Office 365), but with an annual fee instead of a one-off payment. This can be much more expensive, but can allow for scalability in a business setting.

The online versions can be run o
They have a much simpler interfa
because of the smaller screen si

There are other competitor office
proprietary Macintosh offering (P
etc.), while free alternatives such
OpenOffice are available for man
Windows, Linux and Macintosh.

In an online world, it's possible to class web browsers, productivity sof
standard office applications. This is because of the modern use of onli
versions of desktop apps and webmail within web browsers, and our in
applications. Many business have also largely replaced email with inst
such as Slack.

Specialist software packages such as CAD (computer-aided design) and p
are only installed on a limited number of computers, used by specific sta
desktop publishing software is installed. Therefore, these are specialist a

Remember – software can run on desktop and laptop computers runni
mobile devices such as tablets and smartphones.

Task 8

Try out an office suite that you're not familiar with (e.g. LibreOffice or Ope
https://www.libreoffice.org/download/download or
https://www.openoffice.org/download/index.html).

Try to do basic things without looking at the help file. For example, cre
document, try to set up a different style, chang ' f nt, text size, col
How easy was it to master? Could you u e hi as an everyday piece o

Now try to open a document in t i your usual word processor. Are
layout or formatting?

PRAC

4. Exp why standard office applications are so important to b
information with other businesses.

....

....

....

....

Topic 5.3: Digital devices

We access media and applications across a variety of devices. Each is best for certain purposes.

Smartphones are now everywhere – a far cry from when professionals used Blackberry phones with tiny physical keyboards. Android (Google, used by many different manufacturers) and iOS (Apple iPhones) are the two dominant players. We seemingly use a smartphone for anything other than calling or texting people – it's really a tiny computer in our pocket.

We often use web browsers, email ̶ ̶ and apps to access the Inte games, watch video and play podcasts, etc. when we're out and about. maybe 5 or 6 inches ̶ ̶ screen size in order to fit in our pockets, day use o ̶ ̶ a ̶ ̶ ce applications. Some manufacturers sell dock keyboard ̶ ̶ nality. Most smartphones have built-in cameras, used (back camera) and video calls (front camera).

All smartphones include a SIM card which allows access to the cellula 3, EE, giffgaff) to provide voice and mobile Internet access. Most smar your home Wi-Fi network so you don't use up your data allowance at h built in so you can connect wireless speakers or headphones, etc. NFC payments to be made.

All apps must be created specifically for the device you are using, typi versions of the OS, and are downloaded from the App Store (Apple) or desktop PC, smartphones are more of a closed system – it's possible to the store, but not recommended.

Task 9

See if your phone can tell you how long you've spent using it over the your model or operating system) – it may be in an app such as Digita you a breakdown of how much you use each app, and how many time For my phone I used these instructions

https://www.popularmechanics.com/technology/news/a27948/ph

What did you use your phone for over the last week?

Were you surprised how much you actually use it?

PRACTICE

5. W ̶ ̶ es ̶ ̶ need to be adapted for display on smartpho

....

....

Tablets are similar to phones except that they don't usually have acce{...}
and they have larger screens. This makes them more suitable for vide{...}
office apps. They typically have access to the same apps as smartphon{...}
in some scenarios, such as web browsing and VoIP, but wouldn't be su{...}
need desktop apps.

Smart TVs are mainly used to display video content on a large screen (r{...}
definition (at least 1080p or 4K). Smart TVs are mostly used in the hom{...}
regular TV, they have an aerial antenna and tuner for terrestrial TV, and{...}
in a set-top box to receive cable and satellite services, a games console{...}

The part that makes them 'smart' is th{...} h{...} {...}onnect to the Internet
through a wired or wireless c{...} {...}. This allows you to download
apps from a speciali{...} {...}ch as Netflix, Disney+, YouTube, BBC
iPlayer, A{...} {...}ut the need for an external device. You can
usually str{...}edia from other devices such as computers on your
home network. Some people may also install other apps such as web
browsers and social media viewers, and VoIP if there's a built-in
camera and mic.

Discussion Point

What are the benefits of a smart TV compared to owning a regular T{...}
hardware such as media PCs, consoles and sticks to access streaming {...}

PCs and laptops are still the workhorses in the office, but you'll find p{...}
(especially laptops, all-in-ones and gaming PCs). They come in various{...}
* Desktop models (under-desk towers and on-desk boxes) with separate{...}
* All-in-one desktops where the screen and desktop are all in one d{...}
* Laptops (portable) which can often be attached to docking station{...}
  Ethernet, and add ports, external screens and separate keyboards {...}
  to connect all of these items directly to the laptop.
* Laptops which fold to become a tablet-like device.

Desktop PCs, and sometimes all-in-ones, are used where
powerful processing is required, or where they do{...} eed
to be portable – they are used in the office {...} d{...}gners
and architects, and where specifi{...} {...}re or graphics
cards are required (som{...} {...}ic{...} {...}ns, such as Photoshop,
require speci{...} g{...} {...}ar{...}s). Desktops are typically easy
to upgrad{...}ke laptops.

When staff need portability, such as those who frequently need to trav{...}
home, laptops are used (which have smaller screens, and contain a ba{...}
sockets are unavailable). When staff are in the office, they might attac{...}
station or external monitor, effectively turning the device into a deskt{...}

PCs and laptops run full desktop operating systems such as Windows 10 Linux. They are capable of running full desktop versions of Office suites software. This is why they are used frequently in the workplace, and for

---

Task 10

Take a look at an online store that sells PCs and laptops. Compare the PC and laptop of similar price, say around £600 for a laptop and £5 the monitor costs £100). Are you surprised at the hardware difference RAM, hard disk space and processor type and speed)?

Discussion Point

Do you prefer laptops or desktops? Does it depend on what yo

---

PRAC

6. Why are laptops sometimes used instead of desktop PCs?

....

....

Smartboards are found in schools and colleges as a replacement for dry-erase boards or blackboards – you've probably seen plenty of them. The board itself is a large, white touch-sensitive panel that is used with a PC or laptop, and a data projector.

The screen is connected to a PC running Windows and specialist software to draw, write and type text onto the screen using input devices such as styluses or keyboards.
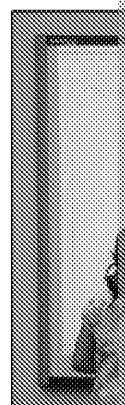
The screen can also be used as a giant touchpad, to drag and move ob effectively a giant input device. The screen tells the PC what has been words and objects, and the software outputs this to the projector in re image can be projected onto the screen from the computer so the sma standard projector screen.

