Computing | KS3 | 2014 National Curriculum

KS3 Computing Activity Worksheets

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Contents

Topic 1 – Abstraction

Objectives:	*Learners should be able to use abstraction and modelling techniques to manage complex problems usi… big problems into smaller chunks in order to make them easier to solve. Learners will be able to use ge… common features. Learners will be able to use algorithms to model problems and represent these as fl… techniques and understand that alternative solutions may exist for the same problem.*
Keywords:	Abstraction, modelling, generalisation, pattern recognition, decomposing, sequence, representatio… selection/decision, connectors, divide and conquer, iteration, sort, search, bubble sort, bucket sort, …
KS3 NC (2014):	'Design, use and evaluate computational abstractions that model the state and behaviour of real-w… reflect computational thinking [for example, algorithms for sorting and searching]; use logical reas…
Progression to KS4:	Develop and apply analytical, problem-solving, design and computational thinking skills. Researc… techniques.

Activity	Expected Outcomes	Resources	Est. Duration
1.1 – Model Behaviour	Learners will: • Understand that abstraction techniques are used to model or represent real-world scenarios and will be able to create models using algorithms. • Be able to identify different flow chart shapes and be able to represent algorithms as a flow chart or in pseudocode. • Be able to decompose problems into smaller chunks and put steps into a logical order. • Understand the terms: iteration, sequence and selection.	Help Sheets Answers	Task A 5 minutes Task B 5–10 minutes Task C 15–20 minutes Task D 10 minutes Task E 15 minutes Task F 10 minutes Task G 10 minutes Task H 10 minutes
1.2 – Sort Codes	Learners will be able to use sort techniques on data to make searching easier and quicker to perform.	Help Sheets Answers	Task A 15 minutes Task B 15 minutes Task C 15 minutes
1.3 – Sole Searching	Learners will be able to use search techniques on data using serial and binary searches.	Help Sheets Answers	Task A 10–15 minutes Task B 15–20 minutes

Topic 2 – Programming

Objectives:	*Learners should know that comparison, Boolean and arithmetic operators differ between different languag will understand the need for BODMAS and be able to use brackets correctly when performing arithmetical o structures, and be able to concatenate and replicate text. Learners will be able to use assignment statemen flow control statements and use selection, sequence, WHILE and FOR techniques. Learners will know the dif*
Keywords:	Sequencing, selection, repetition (iteration), flow control, clause, data types, integer, string, real, floa operators, Boolean operators, arithmetic operators, expression, BODMAS, concatenate, rounding up/d WHILE, infinite loop, procedures, execute, functions, hash, comments, syntax errors, count-controlled
KS3 NC (2014):	'Use two or more programming languages, at least one of which is textual, to solve a variety of comp tables or arrays); design and develop modular programs that use procedures or functions'
Progression to KS4:	Get learners to research the differences between a process virtual machine and a system virtual mach Explore more complex functions, procedures and modules. Get learners to develop and test program learners to develop and test their own programming code.

Activity	Expected Outcomes	Resources	Est. Duration
2.1 – Second Language	Learners will: • Understand comparison, Boolean and arithmetic operators and that they differ between different languages. • Understand the meaning of values and expressions. • Understand the need for BODMAS and be able to use it correctly when performing arithmetical operations.	Help Sheets Answers	Task A 5–10 minute Task B 5–10 minute
2.2 – What's Your Type?	Learners will be able to identify and use different data types and be able to concatenate and replicate text.	Help Sheets Answers	Task A 5–10 minute Task B 5 minutes (m Task C 5 minutes (m
2.3 – Make a Statement	Learners will be able to use assignment statements and be able to incorporate variables.	Help Sheets Answers	Task A 10–15 minu

Activity	Expected Outcomes	Resources	Est. Duration
2.4 – A Structured Approach	Learners will: • Understand data structures and lists and arrays. • Be able to concatenate an indexed list and join an indexed list with text.	Help Sheets Answers	Task A 5–10 minut
2.5 – A Sequence of Events	Learners will: • Understand and use flow control statements and use selection, sequence, WHILE and FOR techniques. • Know the difference between procedures and functions and use both effectively. • Use WHILE and FOR to test statements and create loops.	Help Sheets Answers	Task A 5–10 minut Task B 10–15 minu Task C 10 minutes Task D 10–15 minu
2.6 – Testing, Testing	Learners will: • Be able to test their code and work out which parts are wrong. • Understand the use of the hash symbol and comments. • Understand syntax error messages and what might return an error within code.	Help Sheets Answers	Task A 5 minutes Task B 5–10 minut

Topic 3 – Boolean Logic

Objectives:	*Learners should understand Boolean logic and the difference between and uses of Boolean and com… able to perform arithmetical operations using operators. Learners will understand True/False state… comparison operators in pseudocode and be able to use ELSE and ELIF to test conditions.*
Keywords:	Boolean, operators, comparison, logical, conditions, statements, True, False, ELSE, ELIF, IF, logic…
KS3 NC (2014):	'Understand simple Boolean logic (for example, AND, OR and NOT) and some of its uses in circuits…
Progression to KS4:	Understand OR, AND, NOT and XOR logic gates. Understand complex logic gates and their uses in… adder calculations. Understand and use Boolean algebra in programming.

Activity	Expected Outcomes	Resources	Est. Duration	
3.1 – Whether Conditions	Learners will: • Understand and use True and False conditions and arithmetic, comparison and Boolean operators. • Use conditions IF, ELSE, ELIF, to test statements and make decisions.	Help Sheets Answers	Task A 5–10 minutes Task B 10–15 minutes Task C 10–15 minutes Task D 10–15 minutes Task E 5 minutes Task F 5–10 minutes Task G 5–10 minutes Task H 5–10 minutes	•
3.2 – Circuit Performers	Learners will understand and use logic gates and their use in circuitry and understand truth tables.	Help Sheets Answers	Task A 5 minutes Task B 10–15 minutes	• • • •

Topic 4 – Binary

Objectives:	*Learners should know that, as humans, we use the decimal base 10 denary system, and that compu… transfer and store data in binary in the form of ones and zeros, and that binary can be converted to … understand that overflow errors may occur if the calculation results in a larger binary number. Lear… on a keyboard and that binary code can be converted to ASCII characters.*
Keywords:	Binary, Denary, base 2, base 10, overflow, ASCII, placeholders, bits, bytes
KS3 NC (2014):	'Explain how data of many sorts can be represented and manipulated in the form of binary digits
Progression to KS4:	Convert between binary and hexadecimal, use binary subtraction

Activity	Expected Outcomes	Resources	Est. Duration	
4.1 – Get Cracking	Learners will: • Understand that binary digits can be represented as on/off lights, colour, numbers or sound. • Be able to convert binary numbers to denary numbers and decode results using ASCII code.	Binary placeholder tables ASCII conversion table Table grid blanks Help Sheets Answers	Task A 5–10 minutes Task B 15 minutes Task C 10–15 minutes Task D 10–15 minutes Task E 15 minutes Task F 10–15 minutes Task G 10–15 minutes	• Cre… the… • Dra… to … wh… • Thi… • Cre…
4.2 – Number Crunching	Learners will be able to convert denary numbers to binary numbers and decode results using ASCII code.	Binary placeholder tables ASCII conversion table Table grid blanks Help Sheets Answers	Task A 10–15 minutes Task B 10–15 minutes Task C 5–10 minutes Task D 5–10 minutes	• Cre… the… nee… • Dra… to … frie… bin… you… • Thi… you…
4.3 – Adding Binary	Learners will be able to add binary numbers and understand that an overflow error may occur if the result is too long.	Help Sheets Answers	Task A 5–10 minutes Task B 10–15 minutes Task C 5–10 minutes Task D 5–10 minutes Task E 5–10 minutes	• Cor… the… • Cor… • Cor… you…

Topic 5 – Hardware and Softwa

Objectives:	*Learners should understand the difference between and uses of hardware and software, and be able to between application, utility and operating software. Learners will understand RAM and cache memory, the graphics card. Learners will understand network types and how they are connected and that the Int connected computers, identified by IP addresses, and that the WWW is part of the Internet. Learners wi the fetch–execute cycle.*
Keywords:	Hardware, software, application, system, operating, utility, input, output, RAM, cache, CPU, fetch–exe WAN, WLAN, WPAN, PAN, Internet, WWW, network connection, router, modem, Wi-Fi, 3G/4G, Bluetoo
KS3 NC (2014):	'Understand the hardware and software components that make up computer systems, and how they 'Understand how instructions are stored and executed within a computer system'
Progression to KS4:	Understand the difference between volatile and non-volatile memory. Be conversant with the moth and bridges. Know how the CPU works (CPU architecture), and look at how a computer's performanc Investigate different processor types (for PCs, tablets and smartphones). Look at different storage de Investigate further the performance of different CPU 'cores'. Research further the use of the GPU in g online and proprietary software. Look at the advantages and disadvantages of bespoke and off-the- data packets and security aspects.

Activity	Expected Outcomes	Resources	Est. Duration
5.1 – Gadget Show	Learners will: • Be able to identify hardware devices. • Understand RAM is volatile temporary memory which stores programs. • Understand that screen resolution and graphics cards affect quality of graphics when playing games or viewing movies on a display screen.	Help Sheets Answers	Task A 10–15 minu Task B 10–15 minu Task C 10 minutes
5.2 – Application Form	Learners will: • Know the different uses of software applications. • Know the difference between application and system software.	Help Sheets Answers	Task A 10–15 min Task B 5–10 minu

Activity	Expected Outcomes	Resources	Est. Duration
5.3 – The Ins and Outs of IT	Learners will: • Be able to identify input and output devices and their uses. • Understand that data needs to be input before it is processed and then output via a screen, printer or other output device.	Help Sheets Answers	Task A 10–15 min
5.4 – Joining the Dot(com)s	Learners will: • Understand network types and how they are connected, and that the Internet is a WAN. • Understand that the Internet is a network of globally connected computers, identified by IP addresses, and that the WWW is part of the Internet. • Understand that ISPs provide connectivity to the Internet and will know that a modem is required to access the Internet. • Understand data is sent via packets.	Help Sheets Answers	Task A 20–30 min Task B 5 minutes Task C 5–10 minu Task D 20–30 min
5.5 – Cycle Paths	Learners will: • Understand how the CPU controls the computer and how data is processed via the fetch–execute cycle. • Understand clock speed is measured in hertz and that when instructions are processed concurrently it is called a pipeline. • Understand that the CPU contains the control unit, ALU and registers. • Understand how CPU cores work.	Help Sheets Answers	Task A 30–45 min Task B 10–15 min

Topic 6 – Data Representation

Objectives:	*Learners should understand how instructions are stored as binary digits and how this affects file size these affect image quality. Learners will understand the difference between lossy and lossless compr sampling rates of digital signals. Learners will understand the uses of ASCII and Unicode. Learners w*
Keywords:	Binary digits, bits, bytes, kilobytes, megabytes, gigabytes, terabytes, file extensions, lossy, lossle sampling, bit rate, analogue, digital, ASCII, Unicode, assembly language, interpreter, compiler, t
KS3 NC (2014):	' Understand how instructions are stored and executed within a computer system; understand h represented and manipulated digitally, in the form of binary digits'
Progression to KS4:	Investigate how documents, software and music are stored and processed using binary. Look at h video and audio files are encoded. Look at how different data types need different amounts of st Investigate how Google and Facebook use the Unicode character set and why they don't use ASC with increasing and decreasing pixels and how this affects image resolution. Make patterns usin Investigate scalable vector graphics and how they differ from raster images. Investigate binary c Look at how VoIP converts sound waves and investigate sampling rates. Get learners to calculat measured in frames per second. Investigate codecs, RLEs and compression algorithms.

Activity	Expected Outcomes	Resources	Est. Duration
6.1 – Taking Instruction	Learners will: • Understand that data is processed and stored as binary digits and that this affects the file size. • Understand that files can be made smaller using lossy or lossless compression and this can affect the file quality. • Understand that there are different file formats which affect the size and quality of images. • Understand the differences between ASCII and Unicode and be able to convert binary values into ASCII.	Help Sheets Answers Blank grids	Task A 10–15 minut Task B 10 – 15 minu Task C 10–15 minut Task D 5–10 minute Task E 15–20 minut

Activity	Expected Outcomes	Resources	Est. D
6.2 – Things that go BMP!	Learners will: • Understand the difference between bitmap and vector images and know that bitmap images are made up of picture elements called pixels. • Understand that decreasing pixels affects picture quality and that a high resolution makes a file size larger.	Help Sheets Answers	Task A 10 Task B 5–
6.3 – Speed of Sound	Learners will: • Understand that analogue sound waves need to be converted into digital signals (binary values), manipulated and then converted from digital to analogue using a sampling rate measured in hertz. • Understand the term 'bit rate' and that sound quality is dependent on the number of samples per second. • Understand that different file formats can affect file size and quality, by using lossy or lossless compression.	Help Sheets Answers Sound wave grid	Task A 10 Task B 5–
6.4 – Highs and Lows	Learners will: • Understand the differences between low-level and high-level languages and the need to be translated into machine code in order to be processed by the CPU. • Understand that the assembler converts assembly code into machine code.	Help Sheets Answers ASCII character set	Task A 20

Topic 7– Using ICT

Objectives:	*Learners should understand how to stay safe and secure online, and that their digital footprint coul threats to a computer system and how to prevent them. Learners should be aware that they can re contact and conduct to a trusted adult. Learners should know the dangers of downloading illegal s relevant legal regulations and acts that control the use of data and computer access.*
Key words:	Safety, security, privacy, passwords, log in, firewall, updates, private profiles, grooming, sexting websites, CAPTCHA, encryption, hacking, cipher, crack, gaming, piracy, patches, copyright, cook spam, malware, Data Protection Act, Computer Misuse Act, bias, prejudice, fact, credible, reliabl
KS3 NC (2014):	'Understand a range of ways to use technology safely, respectfully, responsibly and securely, inc content, contact and conduct and know how to report concerns'
Progression to KS4:	Understand how changes in technology affect safety, including new ways to protect their online

Activity	Expected Outcomes	Resources	Est. Duration
7.1 – Safety Barriers	Learners will: • Know the dangers inherent in social media and need for privacy measures to ensure security of personal details. • Be aware that strangers can contact them under the guise of a different name, age or gender, and be aware that concerns about contact should be reported to a trusted adult. • Know that they shouldn't reply to a stranger who asks to meet them and to be wary of anyone using threats or flattery. • Be aware that it is a criminal offence for anyone to be in possession of an indecent image of a child under 18. • Be aware of the importance of passwords and that they should only use secure websites to register for or purchase services or goods online. • Understand the need for encryption and be able to use a simple encryption method. • Understand that hackers can infiltrate online accounts.	Help Sheets Answers	Task A 15–20 min Task B 5–10 minu Task C 10–15 min Task D 5–10 minu Task E 10–15 min Task F 5 minutes Task G 10–15 min

Activity	Expected Outcomes	Resources	Est. Duration
7.2 – Piracy on the High ©s	Learners will: • Understand the need to install legal copies of software and the importance of updates and patches. • Be aware of the dangers of downloading malware from untrustworthy websites. • Be aware that they cannot copy material from the Internet without the owner's permission and understand that copyright law protects owners' rights.	Help Sheets Answers	Task A 5 minutes Task B 5 minutes Task C 5 minutes Task D 5 minutes
7.3 – How to make your Cookies Crumble	Learners will: • Understand how cookies work and how tracking cookies can be used to track a user's activities online. • Understand that they need to protect their computer against spyware, adware, phishing attempts and viruses. • Know that they can delete their browsing history.	Help Sheets Answers	Task A 5 minutes Task B 5 minutes Task C 5–10 minu Task D 5–10 minu *(requires reading tim* Task E 5 minutes
7.4 – Zombie Attack!	Learners will know how to protect their computer against viruses and understand the importance of installing updates.	Help Sheets Answers	Task A 10–15 min
7.5 – Keeping IT Legal	Learners will understand the various acts that protect personal data stored on a computer and acts that protect computer systems from unauthorised access and damage.	Help Sheets Answers	Task A 5–10 minu
7.6 – Trust Issues	Learners will: • Be aware that some online information is unreliable and contains prejudice, bias and inaccuracies. • Know that search engines will display information based on keywords and not on accuracy or reliability.	Help Sheets Answers	Task A 10–15 min *(requires reading tim*

Topic 1 – The Art of Abstraction

Objectives

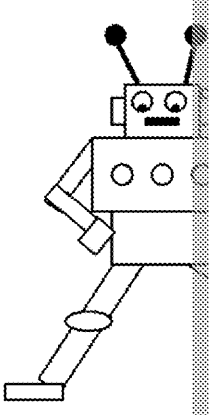
- ✓ Use abstraction and modelling techniques
- ✓ Use pseudocode to represent a program
- ✓ Use a flow chart to represent a program
- ✓ Sort and search algorithms

Activity 1.1 – Model Behaviour

In the following activities you will practise abstraction methods to de
generalisation techniques and create models that represent real-wor

**Tips on modelling: models represent real-world scenarios or proble
predictions, forecasts or spreadsheets.**

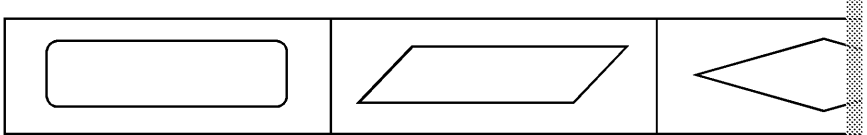
Britain's Next Top Model
Modelling helps to hide complex data behind a user-friendly interface. A robot is made up of circuits and programs but its exterior hides the complexity of his individual parts.



Task A Throwing Shapes (flow charts)

Flow charts are used to represent algorithms. A flow chart is made up
representing a specific instruction (i.e. a decision or an input/output)
of steps in a logical order.