Discussion Point

What are the advantages of a smartboard over a traditional whiteb

---

Topic 5.4.1: Types of distribution channel

Businesses use a variety of modern tools to communicate with the stakeh[...]
customers (both business to business, including suppliers, and the public)[...]
Each type of communication has a slightly different target audience and t[...]
right method for the right purpose to maintain professionalism and confid[...]

Sometimes, more than one method of communication can be suitable,[...]
context. For example, when discussing a complex issue with a colleag[...]
speak to them over the phone or in person rather than having a length[...]
could be a lot quicker for making decisions, and ens[...]ing that the issu[...]
without a written exchange, parts of the ta[...] be forgotten about[...]
evidence, and the reasoning behind[...]ecisions may not be recorded[...]

Some common c[...]a[...]on platforms include:

Email	
How does it work?	**What is it for?**
Each company will have a series of mailboxes, sometimes publicly available, such as an address to receive customer queries, job applications, etc. They are accessed through a desktop client (e.g. Outlook) or a web browser. Each member of staff is likely to have a personal address, but staff in some departments will have access to shared and public mailboxes. Each department might have groups set, e.g. @customerservices or @adminteam, so that everyone in the team receives a copy of the message.	• Staff and mana[...] communication team or departr[...] company news[...] • As a way of cor[...] customers, e.g.[...] • Sending email [...] product launche[...] • Sending updates[...] opening times, u[...] offers and disco[...]
Advantages	**Disadvantages**
Good for communication with internal and external recipients for a wide variety of purposes • Can perform the same functions as et[...]s, but cheap to send, and i[...][...] • Can attach docu[...][...]insert photos / HTM[...]te[...]	• Email fatigue fr[...] hundreds of em[...] time to read an[...] • Can take a long[...] instant message[...] • Easy to send to [...] divulging confi[...] • Important emai[...] spam and sent [...] be missed • Any email addr[...] website can be[...]

Cloud

How does it work?	What is it for?
Each company or person wanting to use cloud services sets up a user account with a cloud provider which gives access to software, file storage, email, etc.	• File storage an(• Email hosting • Running softwa[on the client m[

Advantages	Disadvantages

• Great for collaboration tools and sharing, working on documents at the same time which can be difficult with on-premises options
• Available 24/7 globally so [...] world teams
• Easily [...] pay for what you need, when [...] need it)
• Everyone uses the same software so no issues with compatibility or version control
	• Less control tha[
	  solution
	• May be security[
	  type of busines[
	  hacking)
	• Reliant on fast, [
	  for a reliable co[

Messaging and social media

How does it work?	What is it for?

Companies set up business pages on popular social network sites such as Facebook and Twitter. The company posts news and service updates, and responds to messages from customers.
 	
Internal messaging systems are replacing email in some businesses as part of workflow software, e.g. Slack.
	• To promote the[
	  audience (inclu[
	• To drive traffic t[
	• To provide real[
	• As a way of cus[
	  of contact
	• Email replacem[

Advantages	Disadvantages

• Very fast communications both internally and to external customers and stakeholders
• Quick replies and responses (faster than email, often fewer words)
• Real-time communication – no need t[...] wait for email response
	• Public message[
	  the reputation (
	  (e.g. misinterpr[
	  messages/comm[
	  disgruntled cus[
	• Blurred boundar[
	  professional live[
	• Can be distracti[
	  business settin[

Mobile apps

How does it work?	What is it for?
Businesses program apps to work on smartphones and tablets. They are then made available on the App Store, Google Play, etc. Some are free, others paid for. Many desktop programs are also available as a cut-down mobile app, such as office suites that offer a different interface designed to work or smaller screens.	• Some apps repl shopping, bank replace online • Others are desi applications, e. • Many are preins such as email cl

Advantages	Disadvantages
• Provid... asy... consistent and self-cont... latforms at the press of one icon — no typing web addresses • Add extra functionality than is available through a web browser • Each app can be given different permissions on the resources they can use • Can easily switch between different apps	• Users must hav the app, and a supported versi • Paid-for apps c potential users • Increased supp support many v Android 5–11) • Need to promot • Can be frustrat of apps

Multimedia

How does it work?	What is it for?
A wide variety of different services that provide a combination of text, audio, video and images, etc. Usually two or more shown on the same page at once.	Provides a rich exp text, e.g. images in inserted into a tuto

Advantages	Disadvantages
• More engaging to the audience, adds interest and can use video to explain ... point or demonstrate a produc... effectively than just t... al... • Appeals to a ... u...ence • Easi... ...n...stand • Provi... ...ternatives to people with disabilities (e.g. partially sighted can listen to audio, audio description, alt-text and text to speech.	• Time-consumin especially vide subtitle, provid text, etc. • Needs a faster / connection than • Viewing platfor may need extra extensions/plug

VoIP

How does it work?	What is it for?
Instead of using a traditional phone line, a VoIP (Voice over IP) service allows for video calls and virtual meetings either through a desktop or mobile app, or a special VoIP phone	• Internal and ex[...] staff and custo[...] • Help desk, cust[...] • Project and tea[...] • Online events a[...]

Advantages	Disadvantages
• Very cheap form of voice communications (often free) • Excellent option for internation[...] [...]ll[...] • Can have conference ca[...] [...]ndreds of staff at once, ac[...] [...] diffe[...] [...]c [...] • Easy [...]rd for future use • Easy to combine with video	• While nearly ev[...] phone (mobile [...] everyone has a[...] VoIP equipmen[...] • Call quality can[...] and static • Users may be l[...] to alter setting[...] • May need to ad[...] schedule, recip[...]

Website

How does it work?	What is it for?
Companies set up a customer-facing website on the public Internet that anyone can access. Note that organisations may set up an internal website called an intranet for staff to access information and tools.	• Often a first po[...] • To make custo[...] and services, pr[...] and reviews • To host articles[...] and updates • For online sale[...] • For contact for[...] e.g. with techn[...] • Also blogs • Also company i[...] information sys[...]

Advantages	Disadvantages
• Can contain a lot of information, with [...]nk[...] to other pages, sites, social m[...][...] [...] video • Able to create a seri[...] [...] li[...][...]a pages, availabl[...] fro[...] [...] bars, wikis, etc. • Wid[...] [...]y [...] purposes (personal to corpo[...]) • Easy to create (e.g. online templates) • Easy to update	• Needs constant[...] information bec[...] date – takes ti[...] • May need extra[...] mobile version[...] • No control over[...] browser, screen[...] • Sites may be in[...] some browsers[...]

As you can see, each of the communication methods has different pur[...]
Sometimes, more than one form of communication would be possible[...]

Task 11

For each of the following scenarios, choose the best form of communic
you have chosen it.

	Best communication type	
A manager needs to discuss an employee redundancy with the HR department		
A customer needs to compl... about a faulty prod...		
A comp... ...eds to make its customers aware of a new product		
A colleague needs to let their team know that they've updated a report		
An employee has become unwell and needs to go home early		

Task 12

Take a look at the different types of cloud services that are available
Office 365, Slack. What do these products offer? Can you think of ad
disadvantages of the software?

Make some notes below.

....
....
....
....
....
....

Discussion Points

* How often do you use email? What for? Do you use instant messa[ge]
  always, often?
* Do you find any advantages using a mobile app instead of acces[sing]
  version of the website on your phone?
* Why might a company replace its phone system with VoIP next ti[me]
* Choose two or three websites that you regularly visit – what is the[y]
  use multimedia?

PRACTICE

7. Why is the cloud becoming more popular?

   ....

   ....

8. Why is email use coming under threat from other technologies[?]

   ....

   ....

9. Why is using multimedia advantageous?

   ....

   ....

Topic 5.4.2: Distribution channel connectivity

Below are the different technologies that we use to transmit data.

4G/5G

4G (fourth generation) is the current standard for mobile Internet used smartphones and some tablets. It is provided by cell towers used by te providers. Over the coming years, it will be replaced with 5G (fifth gen which will offer greater coverage and much faster speeds (up to 10 Gb lower latency, and less interference in urban areas because of the high frequency signals. But you will need to buy a new phone to get on to t network, and the service is initially limited to ar r towns and cities.

4G signal can be patchy in al r mountainous areas and indoors a topography can block signals. You'll have found this out when holiday countrysid ls and data connections can drop or time out.

4G routers are available, which use a SIM card in the same way as a m phone (instead of using landline phone or fibre service). The data is th your home's Wi-Fi network. Some business-grade routers also have a 4 connection which the device automatically switches over to if the norr working, e.g. a fault on the external network.

In the future, 5G routers could be a serious competitor to fixed home turbocharge the Internet of Everything, which you'll read about in the

---

Task 13

Research Huawei's work into developing 5G. Explain why some gover have banned and are removing existing Huawei from the core of UK

....

....

....

....

....

....

PRACTICE

10. Explain why some people are hesitant about using the cloud to data / communicate.

....

....

11. Why is VoIP popular?

....

....

Bluetooth

Bluetooth [uses ra]dio frequency to create a personal area network (PAN) [by] 'pairing' devices together. This allows devices to communicate and data [over] a short distance (several metres). Bluetooth is built into most smartphone[s and] laptops. You can add Bluetooth to a desktop device by plugging in an ine[...]

Compared to other technologies such as Wi-Fi, Ethernet and USB, Bluetooth is very slow (max. speed for version 4 is 25 Mbps). We don't often use it for file transfers or for sharing a phone's Internet connecti[on] (tethering), but it's possible to set up. But Bluetooth excels in connecting to wireless peripherals such as speakers, earbuds (pictured[)], keyboards and mice, game pads, and printers. We can also use Blueto[oth] to connect to our cars for audio streaming and making hands-free call[s,] to access security devices, and for connecting devices together for gam[ing].

Discussion Point

Do you use Bluetooth? If so, what for?

Mobile Wi-Fi hotspots

In businesses and homes, there is often a fixed network set-up. Routers, switches, cables and network sockets, wireless access points and Wi-Fi extenders make up this fixed network. They are usually serviced by fibre-optic or copper cable [...] and services, allowing a fast and reliable c[onnec]ti[on t]o the Internet and other devices on the netw[ork].

But what if [a n]etw[ork set]-up is not available where you need to work or st[udy? I]n that case, you can set up or connect to a temporary [ne]twork called an 'ad hoc' network.

Tethering is sharing the mobile data connection from your smartphone with other devices such as a tablet or laptop over a Wi-Fi, Bluetooth or USB connection (the phone acts in the same way as your home router).

Tethering:

* Highly flexible – set up anywhere.
* Secure as you own all of the equipment and can set up a password without your permission.
* The quality of service is determined by the signal strength to the not so good in rural areas or in some cities indoors. The signal cou
* Reliant on your phone having batteries.
* Bluetooth connections can be slow.
* Eats through your mobile data limit (quickly!).
* Affected by walls and distance.

PRACTICE

12. Give two advantages of using ??? h?c ???works.

1. ....

2. ....

Wi-Fi

Wi-Fi takes the incoming cable Internet (copper, coax or fibre) into the home and business and broadcasts a wireless signal that you can connect your devices to. There are many devices that you can connect to Wi-Fi – phones, tablets, laptops, some desktops (all if you include a wireless card or USB adapter), TVs and a whole range of IoT (Internet of Things) devices, including colour-adjustable light bulbs.

You might be surprised to learn that the name 'Wi-Fi' is meaningless – some people incorrectly think that it stands for wireless fidelity.

In your home, Wi-Fi is probably built into the router provided by your In possible to use your own Wi-Fi transmitter and booster equipment, and offices, several wireless access points may be installed, to ensure that t coverage. As you move through the building, your device automatically to the next access point. Wi-Fi is also installed in many public areas inc work flexibility – from working offsite between appointments, to inform

Over time, Wi-Fi has improved in terms of speed and range. Most mode 'n' and 'ac' technologies. Some networks can offer both frequencies in t

However, Wi-Fi networks can perform poorly, e??? ?a ly when the rout and objects, or if there are competing ne?w ?rk??iat overlap on the sa that you get better signal in cer??? ?p ??of your home.

Wi-Fi is great beca????? ?l. ?vs a lot of flexibility on where you???, ??y valuable in businesses where you can move ???d the building and attend meetings. Your device may even be switched to the different access points. But Wi-Fi isn't as reliable or usually as fast as a wired connection. Wi-Fi can also pose a security risk because it is accessible from outside of the building – so make sure that you have changed the network and router's login password! Some companies don't allow staff to use, or connect company devices for business use via, public Wi-Fi over security concerns.
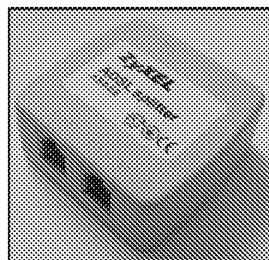
Wired

Wired networking is generally the most reliable, but is more fixed. Typically, wired networking uses an Ethernet cable with an RJ45 connecter on each end. Speeds are fast – usually 1 Gbps. Some run at 10 Gbps.

In businesses, all networking will run in the walls or in trays near or above the ceiling. Network sockets will be installed in the walls, trunking or floors, all leading to switches and patch panels in a server room or cabinet. Wired networking is likely to be built in to new 'retrofitted' (after being built) into older building. While many offices large sites may use fibre-optic cable to link buildings and core infrastr because copper cable typically can be run for more than 100 metre s degrades. Once instal network devices, such as PCs, laptops an to a nearby a short cable.