1) Work out which shape represents which instruction below:



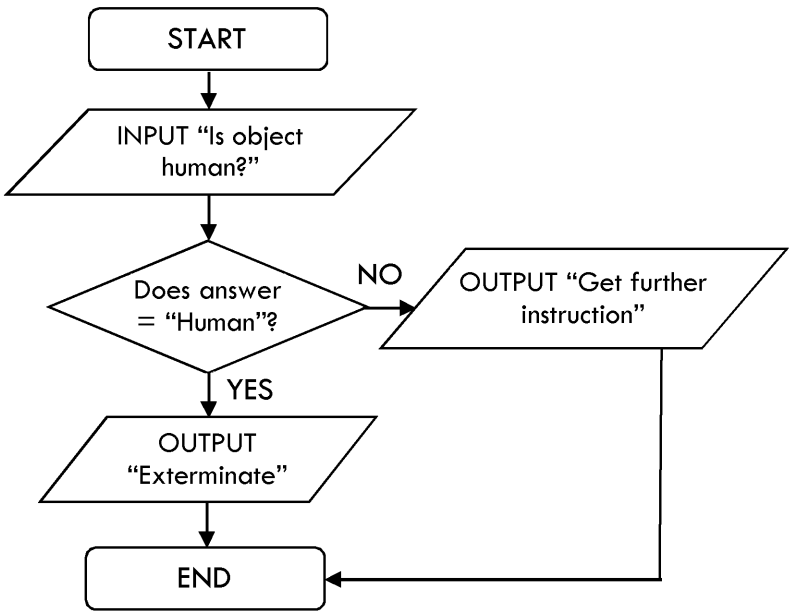
a.	b.	c.

Enter your answers below (a, b, c, etc.):		
1.	A decision	
2.	A connector	
3.	Start and end	
4.	An input and output	

Task B Mind your Step (algorithms – flow charts)

A flow chart can be used to represent an algorithm and should be prese

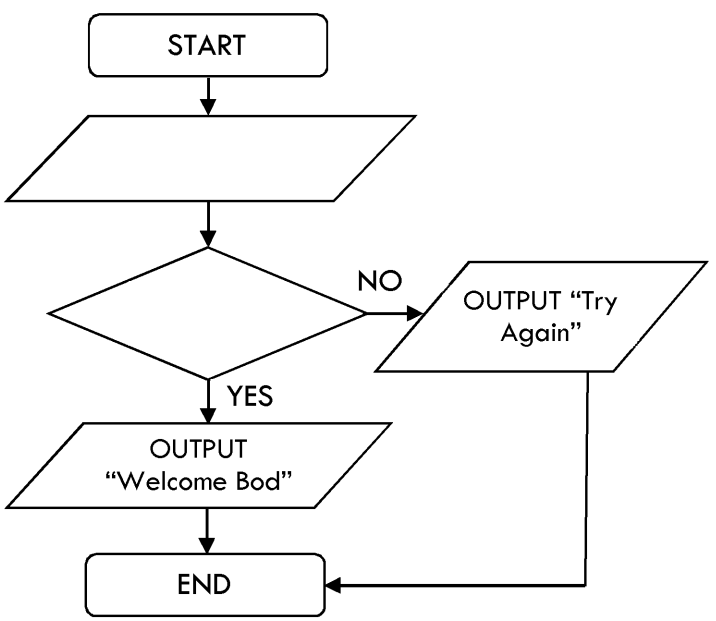
Example: A Dalek is programmed to respond when meeting a human. Fluffy to his friends. As he doesn't have any friends, he's mostly known represented as a flow chart, for 'Fluffy' may look like the one below:



Scenario

Bod has created a program which asks for a password (his passwo Facebot page. There are two steps missing from the code.

1) Add the missing steps in the relevant flow chart shapes:



Task C Divide and Conker

Abstraction helps to manage complex problems by breaking them dow
(decomposing), using models of real-world scenarios (maps, storyboar
pattern recognition, and seeing similarities, differences and shared con

Scenario

Bod wants to hold a conker competition for robots. The game invol
conker. A string, which the player holds, is attached to the conker.
opponent's conker in an attempt to smash it. If a player misses the
further two goes. The player with his conker still intact wins.

Bod's finding it hard to generalise and decompose the problem int
down his task into smaller chunks to make it easier to understand a

- Conkers come from horse chestnut trees
- A group of trees is referred to as a wood or forest
- Two conkers are hit together until one breaks
- Conkers are enclosed in a spiky outer shell
- A conker should be stored for a year to harden it
- The player with conker still intact wins
- Conkers are available in the autumn
- A game of conkers comprises two players
- A string is attached through a hole in the conker
- If a player misses the conker, he/she is allowed another go (max 2
- If a player misses the conker again, he/she is allowed another go (f

1) Bod wants to write an algorithm showing the steps taken in the ga
above steps are relevant to Bod (tick the relevant box)?

a	Two
b	Eight
c	Four

2) Help Bod by putting the steps in the correct sequence.

3) Are any steps repeated? What is the term used for repeated steps

4) Write an algorithm to describe the procedure for a mishit. Do not

Task D Square Dancing (abstraction, sequencing and iterati

In this task you will use abstraction techniques to help break down a la sequencing to ensure that steps are in a logical order, and iteration (re

Scenario

Bod has created a dance program for himself and his robot frien at his school prom. It involves moving forwards four steps, turning four steps, turning right and moving forwards four steps, turning r steps, turning right and moving forwards four steps. This dance se times.

Bod's dance is set to music and they will wear special outfits on th designed the lighting to flash on and off to the music. The venue school assembly hall. The dance floor measures approximately 2

Help Bod use abstraction techniques, such as decomposing, pattern re create the dance program.

Tips

- ✓ Decomposing (break down into step sequence)
- ✓ Generalisation (filtering out unnecessary detail)
- ✓ Pattern recognition (repeated step sequence)
- ✓ Iteration (repeat)
- ✓ Selection (decision)
- ✓ Sequence (logical order)

1) Using pseudocode, write an algorithm to describe Bod's dance rou

Task E Lawn Rangers (abstraction and algorithms)

In this task, use abstraction techniques to work out which data is relevan

Scenario

Bod has developed a new line in rabbotics (robotic rabbits) which h keeping weeds and long grass at bay in large gardens. In order to garden must be 5 m^2 or more, otherwise a mower is recommended.

Help Bot use abstraction techniques to filter out unnecessary inform

Robotic rabbits available for gardens which measure 5 m^2 or more to weeds and grass. Rabbots available in a range of colours, each with and bobtail. One rabbot will eliminate all weeds in gardens up to 10 measuring less than 5 m^2 should buy a mower. Please note that you b your own risk and we are not responsible for any rabbot holes that m Rusting may occur if left outdoors in rain.

Bod's algorithm:

```
OUTPUT enter garden size in m²
INPUT user inputs garden size
STORE size in size variable
IF size >= 5 THEN
   OUTPUT "You qualify for a rabbot"
ELSE
   OUTUT "Get a lawnmower"
```

1) Which data is relevant to Bod's algorithm? (Tick the relevant box.)

a	All rabbots have lifelike cute ears	
b	Gardens need to measure 5 m^2	
c	All rabbots have bobtails	

2) Which of the following statements does not use generalisation?

a	Rabbots are available in a range of colours	
b	All rabbots dig rabbot holes	
c	Gardens measuring less than 5 m^2 do not qualify	

3) Represent Bod's algorithm as a flow chart.

Task F Rise of the Machines (algorithms – sequence, selectio

Within algorithms, sequencing ensures that steps are entered in a logic
such as IF and ELSE are used to make decisions. In an algorithm the de
written as OTHERWISE.

Scenario
Bod is developing a program that will predict the rise in popularity
next year. The current sales figure is 100 rabbots sold. Bod expec
each year.

The pseudocode is shown below:

```
OUTPUT enter current sales of rabbots
INPUT user enters rabbot sales
STORE sales in sales variable
IF sales >= 150 THEN
   OUTPUT "Woo hoo, profit!"
ELSE
   OUTPUT "Sell lawnmowers!"
```

1) Display the pseudocode as a flow chart.

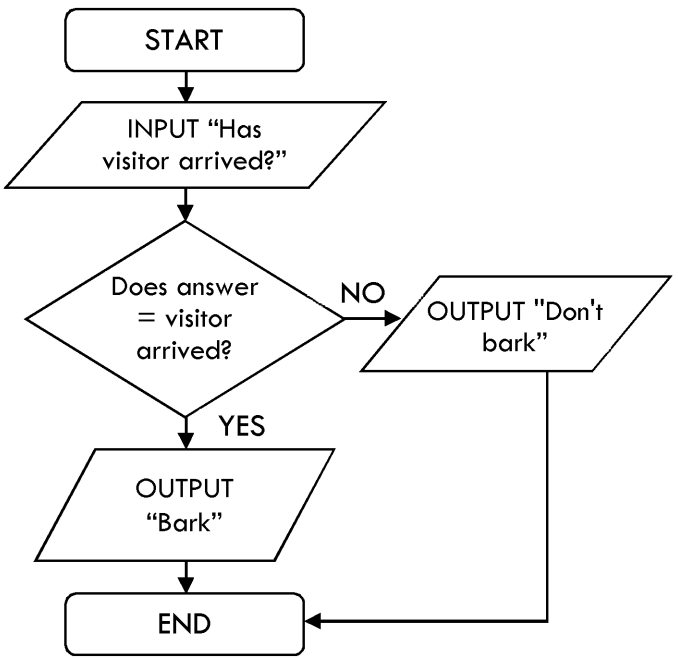
Task G Dogmatics (pseudocode)

Algorithms can be represented as pseudocode or as a flow chart. In th
algorithm from a flow chart to pseudocode.

Scenario

Bod wants to create a program that will make his RoboMutt bark w
door. He has written an algorithm and represented it as a flow ch
the algorithm to pseudocode instead.

1) Convert the following algorithm in pseudocode:



Task H Post Traumatic (flow charts)

Algorithms can be represented as pseudocode or as a flow chart. In th
algorithm from pseudocode to a flow chart.

Scenario
The PostBot needs to refine his program so he responds appropriately to Bod's Robo-mutt. Currently the algorithm is written in pseudocode but PostBot wants to convert it to a flow chart so it is easier to read.

1) Convert the following pseudocode to a flow chart:

```
OUTPUT "Does dog growl?"
INPUT user enters answer
STORE answer in answer variable
IF answer = "Yes" THEN
     OUTPUT "Run for your life!"
ELSE
     OUTPUT "Deliver mail"
```

Activity 1.2 – Sort Codes

In order to search algorithms for data, it is necessary to sort the data into order. This makes searching easier and quicker to perform. In the following tasks you will sort data into order using bubble and bucket sorting algorithms.

Task A Hubble Bubble

A bubble sort uses a simple algorithm that compares two sets of data and swaps the order if required. A bubble sort, however, takes longer to perform because it takes several passes to process each set of data. **Tip:** the final pass in the algorithm is where no changes are required.

Scenario

Bod needs to sort his friends' ages into descending order, with you below:

09 14 11 08 12 13 10 15 01 02 07 03

1) Help Bod sort his friends' ages into order. Show the first pass.

Use this space to work through the first pass:

2) You will need to continue sorting through the ages until all of the n
numerical order.

Use this space to work through the remaining passes:

3) How many passes were required to sort all of the ages into order?

Tick box a or b	
a	More than 3 passes
b	Fewer than 3 passes

Task B Passing the Book

In this task you will use a bubble sort to sort numerical data.

Scenario

Bod has a number of e-books which he needs to sort into order to s
for a particular e-book at a later date. The books can be sorted u
Bod can then cross-reference against his book catalogue. Bod will s
numerical order.

02 Eye Robot
03 Full Metal Jacket (and Trousers)
01 Batteries Included
07 RoboCod: A Fishy Robot Tale
05 Mars Bar Attacks
06 Pasturama
04 How to Train Your Human

1) Help Bod sort his books into order. Show the first pass.

2) a) Sort the book titles into numerical order, using as many passes

Use this space to work through the remaining passes:

b) How many passes are required to sort all of the books into orc
no changes are made.)

Task C Bucket List

Have a go at the task of sorting data using a bucket sort algorithm tech

Scenario

Bod has opened a film club which requires a membership subscrip
When a member joins they are allocated a random membership n
to 50. Bod needs to sort his friends' membership numbers into des
order, with lowest number first. The membership numbers are bel

01 02 22 15 25 05 50 30 10 20 40 45

1) How many buckets should be used to sort the membership numbe
groups of 10? (Use the blank space below to work through this que

Use this space to work through the question:

2) How many numbers will occur in bucket 2?

Activity 1.3 – Sole Searching

In a program containing thousands of pieces of data it is difficult to find the correct search algorithm. Sorting data first makes the searching tas two types of search technique – linear or serial searches, and binary se

Task A Breakfast Serial

A serial search is the easiest algorithm to write, and searches by keywo until a match is found or it reaches the end without finding any matche

Scenario

Bod is searching for a breakfast cereal called Weetabot so he can see the ingredients (he is allergic to bolts).

There are 20 cereals to search.

The data is unsorted.

The criterion is **find the cereal called Weetabot.**

1) Write a search algorithm to find the Weetabot cereal.

Task B Too Clever by Half

A binary search is faster and uses a process of **dividing data in half** at e
This method works best on data that has been sorted into an order.

Example: Search through a (sorted) list of cereals:

- All-Bots
- Alphabots
- Bitz 'n' Botz
- Oatibots
- SugarBots
- Weetabot

Method

1. List of sorted cereals
2. Look for cereal Weetabot
3. **Divide the list in half**
4. Compare cereal at midpoint to
5. Is Weetabot before or after mi
6. **Discard data from half of list n**
7. Divide the cereals until Weetab
8. Output Weetabot

Scenario

Bod wants to search for a film called **RoboCod** in a sorted list of fi
search as it
is faster.

Batteries Included
Eye Robot
Full Metal Jacket (and Trousers)
How to Train Your Human
Mars Bar Attacks
Pasturama
RoboCod: A Fishy Robot Tale
The Third Robot

1) Help Bod search for the **RoboCod** film by writing down the binary s

2) How many times will the list be divided in half before the film is fo

Topic 2 – Get with the Program

Objectives

- ✓ Understand programming and modular design
- ✓ Use sequencing, selection, repetition
- ✓ Understand and use data types, data structure
- ✓ Understand that different types of languages exist (textual and visual)

Activity 2.1 – Second Language

There are textual languages and visual languages. Both types of langua expressed differently. See the Help Sheets for more information.

Differences may occur between textual languages in the way that Bool within the text-editing environment itself. For example, within Python the prompts >>> and the comparison operators **not equal to** and **equal** other text languages. For the purposes of this activity, we will use Pyth

Task A Express Yourself >>>

In this task you will test your knowledge of expressions and values by a questions below:

1. The numbers 6 and 8 are:	
A	Values
B	Expressions
C	Operators
D	Calculations

2. The +, -, * and / symbols are called:	
A	Signs
B	Expressions
C	Operators
D	Values

3. The calculation 1 + 1, when used in programming, is called an:	
A	Arithmetic
B	Expression
C	Operator
D	Addition

Have a go at writing the following expressions; the first one is done for

4) Add the value 2 and the value 2

```
>>> 2 + 2
4
```

5) Multiply the value 3 and the value 2

```
>>>
```

6) Subtract the value 2 from the value 3

```
>>>
```

7) Divide the value 6 by the value 3

```
>>>
```

Task B Place an Order

As in maths, there is an order in which arithmetical operators should be
to as BODMAS (brackets, over, division, multiplication, addition, subtra
more information.

1) Without using brackets, what is the answer to the following expres

```
>>> 5 + 4 * 5 / 2
```

2) Now using brackets, what is the answer to the following expressio

```
>>> (5 + 4) * (5 / 2)
```

Activity 2.2 – What's Your Type?

A value needs a *data type*. Data types can be integer *int* (whole numbe
or alphanumeric characters surrounded by quotation marks, e.g. "Hi Bo
floating-point numbers, displayed as *float* (numbers with a decimal poi

Task A String Along…

Text strings must be enclosed in quotation marks, e.g. “Hi Bod”.

1. Which of the following uses a *string* data type?	
A	1, 2, 6, 10
B	0.1, 0.2, 0.6, 1.0
C	"a", "b", "c", "d"
D	10.0, 11.0, 12.0, 13.0

The addition operator can be used to concatenate (join) text. For exam

```
>>> "cat" + "nap"
"catnap"
```

2. To join the two pieces of text 'flap' and 'jack' together to make th 'flapjack', which of the following is correct?	
A	"flapjack"
B	"flap + jack"
C	"flap" + "jack"
D	"flap" and "jack"

The multiplication operator can be used to replicate text. The example replicated twice *(the value used to multiply by must be a whole numbe*

```
>>> "catnap" * 2
"catnapcatnap"
```

3. To replicate the text 'hip' three times, which of the following is c	
A	hip * 3
B	"hip" *3
C	"hip * 3"
D	"hip, hip, hip" * 3

The **string** data type is typed as **`str()`** in Python and can be used, alon
expressions using text (see the Help Sheets for examples).

4) Enter code using **`str()`** to print *The flapjack cost 50 pence. Barga*

```
>>>


>>>
```

Task B Whole-some

Whole numbers, without decimal points, are referred to as integers (1,
the Python interactive shell >>>, the number 10.0 with an **int** data type

Example

```
>>> int (5.0)
5
```

1. Which of the following sets of numbers has an integer data type?	
A	1, 2, 6, 10
B	0.1, 0.2, 0.6, 1.0
C	"a", "b", "c", "d"
D	10.0, 11.0, 12.0, 13.0

The **int** data type can be used to round numbers up and down:

2. Entering >>> int (5.3) would result in which of the following?	
A	5.5
B	5
C	6
D	5.4

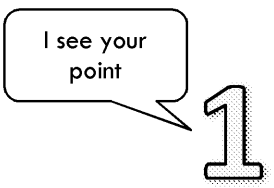
3. Entering >>> int (5.6) + 1 would result in which of the following?	
A	5.5
B	5
C	7
D	6.5

Task C Make your Point

A floating-point number has a decimal point; for example, 1.0, 1.50, 0.1
shell >>>, the number 10 with a float data type would display as 10.0:

Example

```
>>> float (5)
5.0
```



1. Which of the following sets of numbers has a floating-point data t	
A	1, 2, 6, 10
B	0.1, 0.2, 0.6, 1.0
C	"a", "b", "c", "d"
D	100, 200, 300, 400

2. Which of the following sets of numbers does *not* have a floating-p	
A	1, 2, 6, 10
B	0.1, 0.2, 0.6, 1.0
C	1.00, 2.00, 3.00, 4.00
D	10.0, 20.0, 30.0, 40.0

Activity 2.3 – Make a Statement

Values can be stored in variables in order to be used in later expression
bonus could store the value **100**. An assignment statement stores a va
assignment statement comprises a variable name (such as **bonus**), an e
stored (such as **100**).

Task A Variable Conditions

In Python a variable starts with a lower-case letter. Variables are case s
`sAlary` are two different variables. A variable name should be descri
more readable.

1. Which of the following variable names is not allowed?	
A	Overtime
B	oVertime
C	Over_time
D	Over-time

2. What is the name given to a statement containing a variable, valu	
A	Assignment
B	Assessment
C	Alignment
D	Assignation

3. In the assignment statement >>> overtime = 150, what part is the	
A	150
B	overtime
C	=
D	>>>

4. What part is the value?	
A	150
B	overtime
C	=
D	>>>

5. What part is the variable?	
A	150
B	overtime
C	=
D	>>>

6.	Which of the following variable names is displayed in camel cas
A	overTime
B	overtime
C	Over_time
D	Overtime

7) In the Python interactive shell below, enter an assignment stater
money of £5:

```
>>>
```

8) The variable ***pocket_money*** is equal to £5 and the variable ***pape***
procedure for assigning both variables and write an expression t
statements (show the result):

Activity 2.4 – A Structured Approach

A data structure stores data types in lists, tables and arrays. A variable
but an array or list can hold many items.

Task A Hip, Hip Array!

Python works with **lists**; other programming languages such as Java wo

NOTE: More than one data type can be stored in a list but **all** data type

```
>>> RGB = [red, green, blue]
>>> RGB
[red, green, blue]
```

In the above example, the RGB variable is assigned one value – the list val

1. List items are separated by:	
A	Semicolons
B	Full stops
C	Commas
D	Quotation marks

Lists can be joined together by using the addition operator:

```
>>> [red, green, blue] + [yellow, purple, orang
[red, green, blue, yellow, purple, orange]
```

2. Which of the following is the correct way to concatenate two lists:	
A	[apple, orange, pear] – [plum, cherry, fig]
B	[apple, orange, pear] * [plum, cherry, fig]
C	[apple, orange, pear] + [plum, cherry, fig]
D	[apple, orange, pear] = [plum, cherry, fig]

The counting system in programming starts with 0, so in the RGB list **re**

Therefore, in the index `RGB[2]`, [2] refers to **blue**.

3. To which list value or item does RGB[0] refer?	
A	Red
B	Blue
C	Green

The addition operator can be used to join an indexed list value with tex

```
>>> RGB [1] + " for go!"
"Green for go!"
```

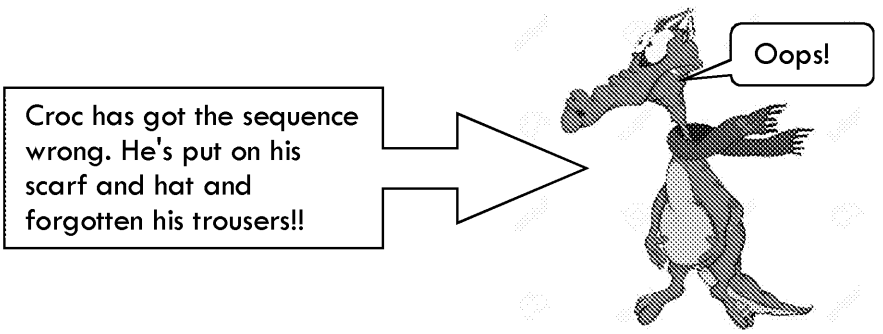
4. Which of the following successfully joins the indexed list value *'b* to the text *'is the new black'*?	
A	RGB [0] + " is the new black"
B	Blue + " is the new black"
C	RGB [2] + " is the new black"
D	RGB [1] + " is the new black"

Activity 2.5 – A Sequence of Events

In order to run successfully, a program must follow a logical sequence. written logically so the computer knows what to skip, what to run and

Task A Go with the Flow

Sequencing means putting items in a structured order.



1) Put the following code in sequence so that when the name Bod is e otherwise the output will be 'Who are you?'.

```
print ("Who are you?")
else:
if name == "Bod":
   print("Hi Bod")
```

ANSWER:

2. Which part of the code is the clause?	
A	The indented block of code
B	The decision
C	The selection
D	The condition

3. Flow control statements are followed by what type of punctuatio	
A	Full stop
B	Semicolon
C	Comma
D	Colon

4. IF, ELSE and ELIF are examples of:	
A	Flow charts
B	Flow control statements
C	Statement control flow
D	Control flow statements

Task B WHILE away the time

The WHILE condition is used to ensure that a program will continue re
user inputs the correct answer. Below is an example of a condition-co

Example:

Go Loopy: In the following code, Bod wants the user to answer **R**
the best way to keep weeds down in your garden?' The program v
until the correct answer is entered (Rabbot), otherwise the user wi

```
answer = " "
while answer != "Rabbot":
 answer = input("Keep trying "
print("Rabbot correct")
```

1) Bod wants to program his computer with a personal greetingthat
name. Write the code needed for this program below:

ANSWER:

2) Bod's concentration levels are not very good. He can only concent
circuits start burning out. He needs regular breaks. Help Bod creat
user to give the time spent in class that will output the message 'ta
indefinitely.

ANSWER:

Task C Plus FORs

The FOR condition is used for count-controlled loops. The **range** is the
instruction will be repeated (iterated).

1) Bod buys a lot of computer games. He wants to program his comp
returned when he inputs the price of each of the four games he is
needed for this program below:

ANSWER:

Task D Following Procedures

A procedure is a part of a program that performs a specific action. A fu
procedure executes a command, while a function returns a value.

1. Which of the following functions outputs to screen?	
A	Input()
B	Output()
C	Print()
D	Len()

2. Which of the following functions asks for a user to enter data?	
A	Input()
B	Output()
C	Print()
D	Len()

3. Which statement defines a function's value?	
A	Input()
B	Def()
C	Print()
D	Len()

4. Which statement returns the length of a value?	
A	Input()
B	Def()
C	Print()
D	Len()

5) Show the method for converting the value 250 within the variab

```
>>> overtime = input()
250

>>> overtime
"250"
```

6) Use the Len function to find the length of the following sentence

7) Use the Def function (named whatever) to repeat the value 'mel

Activity 2.6 – Testing, Testing...

It is important to keep saving your code so you won't lose your work. Y
whether it works. If you find errors or glitches in your program, you ma
elimination to see which bit of code is wrong.

Task A Make a Hash of It

If you want to remove a line of code to test a program, enter a hash sy
common practice with programmers when they want to check lines of
be used to add comments to code to describe what the code does.

1. Which is the correct way to add a comment?	
A	++ ask for password
B	~ ask for password
C	# ask for password
D	£ ask for password

2. What happens when the hash symbol is put in front of a line of c	
A	That line of code is displayed
B	Only that line of code is tested
C	It results in a syntax error
D	That line of code is removed

Task B Syntax Errors

You may end up experiencing several error messages when programmi

1) There are four errors within the following block of code – one on e

```
if name == "Bod:
     print("Hi, Bod")
else
     print ("Who are you?"
```

Answer:

1.

2.

3.

4.

Topic 3 – Smooth Operators

Objectives

- ✓ Understand simple Boolean Logic
- ✓ Use Boolean operators AND, OR, NOT
- ✓ Understand and use logic gates

Do I go to
NOT 2b?
AND am I
the SUM of
That is the

Activity 3.1 – Whether Conditions

In the following tasks you will use conditions, expressions and operator
for guidance.

Task A Expressions of Interest

A condition is a statement or calculation which is either true or false.

1) In the task below, work out whether the statements will result in T
= y. The first one has been worked out for you:

x > y	**TRUE** (e.g. 2 is greater than 1)
x <> y	
x >= y	
x < y	
y < x	
y > x	

2) Now try the task below, using Python operators.

8 = x and **10 = y**

x != y	
x == y	

Task B IF Only…

The conditional IF operator is used in programming to test a statement
pseudocode below uses the IF operator to test a condition.

```
OUTPUT "How many vegetables or fruit do you eat
INPUT user enters amount
STORE answer in amount variable
IF answer >= "5" THEN
   OUTPUT "You're getting your 5-a-day!"
ELSE "You are falling short of the 5-a-day targ
```

Scenario: Bod's invention, the rabbot, is a robotic rabbit that keeps
gardens. Rabbots need to be maintained and are required to und
Help Bod work out whether his rabbot needs to come in for a servi

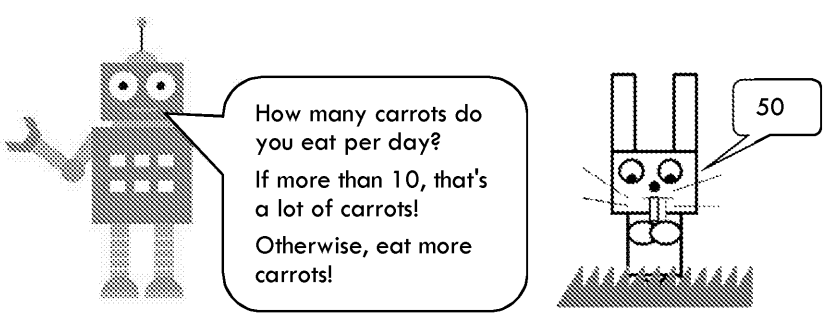
1) Using pseudocode, create a conditional statement for Bod that wil
the age of his rabbot is less than or equal to 3, and otherwise outp
overhaul!'.

ANSWER:

Task C Get with the Program

There are many programming languages, some low-level (called machi
high-level. Python is a high-level language.

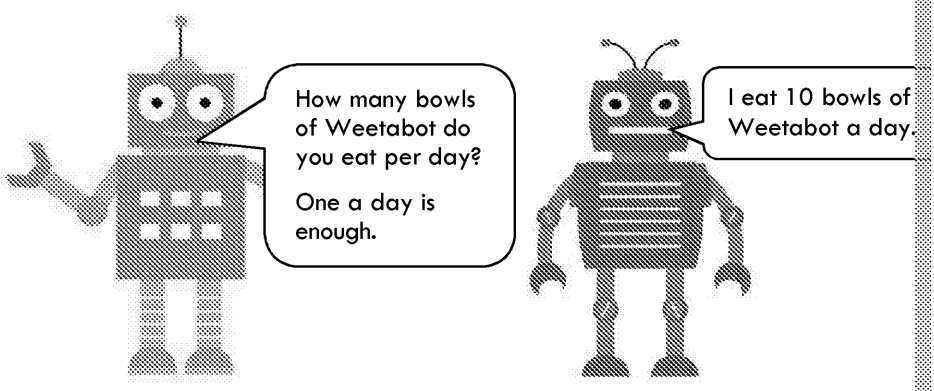
Example: In the following task, Python is used to create a program usin



This is how it looks using Python:

```
carrots = int(input("How many carrots do you ea
if carrots > 10:
    print("That's a lot of carrots!")
else:
  print("Eat more carrots!")
```

1) Bod loves eating Weetabot. Have a go at converting the following programming code:



ANSWER:

Task D Or ELSE...

In the previous task, you used 'else' to represent the word 'otherwise' i Python to test a further condition within the same program (else if).

Example:

```
carrots = int(input("How many carrots do you ea
if carrots > 10:
   print("That's a lot of carrots!")

elif carrots == 10
      print("Not too bad!")
else:
   print("Eat more carrots!")
```

1) Use **elif** to test the following conditions:

Scenario:
Bod likes playing Robot Wars but the rules are changing for p minimum age for robots to play the game and, to ensure that appropriate, there is also a maximum age limit.

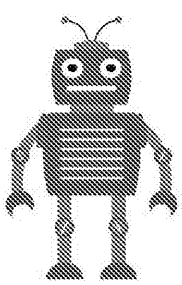
To play Robot Wars a robot must be aged 5 years or more.
If a player is over 10, they are too old to play.
Otherwise, they are too young to play.

ANSWER:

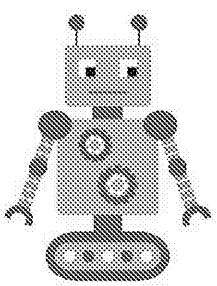
Task E Put Your OR In

The operators AND, OR and NOT can also be used to compare values ar

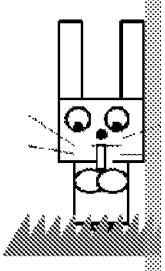
Bod. MALE ROBOT



Bodette, FEMALE ROBOT



Rabbot, FEMALE



- Robot AND Female will find Bodette
- Robot OR Female will find Bod, Bodette or Rabbot
- Robot NOT Female will find Bod

1) What would Rabbot OR Male find?

Answer	

2) What would Robot NOT Male find?

Answer	

3) What would Robot AND Female find?

Answer	

Task F What's Your Game?

The Boolean operators **OR** and **AND** are used in programming code.

Example:
The program below requires a player to be aged 5 or over **OR** have at le
playing the game.

```
age = int(input("How old are you?"))
experience = int(input("How many years' experien
if age >= 5 or experience >= 1:
  print("You are eligible to play!")
else:
  print("You are not eligible to play!")
```

The program below is based on robots playing a computing game calle
player to be aged 5 or over **and** have at least 1 year of experience of pl

```
age = int(input("How old are you?"))
experience = int(input("How many years' experien
if age >= 5 and experience >= 1:
  print("You are eligible to play!")
else:
  print("You are not eligible to play!")
```

1) For a player to attain the first level they must have scored at least
errors. Bod wants a program that will output a message 'You have
has an existing score of 10 **AND** made fewer than three errors, oth
'Try harder!'.

ANSWER:

Task G Acid Test

In this task you will write code using comparison and Boolean operators

Scenario:

Bod wants to plant out some i-Rises but needs to know whether the balance and shade are right for the flowers to grow. His i-Rises ne alkaline soil and a sunny spot to grow successfully.

The number 7 on the pH strip represents a neutral pH balance. An 7 is acidic and over 7 is alkaline. The pH balance is worked out usi from Bod's garden centre.

The position in which the flowers should be planted is governed by shade or sun that is available. This is worked out on a scale of 1–1 numbers over 5 representing a sunny spot and under 5 representin degrees of shade.

Bod's i-Rises need an alkaline soil of at least 8 on the pH strip **AND** with full sun represented as 10 on his sun/shade scale.

pH Scale

1	2	3	4	5	6	**7**	8	9	10

1) Write the code below for a program that will print a message '*Idea* conditions are met, or a message '*Plant elsewhere*' if conditions ar

ANSWER:

Task H The Hole Truth

Bod hasn't quite got the hang of planting yet. He needs to dig a hole fo plant it the right way up. Help Bod create a program to dig a hole 15 cm 15 cm wide.

1) Write the code below for a program that will print a message 'Goo conditions are met, 'Dig deeper!' if the conditions are below those 'Oops, too much!' if conditions are not met.

ANSWER:

Activity 3.2 – Circuit Performers

Truth tables help you to see how the input of a logic gate relates to its output using the Boolean operators AND, OR and NOT. Logic gates are switches within circuits which are either TRUE = 1 or FALSE = 0.

AND = each input must match criteria
OR = one or both inputs must match criteria
NOT = output is opposite of input

Task A Logical Assumptions

In the task below you will test your knowledge of logic gates and truth choice questions:

1. Which of the following statements about the AND operator is cor	
A	AND requires both inputs to match criteria
B	AND requires only one of the inputs to match criteria
C	AND only uses one input
D	AND outputs the opposite of the input

2. Which of the following statements about the OR operator is corr	
A	OR requires both inputs to match criteria
B	OR requires only one or other of the inputs to match criteria
C	OR only uses one input
D	OR outputs the opposite of the input

3. Which of the following statements about the NOT operator is cor	
A	NOT requires both inputs to match criteria
B	NOT requires only one of the inputs to match criteria
C	NOT uses more than one input
D	NOT outputs the opposite of the input

Task B Turning the Tables

1) Fill in the truth table below (A does not equal B).

A	B
0	
1	

2) Fill in the truth table below (A or C equal X).

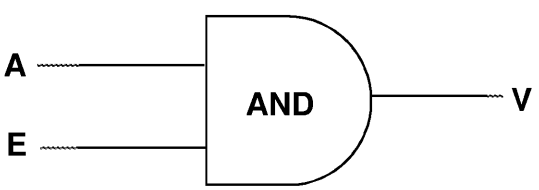
A	C	X
0	1	
1	0	
1	1	
0	0	

3) Fill in the truth table below (A and C equal X).

A	C	X
0	1	
1	0	
1	1	
0	0	

4) Turn the truth table below into a logic gate where X does not equa
on logic gates).

X	Y
0	1



5) Turn the logic gate diagram below into a truth table.

A	E	V
0	1	
1	0	
1	1	
0	0	

6) Bod wants to join a film club. Fill in the table based on the pseudo

```
IF age<=12 OR age>=60 THEN Discount
IF Discount THEN JoiningFee = 5
IF NOT Discount THEN JoiningFee = 10
```

Age 12 or under?	Age over 60?	Discount?
Yes	No	
No	Yes	
No	No	

Topic 4 – Base Jumping

Objectives

- ✓ Convert from binary to denary
- ✓ Convert from denary to binary
- ✓ Use addition with binary
- ✓ Create and crack binary codes with ASCII

Activity 4.1 – Get Cracking! (convert binary to

In the following activities you will practise converting binary numbers t
placeholders, sounds, colours and text.

Task A Starter for 10

The denary number system is also referred to as the decimal number s
Computers use a binary number system to process and store informati

1) To get started, try converting the binary numbers below to denary

1001 0100 =

128	64	32	16	08	04	02	01

0001 0001 =

128	64	32	16	08	04	02	01

1100 0011 =

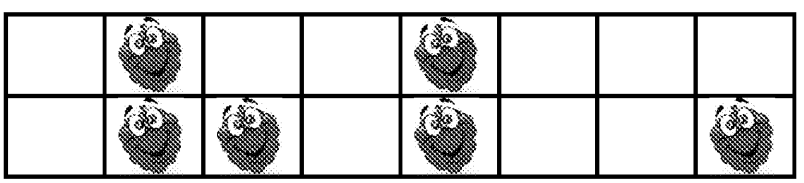
128	64	32	16	08	04	02	01

Task B Mind your Language

Binary code can be represented as sound, e.g. on and off.