In your home, you'll connect with Ethernet cables to your router if you w better connection than over Wi-Fi (faster speed, lower latency) – great if devices are in the same room, not so great if you're at the other side of th Some modern houses can be pre-wired with Ethernet for an extra cost, a homeowners have retrofitted their homes with Ethernet cables that run t the loft, or under the floorboards. You can also buy powerline network ac (pictured) which plug into existing electrical sockets and use the electric cabling between the plug sockets to transmit the data. Some powerline a also add an extra wireless access point into your home network.

Wired also refers to the delivery of Internet acce business; for example, using an existing phone l ADSL, which is the slowest (20 Mbps download web browsing, but not for uploading video, onli people online at once. If your local street cabine fibre, you'll get faster speeds, maybe 70 Mbps d phone line. You'll know if you have your Interne if you have a small ADSL filter box that separate phone (if you still have one), or a wall socket wi

The fastest and most reliable connection is full fibre-optic (pictured), delivered directly to your home or apartment block – which could offe you several hundred megabits per second to a gigabit per second download. m get your Internet delivered through a coaxial cabl (thick copper wire) – especially if you have a Virgin Media connection. Coaxial cables allow more data than a phone line – you might have a cable TV service where the cable splits in two – one to your TV box, the other to your router. Fibre connections are typically more expensive, and are not available in all areas.

Task 14

Use an online broadband checker to find out what broadband service
live, e.g. **https://www.cable.co.uk/broadband/check-my-area** or
https://www.uswitch.com/broadband/postcode_checker

Work out which providers offer a. the best service and b. the best val

Write them down below.

....

....

....

....

Task 15

When you go home, set up a hotspot and tether a laptop to your mob
hoc network. We're going to determine the speed of your phone's cell
your home broadband. We'll also test the robustness of an ad hoc net
and laptop far apart.

Go to **https://www.speedtest.net** and perform three tests:
a. With the mobile phone next to your laptop
b. With your mobile phone away from your laptop – place your pho
c. While connected to your home Wi-Fi

Write down your results in the table below.

Test	Ping (lower is better)	Download speed (higher is better)
Tethered – phone and laptop together		
Tethered – phone and laptop apart		
Speed of fixed broadband		

Task 15 continued

Now you can summarise your findings.

● Which connection was the best, and why?
● How much of an effect did moving the phone away from the laptop
● How would tethering affect the performance of website load time
  online applications such as Office 365?

....
....
....
....
....
....

If you are unable to access a mobile phone and laptop, then you can
below. This is real data from a mobile phone running on O2's 4G net
fibre broadband connection. By comparison, a wired connection from
router gives a lower ping, and speeds close to the advertised and pu

Test	Ping (lower is better)	Download speed (higher is better)
Tethered – phone and laptop together	30	15
Tethered – phone and laptop apart	30	10
Speed of fixed broadband	24	33

PRACTICE

13. Explain why most offices will have both a wired and a wireless

....
....

Topic 5.5: Audience demographics

When choosing how to present information to an audience, the followir
considered in order for the communications to be targeted correctly and

Accessibility

Not everyone has the same level of ability. For example, a visual or an
make some forms of communication difficult. There are ways in which
by providing the same information in different formats, or adding extra

For example:
* Audio description on a video or film (for visual impairments)
* Subtitles on video (for auditory impairments)
* Providing large-print or sometimes Braille formats
* Allowing text to speech, screen reader support, alt-text on images
* Providing a version that uses sign language
* Providing an induction loop for those on the premises for those wh

Here's an example of turning on subtitles on a YouTube video.

prime minister to delay
reopening to get more vaccinations done
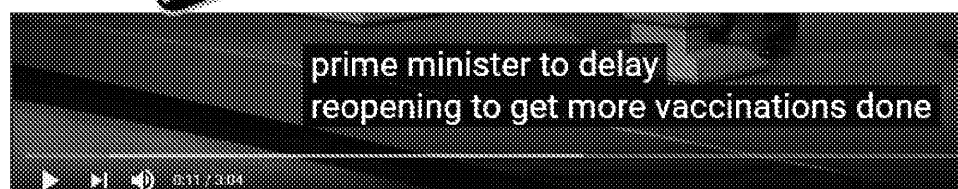
There are also accessibility issues with online content – everyone must
tablet or PC with Internet access. For this reason, printed formats are of
2021 census was mostly completed online, but a printed booklet was av

Similarly, there will always be more than one way to contact a busines
prefer the convenience of filling out an online form or pinging over an
write a letter on paper and put it in the post. Of course, there's usually
pick up the phone if you give them a call (after you sometimes navigate
through to the right department). You might prefer this option if you've
you need to explain that would take far too long to explain in writing.

Task 16
Take a look at a popular website that you often use. How many acce
Look for things such as changing the font, alt-text, etc. There may ever
one from the BBC: **https://www.bbc.co.uk/accessibility/**

Discussion Point
Do you know anyone with a disability? How easy do they find commu
forms that they prefer to use (depending on the type of disability)

PRACTICE
14. How could a video be made accessible to people with various

....

....

Age

Different age groups respond better to different types of communicati[on]
may respond better to a person speaking, a video and sound, than to [a]
page or report. The style, wording and language used to express the c[ontent]
specifically tailored to the target audience.

An adult may have the time and inclination to read a longer document[...]
target audience, the language will be at a much higher level than if di[...]
remain clear. When you look at TV and radio advertising, you will see [...]
presented throughout the day, and by channel. For example, you migh[t...]
people targeted during the day because young people are at school [...]
evening, the adverts might be targeted at a family.

Gender

Gender doesn't just cover male and female, but a wider spectrum to co[...]
etc. Audiences are now diverse, and businesses and individuals must a[...]
methods accordingly. Gendered stereotypes such as pink and blue are [...]
past. But it's true that different genders may have some different inter[ests...]
communication styles, and communicate slightly differently.

Location

There are many ways that location affects the method of communication[...]
* The target audience – e.g. global, which is why websites often hav[e...]
  to change language to that spoken in the most popular countries [...]
  site, or targeted at the countries in which the company operates. S[...]
  may be able to turn on subtitles in many different languages if the[...]
  global (some of the translation may be machine generated). Some [...]
  unacceptable in different cultures, meaning that it is important t[...]
  sensitivities are discussed when the content is created for a speci[fic...]
* The location that the material is viewed – at home, on a TV
  vs laptop when on a phone or tablet when on the bus, or in a café,
  etc. If people view the media on a phone when out of
  the house, then the media needs to be mobile-friendly.
* Whether the material is designed to be publicly released, or
  to remain internal to the company – the language, style,
  presentation and type will be very different.

Task 18

If you or someone you know has a YouTube channel, it's possible to us‖
who watches their videos. Take a look at the demographics of the aud‖
and location. Can you explain why specific demographics watch vide‖

Discussion Point

Do you consume different types of media in different locations on diff‖
some forms that you access on many different devices — e.g. watch vid‖
laptop and TV?

PRACTICE

15. Why does geographi‖ ‖ ‖n have a role to play in distrib‖

....

....

Topic 6.1: Use of IoE

What is the IoE?

The IoE is collectively the current stage of the Internet's development
data and things, while processes act as the links. These are the 'four p
course, all of the data is carried over the Internet. Because the data is
more connections can be made and our lives and business operations
lot of praise given over the future benefits of IoE; much of the marketi
buzzwords in relation to the better decision-m̲a̲k̲i̲n̲g̲, ̲a̲bility, experienc
These benefits are set to occur on a nati̲o̲n̲ ̲s̲c̲a̲l̲e down to individuals
benefit businesses.

You are pr̲o̲b̲a̲bly f̲a̲m̲i̲l̲i̲ar with the Internet of Things (IoT) –
that's all o̲f̲ ̲t̲h̲e̲ smart appliances and sensors across our homes
that are linked together by the Internet. For example, if
something moves in your house, a camera might turn on and
send a video feed to your smartphone. Or you might be able to
control when your heating turns on.

The IoT is just one part of the Internet of Everything (IoE), but in our c
beyond the traditional notion of simply connecting things together an
By adding sensors to existing things, we can turn them into smart dev

IoE is rapidly growing, and, one day, nearly every person and device o
connected. The amount of traffic sent across the Internet has grown ra
collect, store and distribute data. It's thought that by 2025, IoT device
zettabytes of data each year.

By linking together billions of devices, better ways of working, living,
cities will evolve; for example, by passing mundane tasks to machines
chores done faster. You'll hear the words 'smart' and 'intelligent' appli
IoE device will be specific for each purpose, and for each user in some

For all of the benefits of IoE, there are disadva̲n̲t̲a̲g̲e̲s̲
* Cost (and environmental cost) of m̲a̲n̲u̲f̲a̲c̲t̲u̲r̲i̲ng, purchasing and d
* The increased energy dem̲a̲n̲d̲ ̲f̲o̲r̲ ̲devices and data centres (clim
electricity is gene̲r̲a̲t̲e̲d̲ ̲f̲r̲o̲m̲ fossil fuels).
* Traini̲n̲g̲ ̲c̲o̲st ̲t̲o̲ ̲t̲h̲o̲se using the new technologies.
* Possib̲i̲l̲i̲t̲y̲ ̲o̲f redundancy – fewer staff are required.
* Safety concerns as we interact with machines which are making d
cars may need to choose which way to swerve if there are objects
and could run people over).
* Privacy implications – businesses can track, store and analyse you
recognition technology could be implemented on a large scale.
* Concern over the extent to which AI (artificial intelligence) will co

PRACTICE

16. Do the advantages of IoE outweigh the disadvantages?

....

....

....

....

The role of the Internet

Despite what you might say in real life, the World Wide Web (WWW) and the Internet are not the same thing.

* The Internet is a 'a network of networks'.
* WWW is transferred via the Internet (web pages sent using HTTP/HTTPS and viewed in a web browser).
* The Internet carries many other 'protocols' – the communication standards used by devices for other purposes to transmit files, email messages and other IoT data.

Every device on the public Internet has a unique IP address assigned to One limitation of the Internet was the IPv4 system, which only allowed connections. This means that there aren't enough addresses for each of devices that we might want to connect. This limitation has been over the IPv6 system. This allows for such a large number of addresses that wrapping your head around 3.4×10^{38}...

Just for reference, only your home router and your smartphone (when network) have a public IP address. Any devices on your home network (e.g. 192.168.0.2). Your router does an amazing job of sending out you Internet and knowing which incoming data to send back to just your d network address translation. This frees up space on the IPv4 Internet from outsider attacks.

For added security, it's recommended that you set up a separate netw for IoT devices because, at the moment, some devices have security fl

In addition, the roll-out of next 5G mobile networks will also fuel the g

Tasks 19–21

19. Remember, your exam board, OCR, wants you to keep an eye ou[t]
    technologies. When you come across anything new, or anything th[at]
    make a note of it below.

    ....

    ....

    ....

    ....

    ....

    ....

20. Cisco [...] [cha]mpioning the use and development of IoE. Research C[i]
    IoE de[velo]pment.

    ....

    ....

    ....

    ....

    ....

    ....

21. Take a look at some of the figures presented at **https://techjury.**[n]
    devices-are-there/#gref For example, 46 billion connected devic[e]
    this data? Can you find realistic/reliable figures that are more re[...]

    ....

    ....

    ....

    ....

    ....

    ....

Discussion Point

Do you think that IoE can really live up to the hype? Explain why, or [...]

The four pillars of the IoE
The IoE relies on the connections between each of the following four

People:
We all connect digitally through our devices, from smartphones to des
social media, chatting on messaging services and VoIP, and posting vi
likely to emerge, in addition to the newer technologies such as smartw
We connect with each other for social reasons, and for business (netwo
in the economic world – we are the consumers and the labour force.

Things:
All connected devices, either with wireless connectivity built
tagged with RFID (small chips read with a scanner), or our digital
Sensors can detect a wide range of specific things, depending on cont
number of people in a shop, or the air quality in an underground
to a drive. Sensors are tied to a controller that can either proc
the data or more powerful device to process. We can also use RFI
they travel through a factory or warehouse. Things also include the tra
communicate – phones, tablets, laptops and desktops, etc.

Data:
People and things both generate a lot of data. We have now developed
'big data'. We can analyse this data and use it in real time to identify p
behaviour and purchasing trends, and to make smart (business) decisio
many different sources, including sensors, devices and social media. C
virtualisation are helping to drive the data pillar – cloud solutions dor
service, but also infrastructure and platforms.

However, at the moment only a fraction of the data we generate is act
less), and most of the data (about 90%) is unstructured.

Process:
Work between the three pillars to ensure that everyone or everything
information in a timely manner (and in a usable format). Processes wo
between humans and devices.

Discussion Points
* We now have immediate access to information. How many examp
* Do you have any IoT devices in your home? If not, would you like
* Do you think that the use of IoE data is sustainable (can it keep g
* How many p can you think of?

PRACTICE

17. Give two examples of sensors.

1. ....

2. ....