Scenario:
Interplanetary travel means that Blurb needs to communicate with
language to his own. Blurb has been confronted by a peculiar-loo
who makes rude noises at him.

Blurb is convinced that the alien is blowing raspberries at him until he begins to recognise a pattern and sequence in the language.



Raspberry Aid: a raspberry is a 1 and a blank square is 0

1) Use your knowledge of binary and the ASCII table to help Blurb cra

128	64	32	16	08	04	02	01

=

128	64	32	16	08	04	02	01

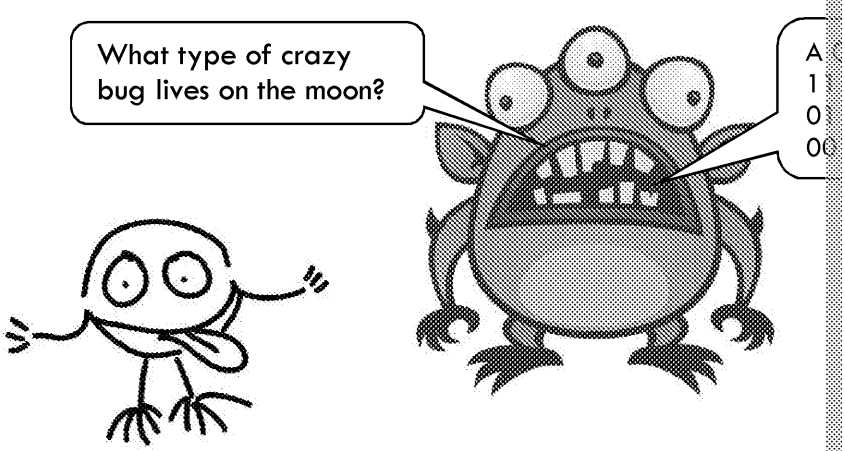
=

Answer	

Task C Cracking Jokes

Now that Blurb can understand the alien, he tries out a (bad) joke on h

1) See if you can get the answer.

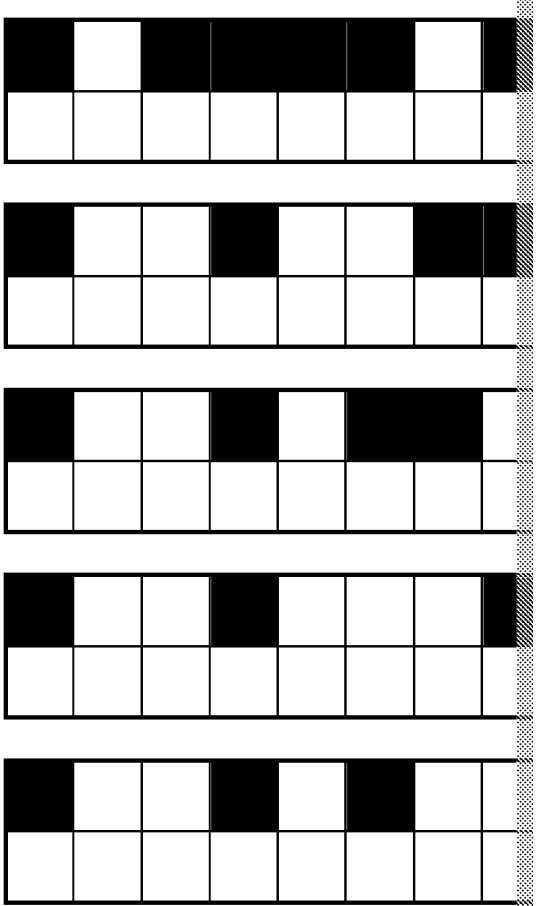


Answer	

Task D Optical Illusion

Optical storage devices, such as CDs and DVDs, use on/off light to read

1) Decode the following tables. The dark squares represent **off** and th
Work out what the flashing light represents in binary and then finc



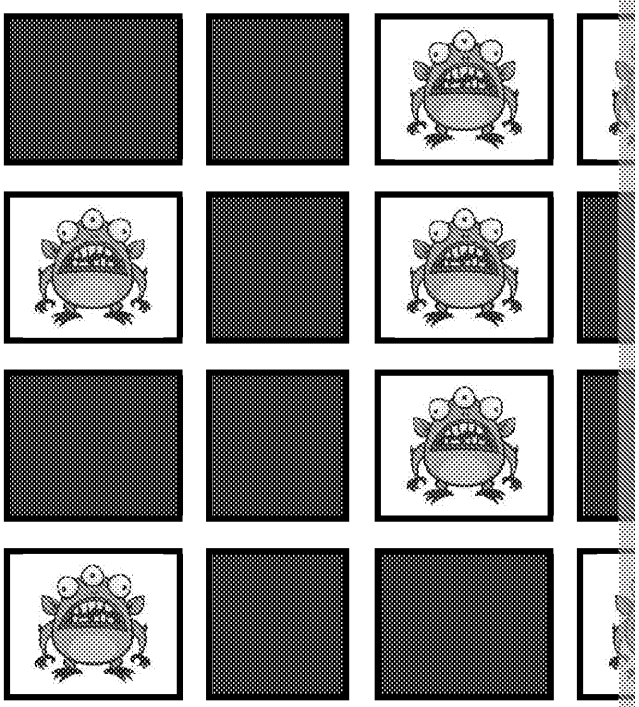
Answer	

Task E Mug Shots

Binary code can be represented as images or colours (e.g. blank square

Scenario
Blurb has some passport photos of himself. Blurb lays out the photo
face down.

1) a) Work out the binary code from the pictures below – face up re
represents 0 (remember 1 is on and 0 is off).



128	64	32	16	08	04	02

128	64	32	16	08	04	02

b) Now convert the binary code to denary:

128	64	32	16	08	04	02

128	64	32	16	08	04	02

c) Now encode the denary number using the ASCII table at the e
What ASCII character is Blurb displaying?

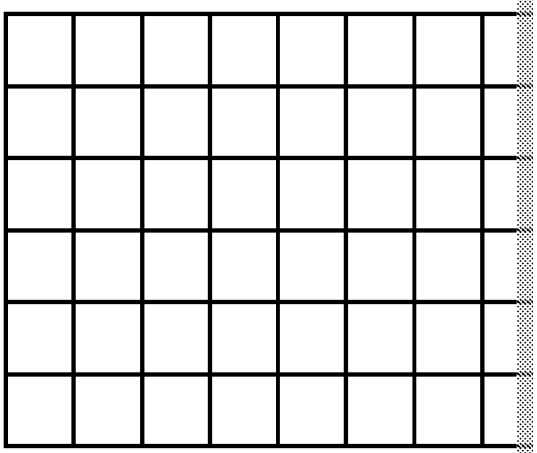
Answer	

Task F Making Faces…

Bitmap images are made up of tiny squares or picture elements called p
represented by a colour to make a picture.

1) What picture do you get when you convert the following code to c
(Black = **on** and white = **off**)

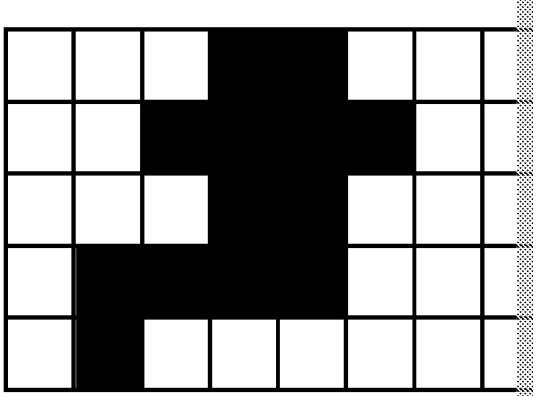
0011 1100 0101 1010 0111 1110 0110 0110 0011 1100



Task G Tap Into your Potential

Binary code can be represented by coloured squares with white as 0 an

1) What is the binary code that makes up the picture below? Enter th
box below.



Answer	

Activity 4.2 – Number Crunching (conve numbers to binary)

Denary is the decimal system that humans use – this system is called **base 10** because there are 10 numbers and it uses the power of **10**. The denary system uses 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

Task A Become a Convert

Denary numbers, such as 0123, need to be converted to binary numbers so that a computer can understand and process them.

1) Convert the denary numbers below to binary.

120 = ...

45 = ...

80 = ...

2) Convert your age to binary.

Answer	

3) Convert the age of one of your friends into binary code.

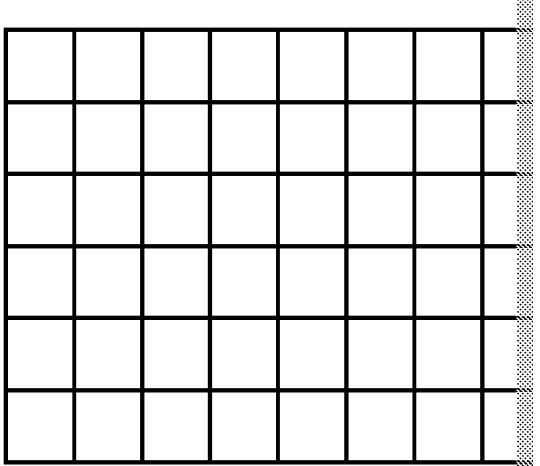
Answer	

Task B Picture This…

In this task you will convert denary numbers to binary and represent th

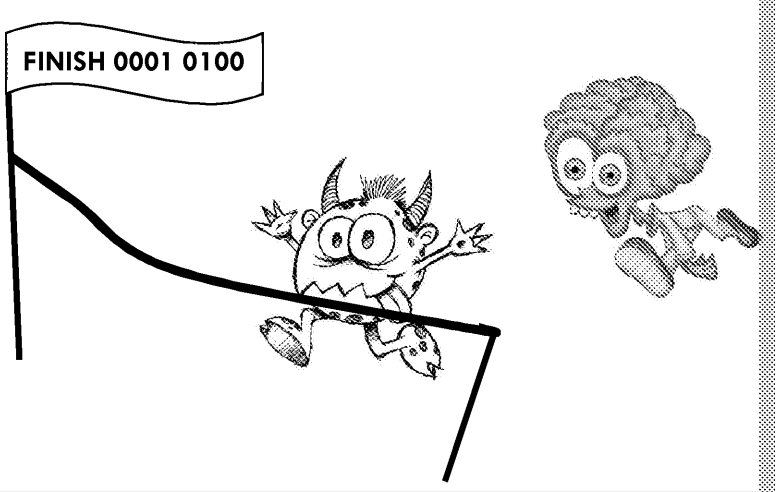
1) What picture do you get when you convert the following denary nu colours? (Black = **on** and white = **off**)

0
255
153
153
231
231



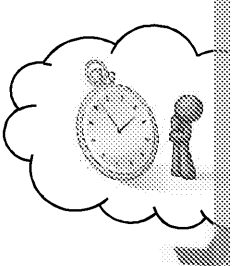
Task C Alien Race

Blurb has devised a race for his friends. They must run a specified dista
distance in km using the binary number 0001 0100 (converting binary t



Answer	

Task D Beat the Clock



Bod's internal chronometer runs faster than human time and he's bored as his class appears to be going very slowly. Bod has another 30 minutes to go.

1) Bod uses binary to store data. Help Bod work out how much time is remaining by converting the denary number **30** into binary.

Answer	

Activity 4.3 – Adding Binary

To add two denary numbers together we add a number to an existing n
The binary number for 2 is a 1 and a 0 (10). The binary number for 3 is

Task A Sum it Up

In the following task you will add binary numbers together.

1) Add the following binary numbers:

   00011000
   00001111

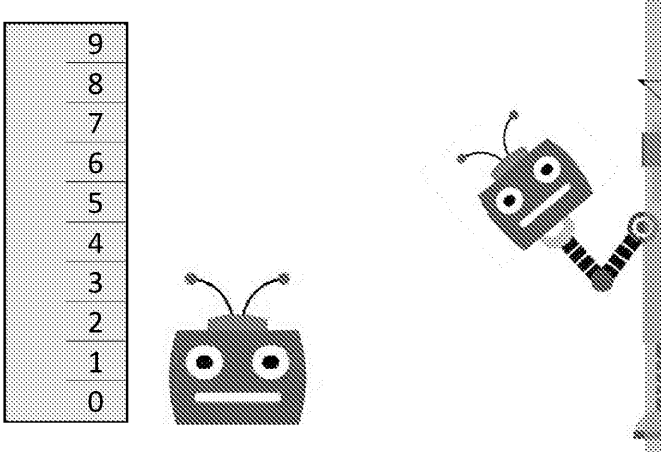
Answer	

Task B How to Get Ahead in Robotics

There are two parts to this task: first convert measurements to binary a
together.

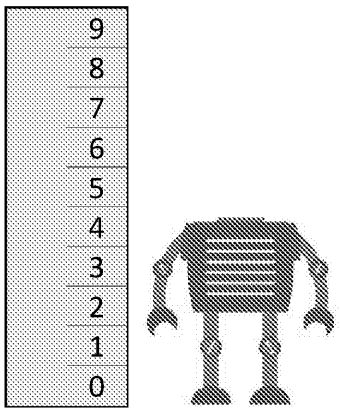
Scenario:
The Automatron needs to repair Bod after his disastrous attempt a
reassemble him, she needs to know the original height of each par

1) Work out in binary the measurements shown on the ruler below to
   Bod's head including antennae.



08	04	02	

2) Now work out in binary the measurements shown on the ruler bel
of Bod's torso and legs.



08	04	02	0

3) Now add the two binary measurements shown to find Bod's total h

Answer	

Task C Eye Robot

Scenario:
Orb is a school class monitor. He's got his eye on Bod. Orb also has

1) How many eyes does Orb have? Convert this number to binary.

08	04	02	01

Answer	

The school has employed another class monitor. This monitor has one

2) Add this binary number to the previous number to work out how n
progress.

```
  0001
+ 0010
------
```

Answer	

Task D Beat the Clock 2

Add together the binary numbers representing the time remaining and
class to find the duration of the class (your answer must be in binary fo

30 minutes	00011110
60 minutes	+ 00111100

Answer	

Task E Go with the Overflow

In the following task you will work with overflow errors.

1) Add the two binary numbers below – do you get an overflow error

```
  1110011
+ 1010100
```

Yes ☐ **No** ☐

2) Overflow errors can occur when adding binary numbers. Tick the b
explains why overflow errors happen.

a	Overflow errors occur when the result contains fewer digits th added together
b	Overflow errors occur when denary numbers are added toget
c	Overflow errors occur when the result contains more digits th added together
d	Overflow errors only occur when eight binary digits are added

3) Tick the statement that best describes what can happen when an o

a	The computer will work normally with no incorrect answers
b	The computer may crash but answers will always be correct
c	The overflow error may result in an incorrect answer and the
d	Overflow errors can cause viruses to enter a computer system

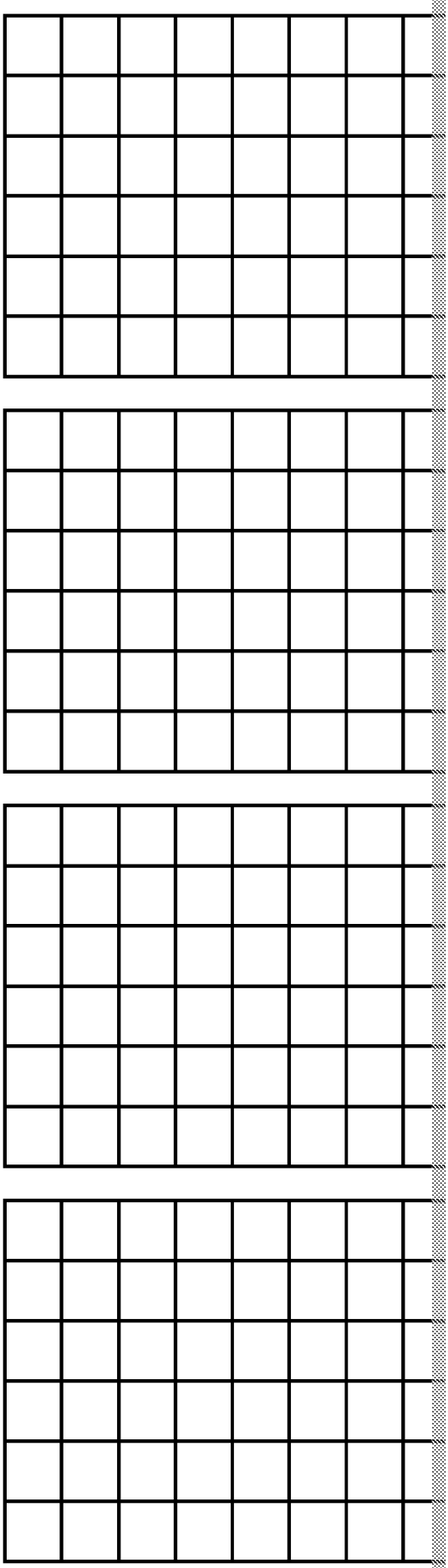
ASCII Character Set

Common Printable Characte	
BINARY	DECIMAL
0011 0000	
0011 0001	
0011 0010	
0011 0011	
0011 0100	
0011 0101	
0011 0110	
0011 1001	
0011 1000	
0011 1001	
0010 0000	32
0010 0001	33
0010 0010	34
0010 0011	35
0010 0100	36
0010 0101	37
0010 0110	38
0010 0111	39
0010 1000	40
0010 1001	41
0010 1010	42
0010 1011	43
0010 1100	44
0010 1101	45
0010 1110	46
0010 1111	47
0011 0000	48
0011 0001	49
0011 0010	50
0011 0011	51
0011 0100	52
0011 0101	53
0011 0110	54
0011 0111	55
0011 1000	56
0011 1001	57
0011 1010	58
0011 1011	59

Common Printable Charact	
BINARY	DECIMAL
0011 1100	60
0011 1101	61
0011 1110	62
0011 1111	63
0100 0000	64
0100 0001	65
0100 0010	66
0100 0011	67
0100 0100	68
0100 0101	69
0100 0110	70
0100 0111	71
0100 1000	72
0100 1001	73
0100 1010	74
0100 1011	75
0100 1100	76
0100 1101	77
0100 1110	78
0100 1111	79
0101 0000	80
0101 0001	81
0101 0010	82
0101 0011	83
0101 0100	84
0101 0101	85
0101 0110	86
0101 0111	87
0101 1000	88
0101 1001	89
0101 1010	90
0101 1011	91
0101 1100	92
0101 1101	93
0101 1110	94
0101 1111	95
0110 0000	96
0110 0001	97
0110 0010	98
0110 0011	99

Common Printable Charac	
BINARY	**DECIMAL**
0110 0100	100
0110 0101	101
0110 0110	102
0110 0111	103
0110 1000	104
0110 1001	105
0110 1010	106
0110 1011	107
0110 1100	108
0110 1101	109
0110 1110	110
0110 1111	111
0111 0000	112
0111 0001	113
0111 0010	114
0111 0011	115
0111 0100	116
0111 0101	117
0111 0110	118
0111 0111	119
0111 1000	120
0111 1001	121
0111 1010	122
0111 1011	123
0111 1100	124
0111 1101	125
0111 1110	126
0110 0000	127

Blank Grids



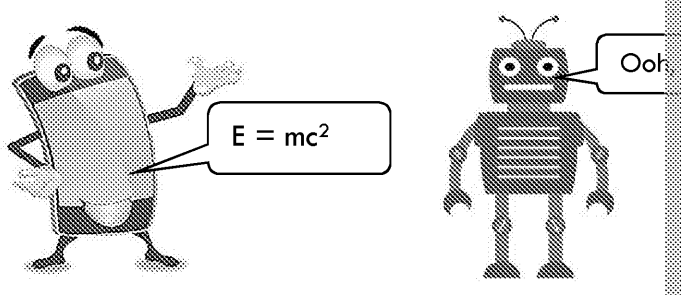
Topic 5 – The Appliance of (Computer)

Objectives

- ✓ Understand the terms Hardware and Software
- ✓ Understand Inputs and Outputs
- ✓ Understand Networks and how they are connected
- ✓ Understand and use the Internet and World Wide Web
- ✓ Understand and demonstrate the Fetch–Execute Cycle

Activity 5.1 – Gadget Show

Hardware consists of the parts of a computer or device that you can ph
to actual appliances and the components within them. Hardware can r
mobile phones, GPS systems, circuit boards, display screens, peripher
and disk drives.