The interactivity between the four pillars

You can think of the interactivity between the four pillars as a triangle things and data. Processes are located in the middle. This interactivity you can have direct people and people, and also devices and people, w

One disadvantage with the current state of IoE is that the different ma use a unique (proprietary) data transfer protocol. This means that the manufacturers are incompatible. There are many different connection cellular, NFC (near field communication) and Bluetooth (also standard common) and Z-Wave).

Furthermore, the people and devices can communicate with and betw

---

Discussion Point

In the futur you think that 99% of all physical devices ('things') w

---

IoE digital interactivity

There are two ways that the IoE interacts digitally:

Device to device (AKA machine to machine (M2M)). This is the IoT in th machines communicate with each other automatically.

Human to device (AKA machine to people (M2P)). This is where device either at our request, such as a database lookup, or provide us with a r or display a digital sign or dashboard, etc. Data is transferred from the order for the person to make decisions.

We also access information via the Internet – we read and watch the streams and video streams.

A third method is **people to people** (P2P). This is collaboration. We ser and social media in a social setting, and work with others in the workp tools and email.

PRACTICE

18. Why is device-to-device communication very fast?

....
....

Topic 6.2: Application areas in everyday life

Businesses are developing and using new technologies all the time. Ju§
later the Internet became available, companies once again need to qui
technology. Businesses can improve their production techniques and g
competitors. Real-time data analysis could spot new trends and gear u
even mining, to appropriately meet customer demand. Businesses can
collaboration, marketing and customer feedback.

Businesses and governments are able to monitor changes (e.g. using re
sensors), predict changes through analysis, and respond immediately. T
predictive and agile. You may already be familiar with how supermarke
sales and target advertising to specific demographics.

Specific examples for different sectors are described below.

Energy management

- We can monitor and reduce our energy use either through
  installing sensors within a building or through smart meters to
  find out when we are wasting energy by turning the lights off
  automatically, or warning us when we use too much power.
  Hotels can have air conditioning turned down when electricity
  demand peaks, allowing them to save money – the hotel guests
  usually don't notice.
- Real-time consumption data helps energy companies to make the
  knowing exactly when they need to buy and sell energy.
- Sometimes you might see IoE in the energy sector referred to as 'I
  set-up, appliances could be automatically switched on when lots d
  produced, and help to reduce the peak demand.
- Smart-metering also helps with paying bills – readings are sent a
  need to send a reading to your energy company. You won't be in d
  estimated bills any more.
- Smart meters are being installed throughout the UK. However, the
  stopped working when you switched energy supplier.

Discussion Point

With the increase of electric cars, electricity demand could increase si
thousands of cars are likely to be charged in the early evening as peo
How could the IoE reduce the spike in demand?

PRAC

19. Why is increased energy efficiency an advantage to both peo

....

....

Health

* There are many different applications of IoE to health. You may even use a smartwatch or fitness tracker yourself – the built-in tools can be very motivating to increase exercise and benefit health.
* A variety of sensors can be used in hospitals to measure vital signs and monitor for health deterioration, and monitor patients. If patients become more unwell (e.g. a diabetic has dangerous blood sugar (glucose) levels) or stop responding when they need to 'check in' with some of their equipment, then a doctor or nurse can be alerted and dispatched immediately. In the home setting, extra medics might be called automatically. At home, devices could be connected to a smartphone to alert to ...
* IoE in healthcare setting could save a lot of money due to improvements in efficiency.
* However, while the equipment can be useful in alerting and providing, humans still need to make the final decisions.


Task 22

Find as many different examples of health monitoring as you can. Wr

....

....

....

....

Manufacturing

* The IoE has significant implications for manufacturing. Customers (retailers ordering stock, or customers ordering custom-made items) can receive regular updates on the production of their order, as the codes on products are scanned in order to keep track of them throughout the process. For the best results, the entire supply chain must be connected using the same protocols – a major challenge for such a wide industry where there are many different suppliers.
* Across the production line, sensors and cameras can be used to monitor the production process and make adjustments if a higher than normal number of products are failing quality control. You may have seen videos or TV programmes on how food is manu used to discard poor-quality or damaged products – the ways that production line by levers or jets of compressed air.
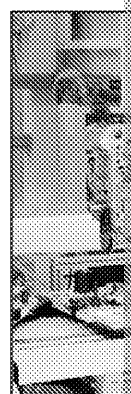
- Smart warehousing, where each item has an RFID tag attached. Th[...]
  stocktaking and is much faster than scanning individual barcodes.[...]
  automation by robots and other automated equipment. In the past[...]
  about sharing a space with robots.
- Further development of person-to-person communication and rem[...]
  experts around the world; for example, during the R & D (research[...]
  before the product enters manufacturing. This allows an efficient [...]
  and reduced cost of international travel and long-distance calls. A[...]
  break down language barriers.

Discussion Point

How might improvements in man[...]g processes benefit the consu[...]

Military / Emergency Services

In military [...] field situations, IoE could lead to a significant advant[...]
pinpoint the location of every soldier, vehicle and piece of equipment[...]
from sensors. This allows for better communication, decision-making [...]
protect the lives of those serving on the front line. However, there are [...]
using technology in military settings, and security implications for suc[...]

Task 23

Take a look at the article at
https://defensesystems.com/articles/2013/10/01/internet-of-everyt[...]

Who wrote the article? What bearing does this have on the content a[...]

What is the tone of the article?

Why do you think that the article is so vague?

....

....

....

....

....

....

The use of [...] an really help out emergency services personnel such [...]
staff. But remember that the emergency services also include the coas[...]

IoE allows for the rapid response and communications from these services and can utilise real-time data in order for situations to be resolved quickly. You may be familiar with the technologies already in use such as automatic number plate detection and speed monitoring, and that traffic cameras on bridges and smart motorways watch out for congestion and accidents. Mountain rescue teams need to be able to quickly pinpoint where the victim is located – often on steep, rugged terrain in poor weather conditions.

IoE can be a crucial tool following natural disasters such as earthquak personnel are all required for search and rescu..., clear debris and se accommodation and medical care. But the conditions are challenging, and mobile phone masts as well as telephone lines are often damaged

Discussion Point

What are your views on privacy – for example, if your face was track your social media was tracked for signs of civil unrest?

Task 24

Research how IoE could be deployed to assist in disaster relief – such tsunamis. Make notes below.

....

....

....

....

....

....

Transport

* Sensors can direct traffic jams, accidents and congestion – for example, on smart motorways. Similarly, Google Maps uses real-time data from drivers' handsets to plot congestion and reroute drivers away from problem areas. More sophisticated set-ups could use weather sensors such as rainfall and light to automatically reduce speed limits and turn on street lighting for safety. The cars automatically turn on headlights at dusk, or set the windscreen wipers to come on when moisture sensors are

* You may already have live public transport statuses in your town times either through a smartphone app or website, and sometimes next to the bus shelter. All train stations have live information boa

Smart devices

There are thousands of smart devices – some are specific to particular se

Businesses:
* Smart cameras and locks
* RFID and stock tracking, better tracking for   nts and deliver
  management
* Smart lighting and heatin   d   energy costs in the business

Homes:
* Smart
* Smart energy meter
* Smart appliances, heating and lighting
* Doorbells equipped with cameras (and separate security cameras)
* Smart speakers (e.g. Amazon Alexa, Google Nest)
* Smart locks
* Home security systems
* Smart windows and blind/curtain control

Personal:
* Smartwatches and fitness trackers
* Smartphones
* Health devices such as glucose meters, air quality monitors, gluten m

Task 25

Choose three or four sm   om the list above. Find the popular
cost. Now compa   o   to a non-smart version. How much more e
(e.g. comp   a   art doorbell to a standard doorbell).

PRACTICE

20. Why are differing protocols a major issue for IoE connectivity?

....

....

Suggested Answers to Practice Questions (Indi

Workbook A

Topic 1: Design Tools
1.1: Types of design tools
Note that there are no questions in Topic 1.

Topic 2: Human Computer Interface (HCI) in Everyday Life
2.1: The purpose, importance and use of HCI in application areas
1. Advantage – e.g. menu system gives many different opt[:] is on using a logica
   Disadvantage – e.g. users could get lost or fru⁻ e y a branching system,
   not clearly positioned next to the scre⁻

2. Answers will be dependen⁺ th a...er's experience.

3. Over co^{m...}x i ..., poor design of symbols and may not be in a logica

2.2: Hardwa...nsiderations
4. Screens used for everyday computing, web browsing and video/gaming are
   improved experience and clarity. If colour isn't required – e.g. a simple status
   heating panel – then there's no need for the extra expense of colour and the

5. Alters how much information is visible on the screen at once, the visual exper
   something complex like a full software on a small screen can be difficult to re
   required for a basic system. Screen size also determines how easy a touchscr

6. Much easier to use / more familiar. Modern hardware can easily run a GUI.

7. Older hardware or legacy systems where the resources may not support a ful
   necessary, or a system admin can quickly perform tasks faster using a CLI.

2.3: Software considerations
8. Any suitable suggestions, such as the ability of each operating system to perf
   when users migrate between platforms, etc.

9. Any two explained differences, such as databases are much larger, have mult
   command line or form to add, update, etc., run queries and reports, while spr
   data sets where formula can be created, charts created, etc.

2.4: User interaction methods
10. Learner answer – e.g. the keyboard can replace the mouse entirely, meaning
    important (more common than using an on-screen keybc rd on a desktop).
    websites and clicking are easier than when usinn ... o. d.

11. Concern over always listening, possib^{...} vc...e being recorded / uploaded
    for analysis, etc.

Workbook B

Topic 3: Data and Testing

3.1: Information and data

1. Data – no meaning, Information – includes structure and context.

3.2.1: Use of data types in different contexts

2. Contains a decimal point. Could be a decimal or real number. Also accept text

3. Currency – it's a financial report and the data will include £ or $, etc. Percenta
   etc. Also allow decimal for individual numbers in tables, and text for numbers
   of data. Allow two explained points.

3.2.2: The difference between validation and verification

4. Validation – checks the format / whether the data is within an expected range
   100% accurate. Verification check confirm that the data is accurate.

3.2.3: Data validation tools

5. Two validation checks, e.g. length and range (meets the minimum password length b
   password meets the complexity requirements, e.g. upper- and lower-case letter

6. Radio buttons when the answer is binary / can only select one option. Tick bo
   than one answer can be given.

7. Any two suitable fields, e.g. a name, a contact phone number or an email add

3.2.4: Data verification tools

8. If employees are entering the data, the salary costs are increased. Unless the
   volunteers, as in many citizen-science projects.

9. Any advantage and disadvantage, e.g. Advantage – picks up errors and has t
   information, allows experts in that field to thoroughly check it. Disadvantage
   this, not all information may be complete, may require a long wait / waiting o

3.3: Data collection methods

10. Advantage – high level of detail and personal connection, better idea of pers
    etc. Disadvantage – very time-consuming to conduct and code, can only invit
    interviewees to be interviewed.

11. Any two suitable reasons – e.g. based on data age, collection techniques and robus

3.4: Storage of collected data

12. Private storage is more secure because the information is financial/sensitive.
    information between the branch offices harder. Storage costs might also be h
    balance, security is the most important and data can be encrypted and share

13. Any two, such as no centralised backup / the data is more likely to be lost
    there might be less sharing between co-workers or working on older versions

3.5.1: Importance and purpose of testing

14. Any two suitable reasons, e.g. fix bugs before shipping, maintain reputation,
    going over budget, etc.

15. Any two suitable reasons, e.g. can be expensive, can't plan or test against every

3.5.2: Test data

16. Extreme data falls outside of the expected range. Invalid data is in an incorre

3.5.3: Types of testing

17. An explanation of why alpha testing occurs internally, with major bugs fixed,
    the client. This is done in terms of reputation and cost, etc.

Workbook C

Topic 4: Cybersecurity and Legislation

4.1: Threats

1. Worms are self-replicating while viruses need the user to open the file first. W
   while viruses are attached to another file or program, etc.

2. Links could be phishing for information – e.g. request that you enter login de
   you click the link, the hacker might be able to see that your email address is a
   email as it can have an image or a hidden pixel that contacts a server to dow
   could contain malware, such as a file with a virus attached.

3. The phishing email could be very convincing and the ... might not notice t
   or in a hurry. Sometimes the email might eve ... be targeted to the person, so
   appears to originate from someone ... ow. People may just try to be frie
   doors, etc. (called tailgating) ... incompetence may play a role, such a
   shield their PIN, or ... git want to make life easier by leaving a door u

4. The do ... could be malicious, contain malware, be tampered with, etc.

4.2: The impacts of a cybersecurity attack on individuals and/or organisation

5. For example: to try to make the company lose sales or to make a point about
   working conditions, etc.

6. Fraudulent activity taking place in the victim's name such as fake ID, taking o
   disruptive to the victim in terms of time and stress, sleeplessness and potenti

7. Attacks that take a company offline for several days or more (reducing staff p
   fines or mean that a significant number of customers move to a rival service.
   for, the less likely the company will be able to recover. A very small company
   data and/or customers could easily fail.