Task A One's Own Devices

In this task you will identify hardware devices.

Scenario: Bod owns several devices on which he downloads apps and m
are referred to as ***hardware***.

1) Tick the items that are hardware only (the first one has been done

	Hard
Tablet	✓
Smartphone	
Smartphone app	
Games console	
Space Invaders game	
Spreadsheets	
Disk drive	
Printer drivers	
Circuit board	
Memory	
Word processing	
Digital camera	

2) Decide which of the hardware devices listed above would be best t
can do this yourself or as part of a group):

Action	H
Texting friends with photos and downloading apps	
Inserting media for watching a DVD or listening to a CD	
Adding some more RAM	
Taking photographs and small movie clips	
Playing games on an Xbox	

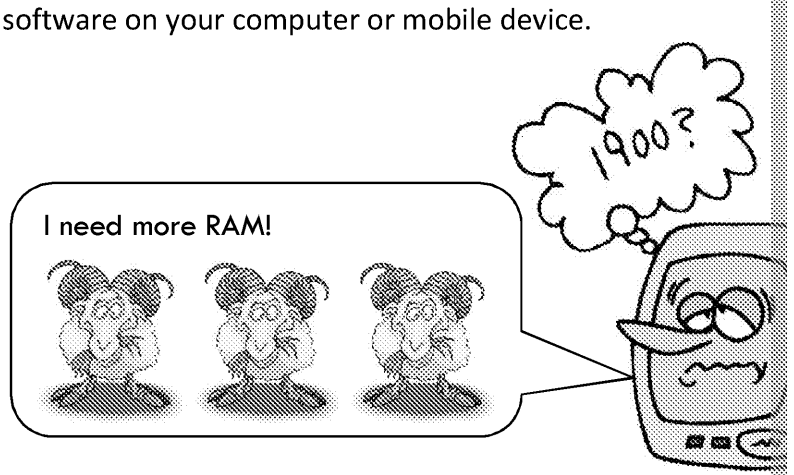
3) What other hardware items can you think of? Write a list of three
what action is performed by that piece of hardware (i.e. how is it u

This can be completed individually or in teams of four (e.g. one tea
hardware items and gets another team to write down a practical a
the item).

Hardware item	

Task B Memories are Made of This…

RAM stands for Random Access Memory and is the memory that stores
application software on your computer or mobile device.

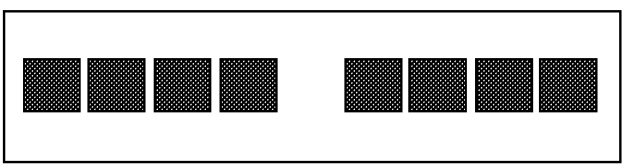


Scenario: Bod's memory isn't too good and he wants to install extra RAM his motherboard will support. He would like to upgrade with a further 8 specifications:

SDRAM, DDR3 1600, PC3 12500, 2 slots

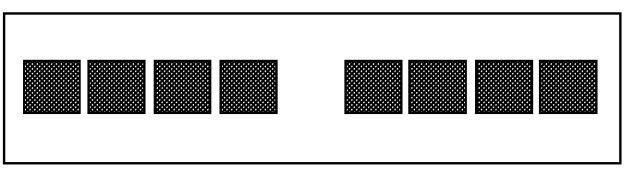
1) Which of the following RAM sticks is the most suitable for Bod's sy

a)



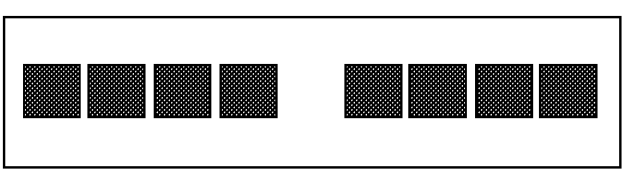
8 gigabyte
12500, 1 R

b)



2 RAM stic
DDR3 160

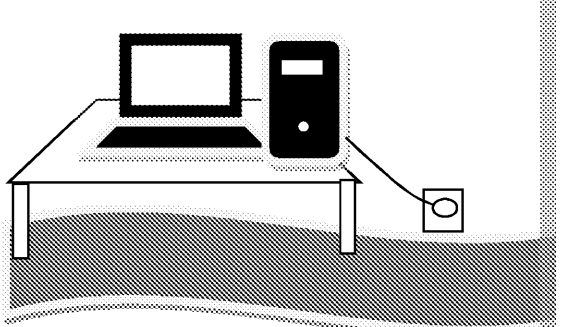
c)



2 RAM stic
DDR3 160

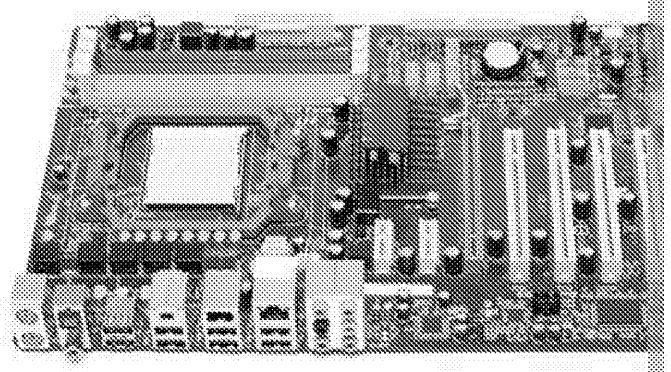
	✓
a)	
b)	
c)	

2) Look at the image below. It is important to discharge static build-u two safety actions that should be performed before installation:



a)	
b)	

3) A motherboard contains components such as the CPU, memory, cl
and ports (e.g. PS/2, USB, Serial and Parallel, Ethernet and audio).
below to indicate where RAM should be installed:



Task C Play and Display

A monitor or computer screen is used to display data on-screen. In this
knowledge of display screens.

Scenario: Bod likes to play a game called *Botman Forever* with his frien
The graphics aren't very good. What advice do you have for him?

1) Look at the specifications below and tick which one is the best suit

a)

Wide screen	Yes
Screen resolution	1920 × 1080
Screen size	28 inch
Refresh rate	60 Hz
Graphics card	4 GHz

b)

Wide Scre	
Screen res	
Screen size	
Refresh ra	
Graphics c	

c)

Wide screen	Yes
Screen resolution	1920 × 1080
Screen size	32 inch
Refresh rate	144 Hz
Graphics card	4 GHz

d)

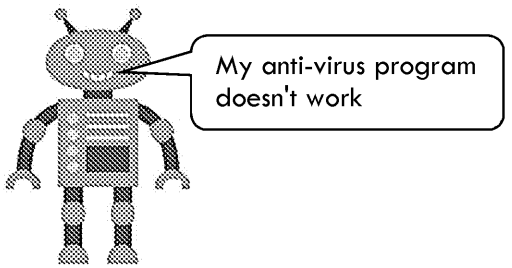
Wide scre	
Screen res	
Screen size	
Refresh ra	
Graphics c	

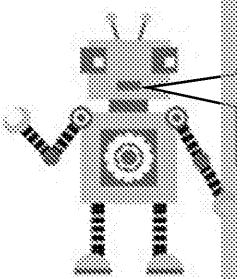
2) What effect does the screen resolution have on how graphics are d

Answer	

Activity 5.2 – Application Forms

Software consists of programs that are installed on a computer or devi
software available – application software, operating system software a





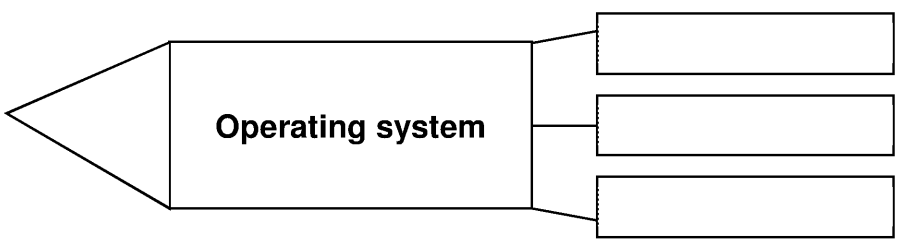
Task A All Systems Go!

In this task you will test your knowledge of system software.

1) Look at the list below and choose which three actions relate to the

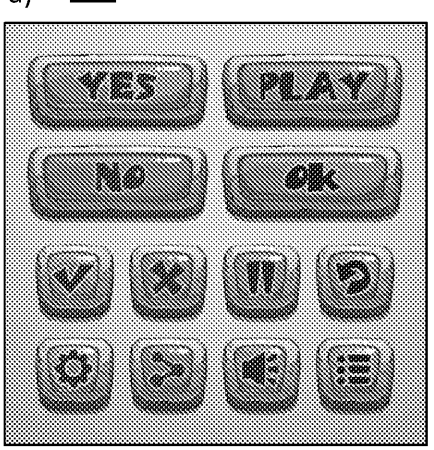
   a) Manages peripheral devices
   b) Scans a computer for viruses
   c) Manages computer programs
   d) Provides a GUI interface
   e) Performs calculations in a spreadsheet

   Write your answers (a, b, c, etc.) in the boxes below:

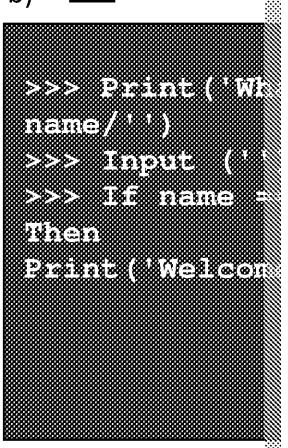


2) Which picture below is an example of a GUI? (Tick the correct box.)

a) ☐

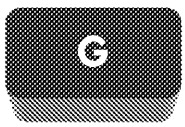


b) ☐



3) Icons are displayed within graphical user interfaces.

Match each image below to the correct description:



a)

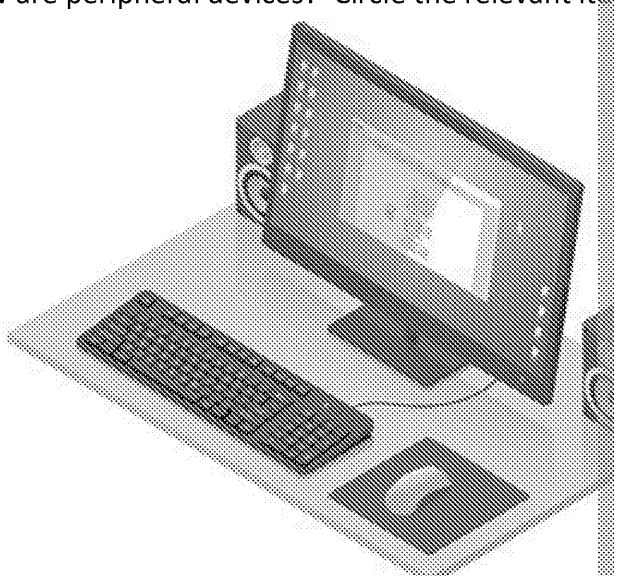
b)

c)

a, b or c?	
	A button or command in a dialog box that is clicked to proceed
	A key on a keyboard for inputting data
	An icon to a software program

4) Draw an icon for a photo editing software program called PhotoBo

5) Which devices below are peripheral devices? Circle the relevant it



Task B Program Guide

In order to work, a computer, smartphone or games console requires s

1) Look at the tasks below and decide which software is best for each

a)

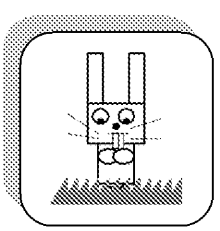
b)

Track	Artist
Full Metal Racket	Wah!
Are Friends Electric?	Gary Nubot
Life's a Circuit	The Clowns

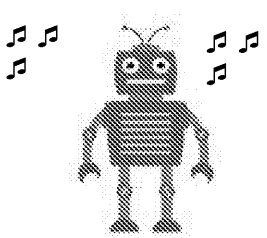
c)

	A	B	C	D
1		**Received**	**Spent**	**Remainder**
2	**Week 1**	7.00	5.00	=b2-c2
3	**Week 2**	5.00	3.00	=b3-c3
4	**Week 3**	7.00	2.00	=b4-c4
5	**Week 4**	6.00	5.00	=b5-c5

d)



e)



Enter your answers below:

a	
b	
c	
d	
e	

Activity 5.3 – The Ins and Outs of IT

Computers work on an input–process–output principle where data is in
microphone, mouse, etc.), the data is processed and instructions execu
output via a screen, printer or speaker.

Task A Putting IT In and getting IT out

The task below tests your knowledge of input devices.

1) Listen to a sound and then replicate it. Which part of your body is
output device?

Answer	

2) Riddle me this – look at the riddles below; what input/output devic

a) I'm shaped like a rodent but don't eat cheese

b) I have keys but can't open doors

c) I make a sound but can't hold a conversation

d) I provide hard copy and sometimes jam

3) Match the correct description to the relevant devices below and in
output devices:

- Digital pen
- Face recognition, DNA and fingerprinting
- Enable users to view each other during a call (using VoIP)
- Games controller
- Graphic printer which interprets commands from a computer
a pen
- Enables a user to listen to audio output while keeping their ha
- Enables a user to manipulate and view information without a k
or ATM)

Device	Description	
Joystick		
Plotter		
Stylus		
Biometric scanner		
Webcam		
Headset		
Touchscreen		

4) Some devices function as both input and output devices. Look at t
any? Can you think of any other examples that aren't on the list?

Activity 5.4 – Joining the Dot(com)s

A network is a group of connected digital devices, such as a home comp
mobile phone network or a landline phone network.

There are different types of network, such as:

- Local area network (LAN) for connecting devices within a site/b
  area network)
- Wide area network (WAN) for connecting devices between mul
  is a WAN)
- Personal area network (PAN) or wireless personal area network
  over short distances.

Task A Feeling WAN?

1) In the box below, draw what a typical LAN might look (keep it simp
represent the different components).

Include the following: switch, a server, clients and wired/wireless c

2) Give one advantage of using a LAN compared with standalone com

Answer	

3) Draw a diagram of a typical peer-to-peer network. (**Remember:** us
devices (peers) connect wirelessly with each other without the nee

4) Draw a diagram of what's needed to use the Internet at home. (**Re**
a modem/router and wired or wireless connection services are nee

Your diagram here:

5) Try to work out what I am from the descriptions below:
   - I provide different connectivity and speeds at differing prices
   - I can help with issues relating to online use and receiving unwa
   - I can provide you with an email address
   - I sometimes offer free web space
   - There is a monthly fee but this can be incorporated into your p

Answer	

6) Consider being given an address to your friend's house 12 Robotic … find and make a visit. Now consider being given a keyword that de… Robotic, and having to trawl though an address book for addresses… makes it harder to find and visit your friend. In the same way, havi… will take you to that page directly. If you don't have a specific web… need to use a search engine to find the web page through using ke…

   a) You have been asked to find your teacher's desk in your classr… directly.

      How many occurrences are there of 'desk' in the room (desks …

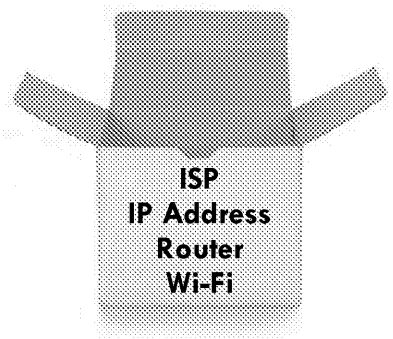
Answer	

7) How could you make it easier to find the desk using different keyw…

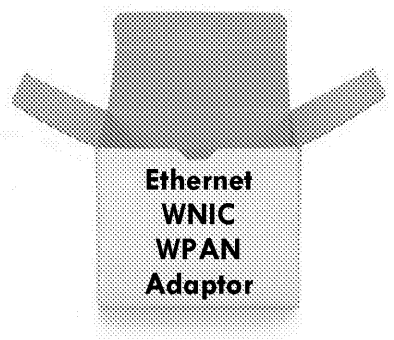
Task B Making Connections

Different types of connection enable communication across a network s
a wired or wireless connection. Network signals can be received throu
channels.