4.3: Prevention measures

8. Some protection – makes it harder to access / delays access to the equipmen
   intruder being caught by security, noise from breaking locks and doors could
   and intruder alarms would be useful – but may only detect or be useful after
   the thief. The fact that theft does occur even with locks in place means that t

9. Any two suggestions – e.g. access information that they would like to know, s
   information about other employees, or other sensitive material, espionage an
   information to steal. Or just trying to bypass filtering – e.g. blocked access to

10. Stop the spread of malware / malware removal from the system to reduce th
    the system, cause damage, steal data, and other fraud ...

11. Extra step that is difficult for a hacker to in ta e ... many automated atta
    attacks. Three or more factors ar ... en ... e secure, e.g. a business that only
    IP address on the netw ...

12. Allows ... s ... of data and protects data when it's being transmitted,
    more f ... n terms of location of workers, etc. and to reduce threat of lea
    of us spend more time online (and use online shopping and banking, etc.) wi
    material, then we need access to secure methods such as HTTPS.

13. For legal reasons, commercial sensitivity reasons and ethical reasons (any two

4.4: Legislation related to the use of IT systems

14. Any suitable suggestions, such as to keep up with new crimes, pace of chang[...]
etc. Necessary deterrent as more and more of our lives are online. For examp[...]
1990 with different attack vectors – via floppy disk rather than via the Interne[...]
unheard of 30 years ago.

15. Allow discussion for individuals – e.g. personal cost of being victims of crime,[...]
and losing money through fraud (e.g. if they are fooled into paying for unnec[...]
as well as significant personal stress, etc. For businesses, a breach could cost [...]
from (including fines and reputational loss). In some cases, the business coul[...]
and leading to loss of jobs for the staff.

16. Learners should be encouraged to discuss patents an[...] demarks dependin[...]
property – which must be applied for by the c[...]ar[...] rather than just a dis[...]
because copyright is automatically a[...]o [...] creative works (but do credit[...]
symbol on the works or warr[...]g[...] a [...] front of a book to serve as a reminde[...]

17. Personal d[...]a i[...] – [...] stolen / insufficiently protected / leaked, crimina[...]
purpo[...] uc[...]g identity theft – with devastating consequences to the ind[...]
profiles[...] a person can be constructed by combining information from l[...]
cookie data – which could be used for targeted marketing.

18. Everyone needs to follow the rules set out to keep themselves and others saf[...]
could harm others. Employees are also expected to report any concerns, viola[...]
management to allow the issues to be fixed / made safe / reminders given to[...]

Workbook D

Topic 5: Digital Communications

5.1: Types

1. Any four points, or two explained points, such as:
   * While several types of distribution may be possible, it's important to use message in the most useful or efficient manner, e.g. a quick phone call (although notes may need to be made about why decisions are made).
   * End user may have different abilities and needs – some forms of commu need adapting – e.g. adding subtitles to video, transcript of audio/video to the Internet and devices and/or social media will not be able to acces and an alternative may be required.
   * Method must be appropriate to the inter... a... ence, may not work in more suited to public-facing in... f... external communications, etc

2. Any four points, or two ... ... points, such as:
   * Some type... ... bution are the same (such as IM between staff and t re... tc... but the content is different. For example, the internal com int..., and will include a lot of proprietary / commercially sensitive /
   * Communications aimed towards the public are likely to be more sales-fo rather than the internal communication between different departments
   * Some of the communication methods are unlikely to be used internally, podcasts, etc.
   * While internal employees may use parts of the company website, they m an intranet for accessing resources internally, which won't be publicly ac

5.2: Software

3. Desktop publishing software can be difficult to use (complex software with lo specialist is required to produce all of the material, such as neatly formatted brochures, etc. Anything that is public-facing needs to look polished and pro

4. Businesses share information with other businesses, often through transferri from standard applications when they need to be editable (PDFs are much ha software save in a proprietary format. They may also be able to save in forma packages, but this is an extra save step and needs to be done manually. Som software package from the one that they were saved in can cause incompatib formatting might change considerably. Therefore, most offices will use an ind These packages are often provided for the main operating systems.

5.3: Digital devices

5. Smartphones have small screens and are usually controlled with fingers rath video, must be able to be watched and viewed on the... ll screen, and webs columns of text, with big buttons and option ... is ... t can be pressed with

6. Portability – e.g. use when travell... ta ... g to client offices, taking home to of screen and keyboard ... ho... ver, external monitors, docks and port repl order to add ba... e... aces of a desktop PC.

5.4.1: Types... tribution channel

7. 24/7/365 availability anywhere in the world and faster Internet connections a allows us to work from anywhere and collaborate more freely – advantages t

8. Email is under threat from services such as instant messaging (might be built of the faster replies and the overall exchange might be quicker with immedia

9. Broad appeal to a wide audience, makes the understanding easier and greate to watch someone do and explain something rather than to simply read abou

5.4.2: Distribution channel connectivity

10. Privacy and data security – handing over your data to somebody else / relinq
    of a hacker accessing and releasing that data. This is why some companies av
    host everything internally, and some people use secure messaging services w
    messages in the cloud.

11. Services are often free because they use your Internet access (which is unlimi
    distance phone calls. Can be used on a wide variety of hardware and also inc
    can be easily upgraded, such as adding a microphone to a desktop PC, while
    are already capable because they generally come with inbuilt microphones a

12. Any two advantages, e.g.
    * Quick to set up.
    * Can be set up anywhere with a mobile d   gr   but where a fixed/wir
    * Very flexible; needs minimal eq   t t   et up, e.g. a single smartpho
      network and transmit th   one other device, such as a tablet or

13. Each netw   k s   fe ent purpose. The wired network will connect the
    desktc   et p permanently at staff desks, and printers – because a wired
    perform   nd there is no need for flexibility in this case. The wireless netw
    portable devices, such as laptops used by staff, e.g. in meeting rooms; tablets
    clients and business associates who visit the site, but need access from anyw

5.5: Audience demographics

14. For example: subtitles, transcript, audio description or a sign-language transl
    the screen.

15. Different target audiences in different cultures using different devices, need f
    different languages, etc.

Topic 6: Internet of Everything (IoE)

6.1: Use of IoE

16. Answers will depend entirely on the examples and viewpoint of the learner, a
    disadvantages are discussed, e.g. economic benefits versus individual privacy

17. Any two examples of sensors – air, gases and fuels, water, weather, etc.

18. Rapid communication between devices over fast networks with powerful pro
    need for human interaction / waiting for a human to respond.

6.2: Application areas in everyday life

19. People – lower energy bills. Planet – reduced level of greenhouse gas produc
    climate change (this is also a human benefit due to fewer droughts, fewer he
    heatstroke, etc.).

20. Much harder for data sharing between de ce o   d by different people –
    connectivity and might not be a   all possible benefits. Also a secur
    than others.