1) There are three boxes below containing services and devices to en
which box contains enough services to enable Internet access?

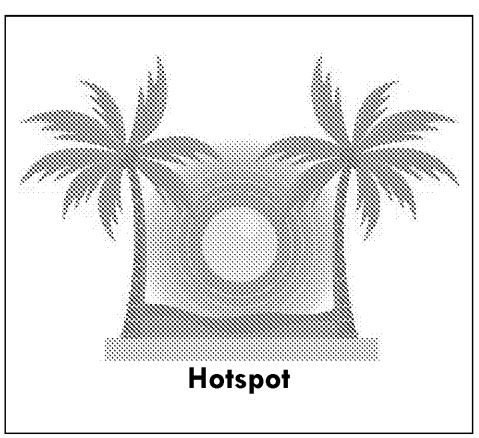


a) ☐

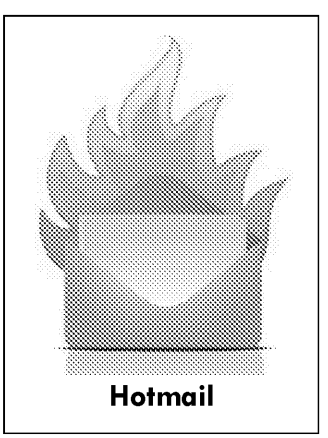


b) ☐

2) What is the term for an area providing Wi-Fi?



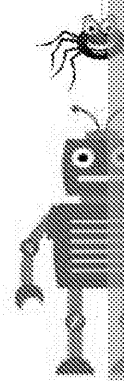
☐



☐

Task C Caught in the Web

The Internet is an interconnected network of computers containing web pages (World Wide Web) which can be accessed globally.



A secure site can be identified by **HTTPS** in the URL. Also look for a padlock symbol beside the address bar (or top right corner on Safari browsers).

1) Bod wants a new website address (URL) for his rabbotics business people to know he's in the UK and to see what his business is by th

Which of the following web addresses would be suitable?

http://www.rabbotics.ge ☐

http://www.rabbotics.co.uk ☐

http://www.bods_rabs.co.uk ☐

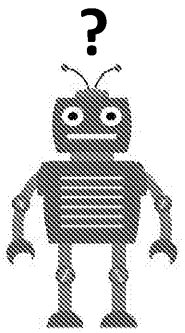
http://www.rabbotics.eu ☐

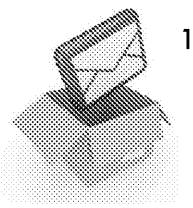
2) Bod wants to find information on the diets of rabbits. Typing 'rabb 100,000,000 hits. He doesn't need to know about carrots but woul reputable source, such as the RSPCA, on what other foods rabbits l

How might you enter the search criteria below?

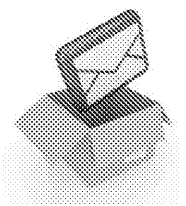
Task D Making a Packet

Packet switching is the transmission method by which emails and web
chunks of data (512 bytes each) over a network.



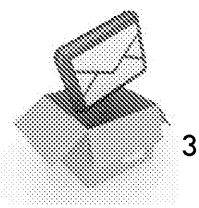


1. H



4. … on Saturday at 7pm?

You've got mail!



3. A
c

1) The packets below contain information from an email which has be
packets need to be passed around and then rearranged into one m

a) Allocate the task of passing them around to the ***router***.

12 Cheers Bod	7 £5 on the door or	4 on S
2 The disco	11 to seeing you there!	5 at 7
6 Tickets cost	3 will be held	9 in a
1 Hi	10 Look forward	8 £4 i

b) Packets can go through several routers before reaching their d
and pass on your piece of information to another person.

c) Now rearrange the bits of information into one message:

Bod's message:

2) Bod wants to know how packet switching works and has received t
Bod appears to have been sent a couple of incorrect packages alon
are incorrect?

a It breaks files into chunks so a large file can be sent in smaller pieces

b Packet switching is about mail going to the wrong address

d Emails use packet switching

e Each packet is numbered and reordered at its destination

g VOiP and IM use packet switching

h A packet can go through several routers beore reaching its destination

Tick the correct boxes below:

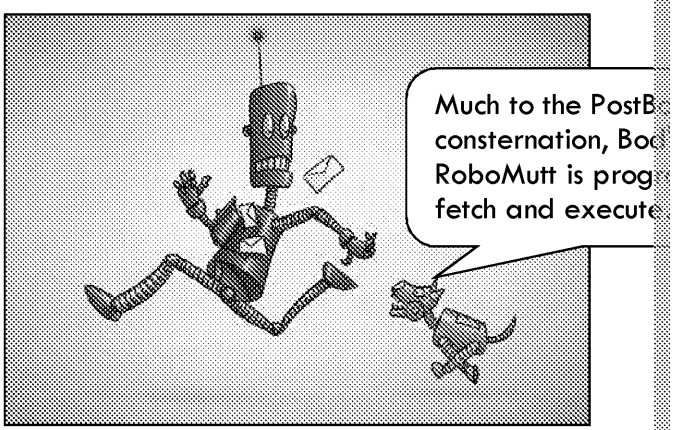
a	b	c	d	e	f	

Activity 5.5 – Cycle Paths

The clock cycle determines the speed of the processor. The clock spee
second with one cycle (per second) equivalent to 1 hertz. The fetch–ex
and processes them ready for output.

Task A Fetch and Execute

The fetch–execute cycle is controlled by the CPU, and starts as soon as
continues until it is closed down. The fetch–execute cycle is controlled
fetch and *execute* (carry out) an instruction with every tick of the clock



The CPU or microprocessor is the brains of a computer that carries out
carries out calculations. The speed of a processor is measured in gigah
'clock speed'.

1) You have 60 seconds to tell the person beside you your name, you
favourite school subject and your favourite hobbies – the clock is t

2) Organise yourselves in a line and pass the following instructions alo
is carried out it must be passed to the next in line) – how many bits
and executed in 60 seconds? (It could get noisy!)

a Stand on one leg

b Blow a raspberry

d Count to 5

e Count backwards from 5 to 1

g Clap your hands twice

h Say red lorry, yellow lorry really fast

For homework, learners can try this task by asking friends and fam

3) Older CPUs use a fetch–execute cycle in sequential formation, whi
fetched and executed at a time. The clock cycle is measured in cyc
get multiple items of data processed in seconds! Parallel processin
be sent in parallel pipelines so they get processed more quickly.

In groups, make four lines of five or more individuals and try the sa
will be processed more quickly because multiple tasks are being pr
of one by one.

4) The faster the clock speed, the faster a task can be processed. Try
clock speed, so the same exercise must be carried out in half the ti

5) Pick one person to carry out the following task (they have 30 secon

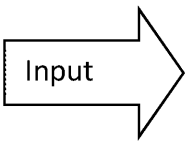
Rearrange the following cards in numerical order:

1	**4**	**6**	**2**	**7**
9	**12**	**15**	**10**	**14**
22	**19**	**17**	**21**	**18**
29	**25**	**23**	**27**	**24**

6) **Core values:** Multiple processing cores enable simultaneous proce
core processor will execute instructions faster than a dual-core pro
more power). Try the task above but use four times the manpowe
each person a row of numbers to sort.

7) Label the diagram below with the correct parts of the CPU.

a) This directs the operations of the CPU and controls the flow of data through the processor. It decodes instructions fetched from memory into commands.	b) This perform operations b loads data fr performs an stores the re
What am I?	**What am I?**



c) This is where the CPU holds the data programs that it is using

What am I?

8) Instructions have to be clear and in a language that the CPU un are input into the CPU, then the CPU will be unable to process i This is referred to as garbage in, garbage out (GIGO).

Classroom based activity: tutor supervision required.

Squares

Ask a learner to help demonstrate creating a square:

- Walk forwards 4 steps
- Turn right 90° and take 4 steps
- Turn left 90° and take 4 steps
- Turn right 90° and take 4 steps

This is not a square! The instructions have resulted in incorrect

Give the following instruction:

- Walk forwards 4 steps.
- Turn right 90° and take 4 steps
- Repeat step 2 (twice)

Task B Cache Value

Cache memory is memory utilised by the CPU to reduce the time ta In this task, you will test your knowledge of the cache memory store

1) Read the information below, memorise it and then put it aside following task.

- Step 1: Take a pen and write your name on a piece of pa
- Step 2: Perform the following calculations:
  - 2 multiplied by 8 equals?
  - 4 divided by 2 equals?
  - 6 * 6 equals?
- Now add up the totals of each of the calculations above
- Divide this by 2
- Write this number down
- Now multiply it by 5 and then divide the result by 3
- Write this number down

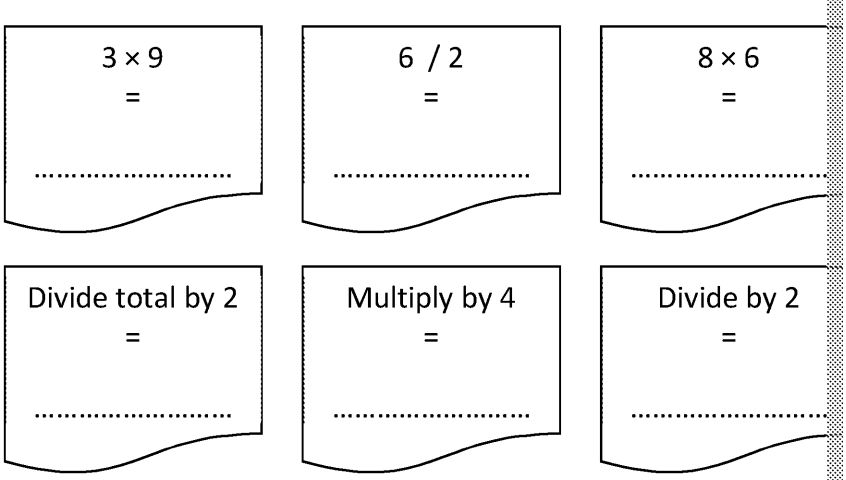
Because you have to access your main memory to perform the (in fact, almost impossible) to perform. Don't worry if you coul

2) Cache memory is a smaller and faster memory, storing frequently a
This means that it reduces time to complete a task.

Try a similar task, but this time access pieces of information and in
a cache.

- Step 1: Take a pen and write your name on a piece of paper
- Step 2: Perform the following calculations:
  - 3 multiplied by 9 equals?
  - 6 divided by 2 equals?
  - 8 * 6 equals?
- Now add up the totals of each of the calculations above
- Divide this by 2
- Write this number down
- Now multiply it by 4 and then divide the result by 2
- Write this number down

Cache Memory Bank



Topic 6 – Bits and Pieces

A by
repre
chara
this b
repre

Objectives

- ✓ Understand how instructions are stored
- ✓ Understand file sizes
- ✓ Understand ASCII and Unicode
- ✓ Understand binary digits

Activity 6.1 – Taking Instruction

Computers store and process instructions in the form of binary digits
denote file sizes; for instance, a photograph may be 2 megabytes and

1 bit	a single digit (**bi**nary digi**t**)
1 nibble	4 bits
1 byte	8 bits (makes up one character)
1 kilobyte	1,024 bytes
1 megabyte	1,024 kilobytes
1 gigabyte	1,024 megabytes
1 terabyte	1,024 gigabytes
1 petabyte	1,024 terabytes

Task A Size Wise

The file size refers to the physical dimensions, such as the height and
electronic files (e.g. kilobytes or megabytes).

In this task you will test your knowledge of file sizes.

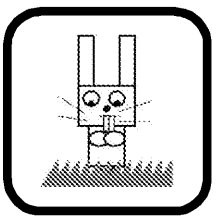
Scenario: Bod has collected lots of photographs of his friends and pets
stored on his flash drive. The storage capacity of his Flash drive is 1 g
MB. He wants to add a further three pictures.

1) What capacity remains on Bod's flash drive?

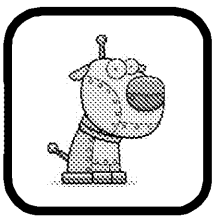
1 GB	–	**800 MB**	=	

Space for working out your answer

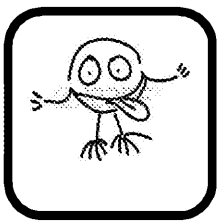
2) The pictures that Bod wants to add to his flash drive are below. Ho
they total?


500 KB

+


340 KB

+


160 KB

=

3) If Bod adds these to his flash drive, what will be the capacity of Bo

Existing capacity		Added files		New capacity
	−		=	

Space for working out your answer

4) Bod now wants to add a further five photos totalling 50 MB. How
left on his flash drive after adding these files?

	−		=	

Space for working out your answer

5) What size capacity will there be if Bod deletes 20 MB?

[ ] + [ ] = [ ]

Space for working out your answer

6) Will the capacity of his flash drive be exceeded if Bod adds a furthe
of 2 MB?

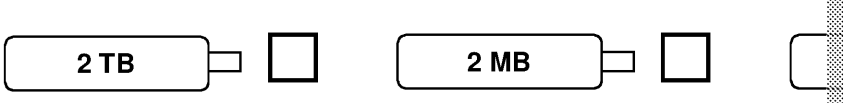
Yes ☐

No ☐

7) How many photos with a file size of 2 MB can Bod fit onto his flash

.....

8) Bod really wants to save more photos and videos to a new flash dr
MB. What is the minimum size memory stick he should opt for fro



Space for working out your answer

Task B Conversion Rate

Computers store and process data using binary code; e.g. the number 6
the letter 'b' is represented as 0110 0010 (*see Topic 4 Binary for more i*
are only two numbers used in binary – 1 and 0 (bi means 2). Binary is u
on and 0 is **off**. Binary numbers are made up of binary digits (bits). To
images or sound, a computer must first convert it to binary.

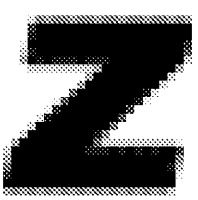
Bitmap images are made up of tiny squares or picture elements called p
made up of binary numbers. Each pixel can be represented by a colour
image is made up of coloured squares representing 1s and blank square
has two 0s, followed by four 1s and then a further two 0s.

0	0	1	1	1	1	0	0
0	0	0	0	0	1	0	0
0	0	0	0	1	0	0	0
0	0	0	1	0	0	0	0
0	0	1	0	0	0	0	0
0	0	1	1	1	1	0	0

00111100 00000100 00001000
00010000 00100000 0011110

This is how the image looks without the pixels magnified: **z**

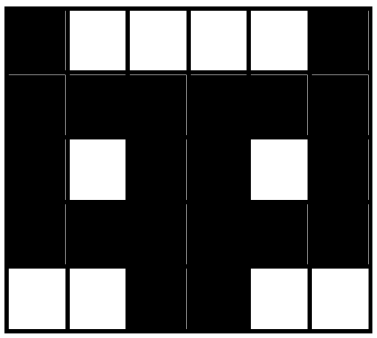
When an image is magnified, the pixels are enlarged which can make the



1) Using the following binary code, create an image below:

00000000 01100110 01100110 00000000 00111

2) Write down the binary code used to represent the image below (1



Answer	

Task C Colour Ways

The previous tasks used 1 bit per pixel to create a monochrome image.
(bpp) will provide four possible colours and are represented in the follo

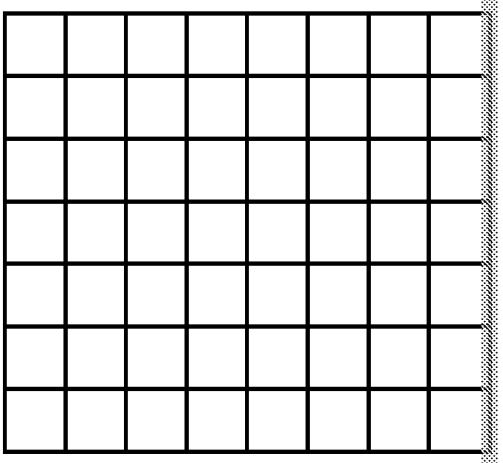
Colour 1 = 00 (e.g. white)
Colour 2 = 01 (e.g. blue)
Colour 3 = 10 (e.g. green)
Colour 4 = 11 (e.g. red)

Adding an extra binary digit doubles the colours. The colour depth is su
to store each pixel. 16 bits per pixel provides more colour than an 8-bi
mind that more colour equals larger file sizes. Images in grayscale are s
with a maximum of 256 colours, whereas a colour image can comprise o
Digital photographs use an RGB model, meaning there are three main c
primary colours red, green and blue.

1 bpp = 1 colour (monochrome)
2 bbp = 4 colours
4 bpp = 16 colours
8 bpp = 256 colours (e.g. grayscale)
16 bpp = over 65,000 colours
24 bpp = over 16,000,000 colours (this referred to as true colour)

1) Create an image below using 2 bits per pixel (max. four colours) in

11	**00**	01	10	10	01	00	**11**
00	**11**	01	10	10	01	11	00
01	01	**11**	**11**	**11**	**11**	01	01
11	**11**	**11**	01	01	**11**	**11**	**11**
01	01	**11**	**11**	**11**	**11**	01	01
00	**11**	01	10	10	01	**11**	00
11	**00**	01	10	10	01	00	**11**



2) Using 8 bits (a byte) per pixel, what is the maximum number of co

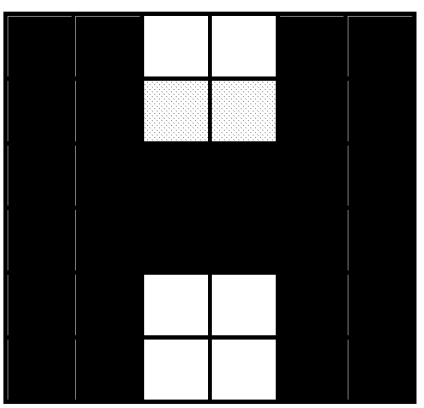
a	16		b	256		c	4

Task D Shady Characters…

The computer needs to know the metadata within an image, e.g. the n
the image. The metadata for the image above is 8 × 6 (8 pixels wide by
below is 6 × 6 (6 pixels wide by 6 pixels long).

6 rows
6 columns
1 bit per pixel

36 bits



An image using a 2-bit image format will use twice as much memory as

1) Assuming the size of the image is 36 bits, what file size would resu

Answer	

To find the size of an image a computer needs to know the numbe
bpp. Assuming that the image below is made up of 512 rows and 5
colours (grayscale), this can be calculated in the following way:

Rows × columns × bits per pixel

512 × 512 × 256 = 262 144 bits

To find the size of the image in megabytes, we will first convert it t
finally to megabytes.

2) Convert 262 144 into bytes:

262 144	*		=	

3) Convert the number in bytes to kilobytes:

	/		=	

4) Convert the number in kilobytes to megabytes:

	/		=	

Task E ASCII Silly Question!

ASCII is an 8-bit character encoding standard that enables binary values
Unicode is based on ASCII and uses the first 0–127 numbers to represe
the larger character set, Unicode needs more storage space than ASCII
recognised by all email or communication systems.

To convert the letter **Z** into binary so the computer can understand and
it is represented using ASCII code (there is a separate binary equivalent
characters):

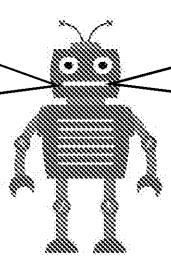
Z = 0101 1010

1) What is ZigZag Education in binary code?

Answer	

2) Decode the answer to Bod's bad joke, using the ASCII chart in the R

Q What's it called when a cabinet takes a photo of itself?



A 0101 0100 0110 000
1110 0110 0110 001
0111 0011 0110 100
0110 0110 1001 011

Answer	

3) The Extended ASCII character set contains how many characters? (1

a	128		b	256		c	127

4) Which of the following statements is true about ASCII?
   a) It is suitable for American English only
   b) It is suitable for all languages
   c) It is suitable for Cherokee and Arwi
   d) It is suitable for British English only

a		b		c		d	

5) Which of the following statements is true about Unicode?
   a) It is based on Cherokee, Mandarin and Arwi only
   b) It is based on ASCII but can be used to communicate globally
   c) It is not based on ASCII
   d) It is more limited than ASCII

a		b		c		d	

6) Which of the following statements is NOT true about Unicode?
   a) It is recognised by all email and communication services
   b) It enables computers to communicate globally
   c) It has a smaller character set and so needs less storage space
   d) A unique number is assigned to each character or symbol

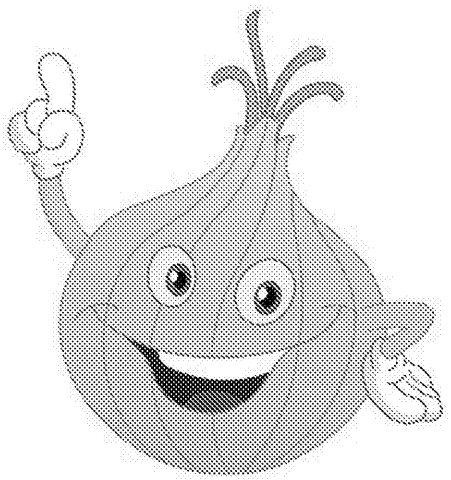
a		b		c		d	

Activity 6.2 – Things that go BMP!

Bitmaps are made up of coloured squares called pixels – picture eleme
are bitmap images. Information about each pixel is stored by the comp
higher file sizes. The resolution of an image refers to the number of pix
squares that make up the picture. Pixel density is measured in pixels p

Task A Make a Resolution

The examples below show two copies of the same picture; the first has
has reduced resolution, resulting in a 'pixellated' image.

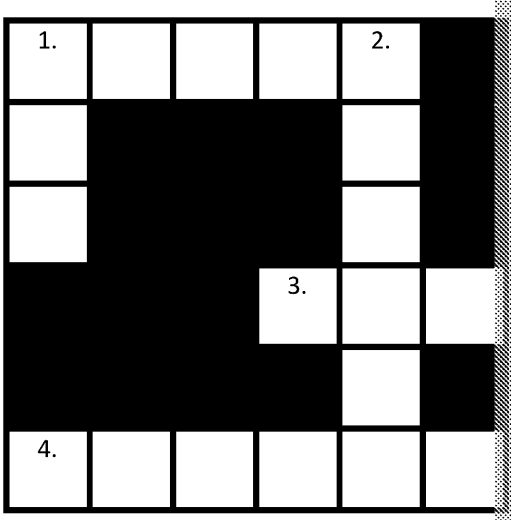


Pixelled Onion
The onion on the right has fewer pixels but a smaller file size. The image, when resized, is 'pixellated'.

Memory used: 512 kilobytes,
Resolution 72.00 ppi

M

1) Test your understanding of image resolution by completing the cro



Across

1. A name that refers to a picture element (5
3. Colour model used by monitors (1, 1, 1)
4. Bits are - - - - - - - digits (6)

Down

1. Pixel density is measured in this (1, 1, 1)
2. A higher pixel density makes files - - - - - -

2) The crossword on the previous page uses 6 pixels × 6 pixels of 1 bit used to recreate this crossword (black is 1).

Answer	

3) What would happen if the resolution of the following image was d the image was resized to height 8.5 cm and width 10.5 cm?

Current dimensions
- Resolution: 72.00 ppi
- Height 6.5 cm
- Width 7.5 cm

Answer	

Task B At a Loss

To make the file size of a photograph smaller, it is sometimes necessar However, by doing so, you may decrease the file quality. There are ma file extension) that will compress a picture by removing some of the da compression. *Lossless* compression is where a file size is decreased wit without loss of picture quality (resolution). Pixel density is referred to a

The images below have been compressed using lossy and lossless com

Original

Compressed file has lost pixels (lossy)

Of the two compressed files above, which file will have the largest
a) The file with lossy compression
b) The file with lossless compression

A		**b**	

2) The following digital photograph has been compressed using lossy common file format with a size of 1.94 MB.

What is the file format likely to be? Tick the correct box:

a		b		c	
	JPEG		BMP		RAW

Activity 6.3 – Speed of Sound!

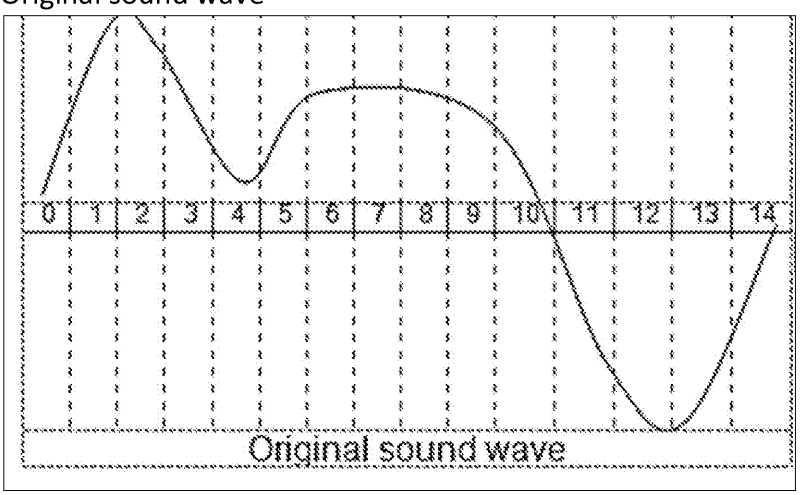
As part of the sampling process, sound waves are converted from an analogue signal into a digital signal.

Task A Making Waves

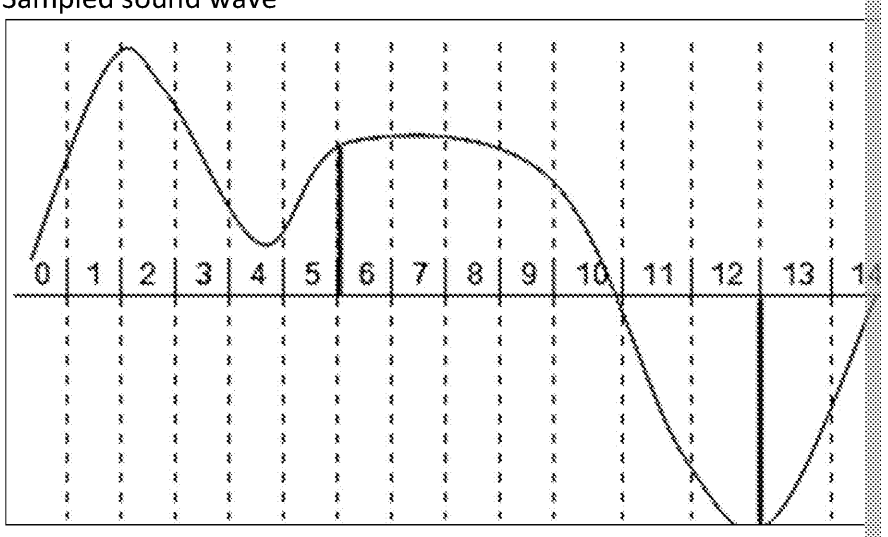
Analogue signals are continuous signals that a computer cannot process until they are converted into binary values. To ensure that the digital sound represents the original sound wave quality, the analogue sound wave must be sampled at multiple bits per second (called the sampling rate).

Look at the sound waves below – the first one is the original sound wav

Original sound wave



Sampled sound wave



1) Has the sampled sound wave had more samples taken per second

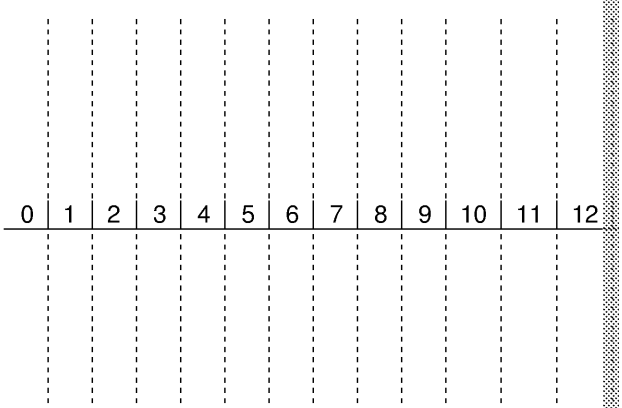
a	More

b	Less

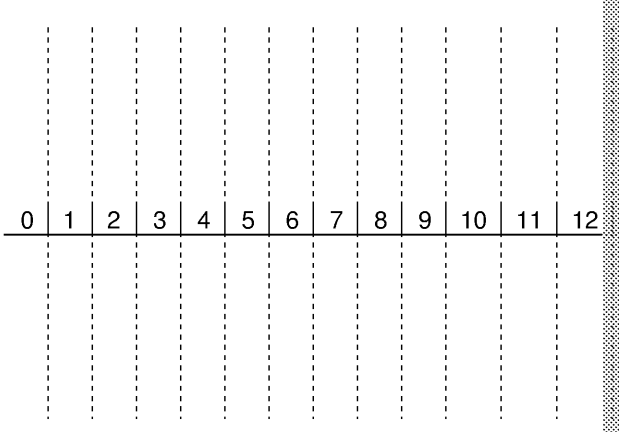
2) Explain below the effect that reduced sampling has on a sound wa

Answer	

3) Draw your own sound wave and then show how sampling rate has

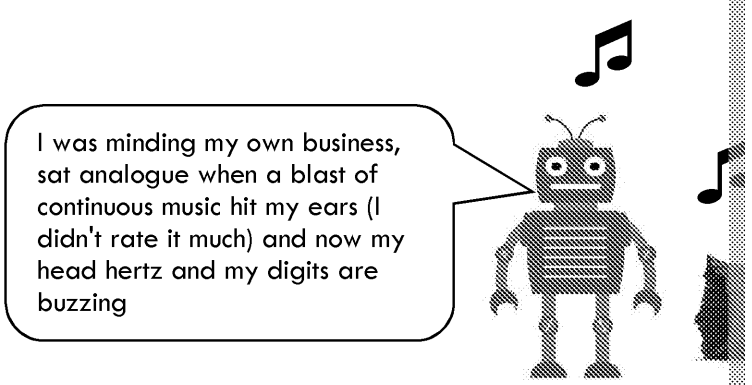


Your sound wave



Sound wave – sampling rate reduced

4) Pick out the relevant words that Bod uses below to describe sound



a) An _____ signal is picked up by a micro

b) A digital sound wave is discrete but an analogue sound wave is

c) The number of bits required for each second of sound is called

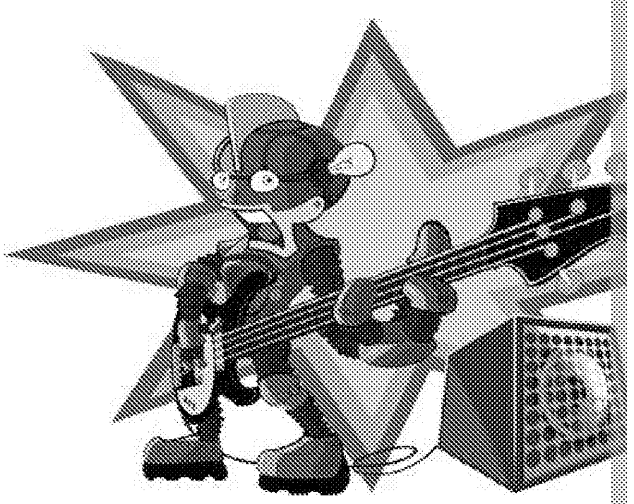
d) Sound waves are measured in a frequency called _____

e) A digital-to-analogue converter enables binary _____ as sound waves

Task B Small is Beautiful

MP3 and Windows Media Audio are audio file formats, both of which u
that the files are smaller in size and so quicker to transfer over the Inte
they can lose some sound quality compared to the larger WAV file form

Scenario: Bod wants to download a track **'Full Metal Racket'** from Botify
He will be listening to the music on his smartphone.



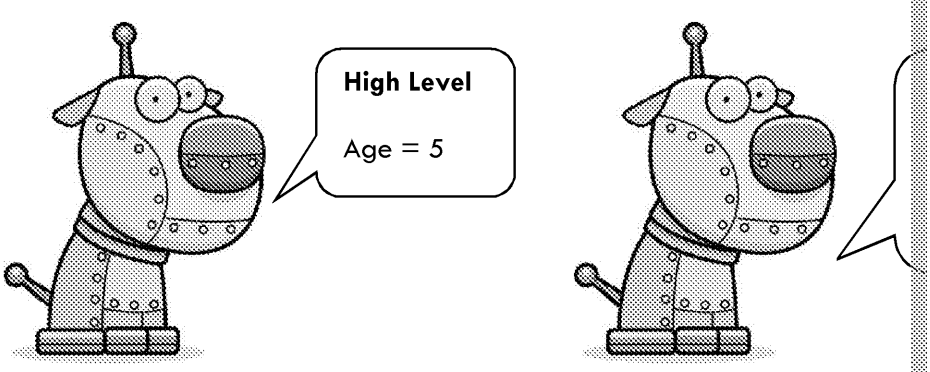
1) What is the best file format for Bod to use?

a	WAV	b	MP3	c	RAW	d	W

2) How many of the words below are relevant to your choice of soun

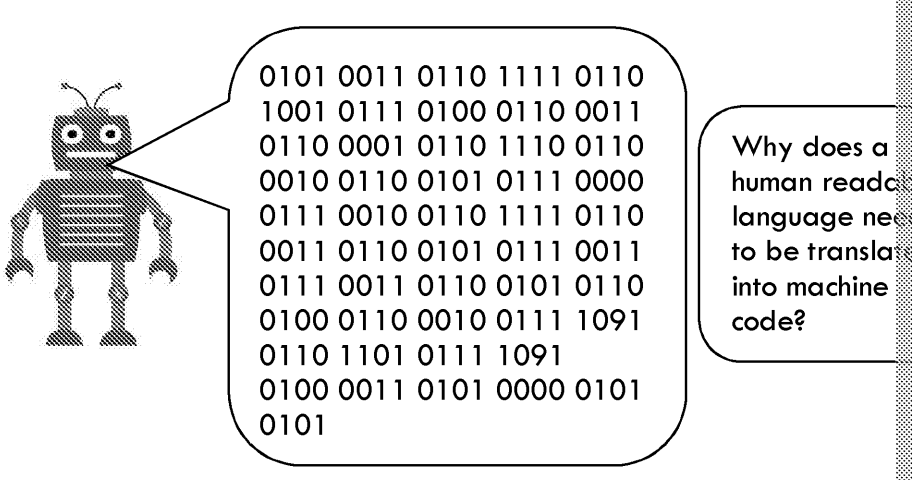
Activity 6.4 – Highs and Lows

Computers use binary code to process information and communicate w
hardware, such as your smartphone or tablet, and the 'brains' of the co
understand high-level language but must first be translated into machi
binary numbers. Assembly code is a low-level programming language w
the CPU. The translation process is usually written into software progr
interpreters and compilers.



Task A Open to Interpretation

1) Work out what Bod is saying to his human friend – Bod uses a low-
(binary code). Translate the binary by using the ASCII conversion t



Bod's answer decoded:

Answer	

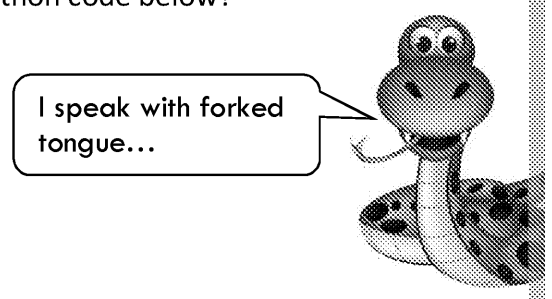
2) Circle the words below that are relevant to the translation process.

Converters	Assemblers
Interpreters	Assigners

3) Label the translation procedure below against the correct descript

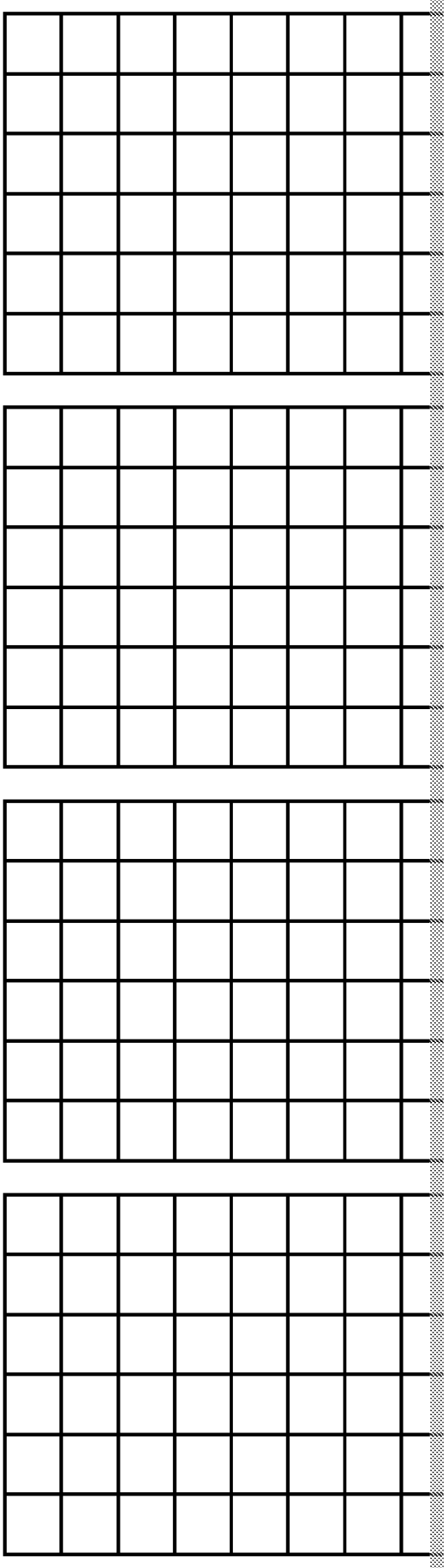
Your answer	Desc
	This translates instructions se and useful for scripting dynan
	This translates the entire pro making it more difficult to de
	This translates low-level lang code, so it can be processed

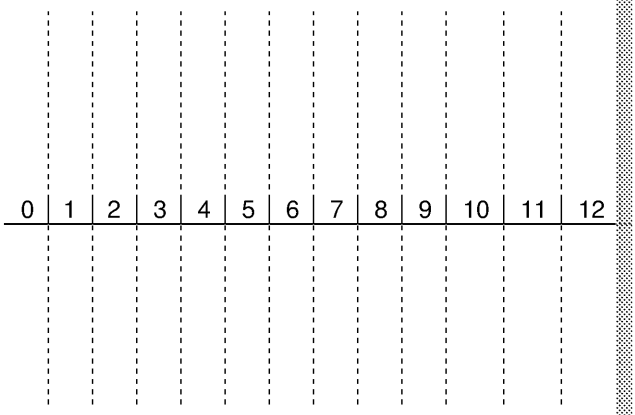
4) Bod wants to use a high-level language, such as Python, to commu the correct example of Python code below?

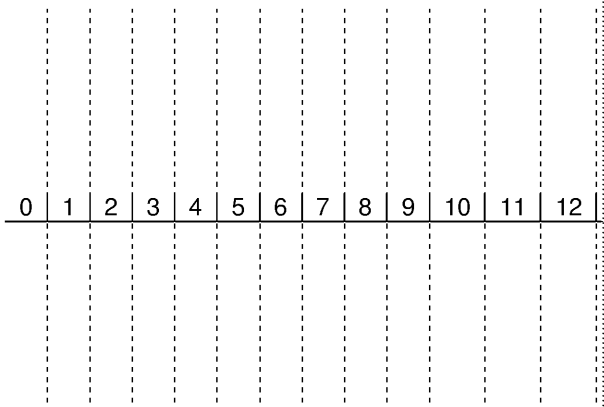


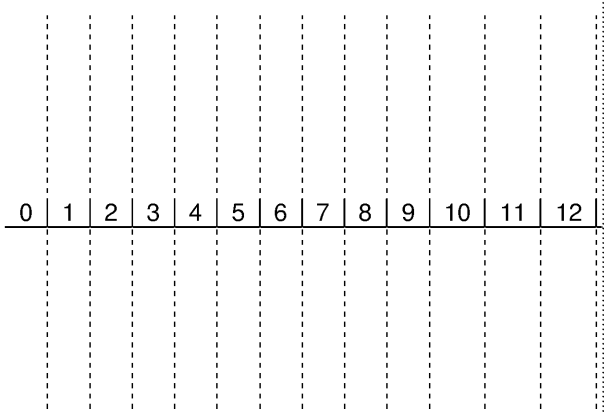
a)	✓	b)	✓
0011 1010, 0010 1010		**Print("Hi")**	

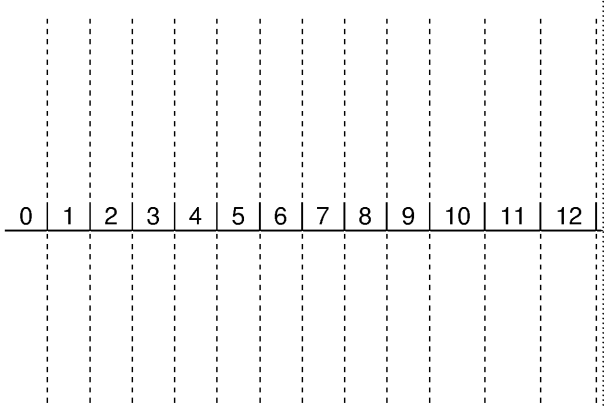
Blank Grids











Topic 7 – Safe as Houses?

Objectives

- ✓ Understand the implications of online safety
- ✓ Understand what a digital footprint is
- ✓ Identify threats to online security
- ✓ Understand legal issues associated with online use

OPEN HOUSE
I will be away for a few weeks. Please feel free to enter and walk around.

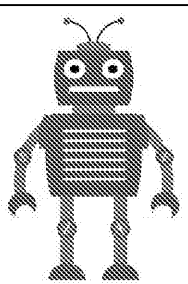
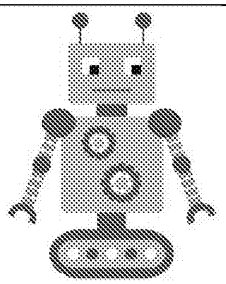
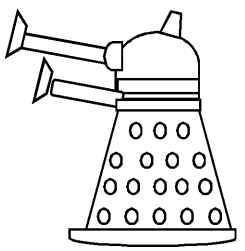
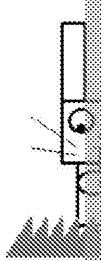
Consider this scenario:
Bod is going on holiday and tells all his friends on Facebot the dates he unlocked and all his windows open. Bod has no idea about security.

Activity 7.1 – Safety Barriers

The advent of social media has created a new set of safety issues, such personal data. In the following activities you will test your knowledge o Social media sites enable users to report abuse or offensive material.

Task A – Friend or Foe?

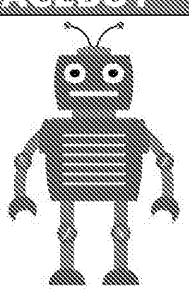
Bod has made many friends on Facebot. Some 'friends' are complete s friends and only a few are real friends that Bod knows personally.

Bod	Bodette	???	Ra
			

Bod needs to manage his Facebot page safely and securely.

Below is Bod's Facebot public profile:

FACEBOT



Click here to see photos of my friends

Personal Profile

Name: Bod

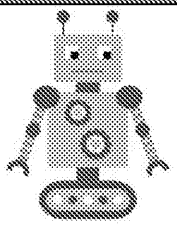
Likes: Inventing, embr baking and mak friends

Age: 12

Address: 0100 Robotic Av Bot-on-the-Wold Botsworth

Below are three Facebot profiles of Bod's best friend Bodette, his Rabb

FACEBOT

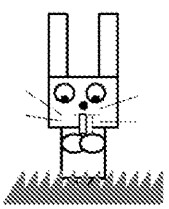


Personal Profile

Name: Bodette

Likes: Algorithms and b

FACEBOT

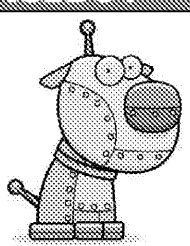


Personal Profile

Name: Rabbot

Likes: Eating grass, be

FACEBOT



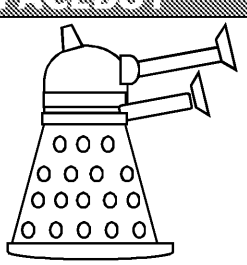
Personal Profile

Name: RoboMutt

Likes: Chasing postmen/postwo being cuddled by

Bod has also received an invitation to connect with Fluffy (below). Bod but Fluffy assures him that he is a friend of a friend.

FACEBOT



Personal Profile

Name: Fluffy

Likes: Anything that Bo

Age: 12

1) Should Bod be wary of Fluffy's request? Give your reasons.

Answer	

2) Bod has a public profile. Briefly give reasons below why this isn't a

Answer	

3) Take a look at Bod's profile. Which information shouldn't he be dis
profile)? **You can tick more than one box**:

a) His age ☐

b) His likes ☐

c) A link to friends' photos ☐

d) His address ☐

4) Bod provides photos and personal details of his friends on his Face
this isn't a good idea.

Answer	

5) Bodette has tagged a photo of herself and Bod on her Facebot site.
tagging photos?

a	A tagged photo only goes into the owner's photo album so
b	A tagged photo cannot be displayed on social media sites
c	A tagged photo automatically goes into the photo album of Bodette should be wary of Bod's level of security
d	A tagged photo is shared across all social media sites

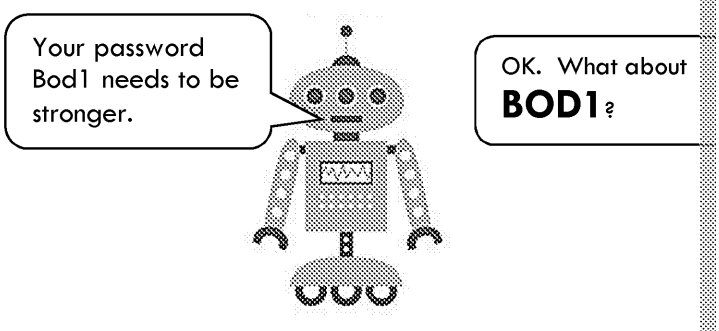
6) Bod uses Facebot Places tagging services, a GPS device that makes
Provide one advantage and one disadvantage of using this feature.

Advantage: .....

Disadvantage: .....

Task B Safety PINS

In order to gain access to some online services, such as e-shopping, ban
necessary to use passwords to enter the site.



Scenario: Bod has used the same password **bod1** for several accounts o
to remember.

1) Is **bod1** a weak or a strong password?

   a) Weak ☐

   b) Strong ☐

2) Passwords should contain at least eight characters and consist of a
case letters, numbers and symbols. A password should not contain
information which can be easily 'cracked'. Which of the following is
password matching all of the criteria?

	Password	✓
a	!B02?*1*	
b	Bod12345	
c	12345678	
d	MyNameIsBod1	
e	*bod&45!	

3) What advice could you provide to Bod about passwords and keepi

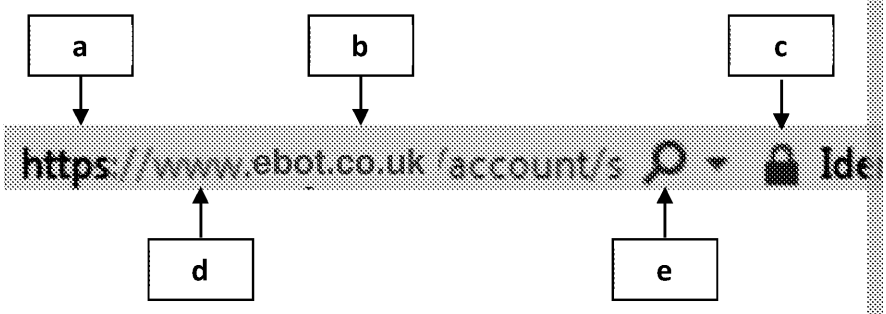
Answer	

Task C Safety Net

There are many ecommerce sites which enable users to purchase goods online. It is important to only access secure websites with URLs that begin with **https** and display a padlock symbol.

Scenario: Bod wants to buy his favourite 1980s track '**Are Friends Elec** called **ebot.**

1) Look at the web address (URL) in the image below. Which two thin website?



	Web Address	✓
a	The Hypertext Transfer Protocol	
b	The domain	
c	The padlock	
d	www.	
e	Magnifying glass	
f	Refresh button	

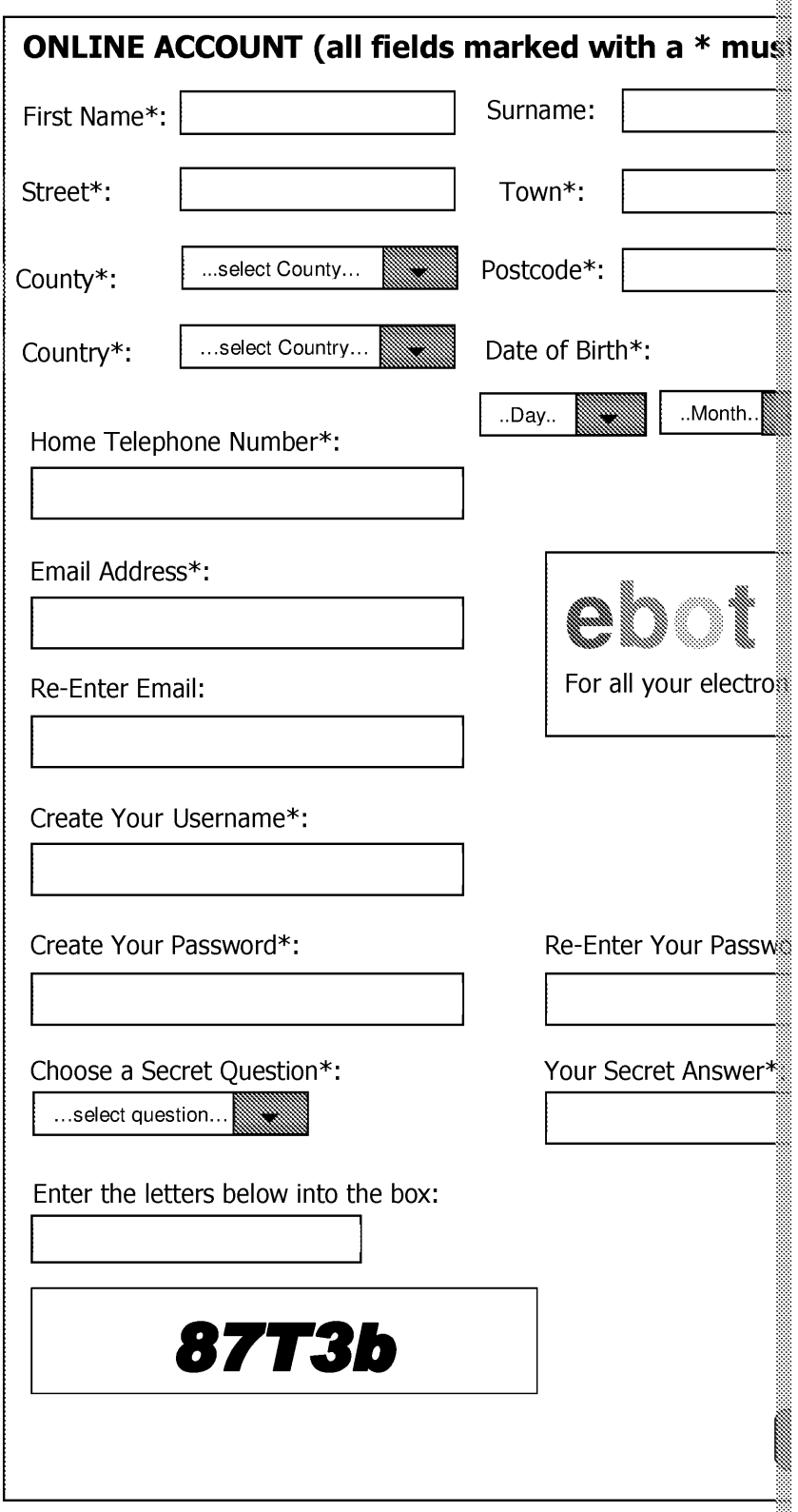
2) When Bod enters his password to log in to the site, how should it a

a) !B02?*1* ☐

b) ******** ☐

c) ☐

Look at the online form below:



3) What does the asterisk * represent in an online field?

a) A required field ☐

b) Verification ☐

c) Validation ☐

4) Why is Bod asked to enter his email address bod@botyahoo.co.uk

Answer	

5) Which part of the form is a CAPTCHA?

	Part of form
a)	**87T3b**
b)	Secret question …select question…
c)	Re-enter your password*:

6) What is the purpose of a CAPTCHA?

.....

.....

Task D Being Cryptic

Encryption and decryption are used to make files secure in transit. Enc
indecipherable until it is decrypted using a key at its destination.

1) Why is encryption used?

	Encryption
a	To make file sizes smaller to enable Internet transfer
b	To make text readable, so the recipient can read it
c	To make text illegible while in transit, so unauthorised users c read it.
d	To break files into small chunks called packets and rearrange

2) This word means 'to convert encrypted data into plain readable te

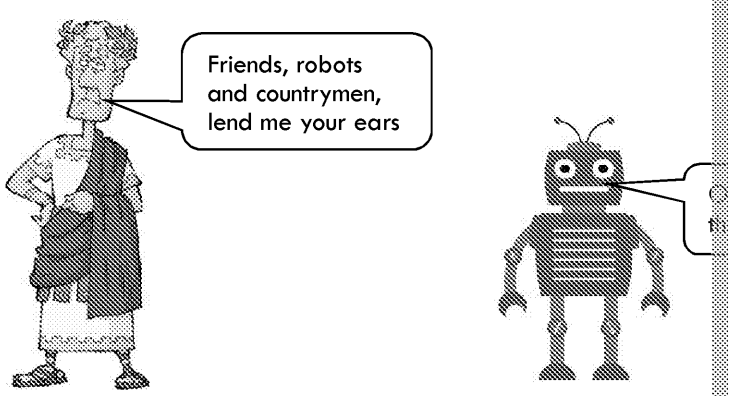
a) Decoder ☐ b) Decipher ☐ c) De

3) The destination computer must have what to decrypt data?

a) Decoding key ☐ b) Decipher key ☐ c) De

Task E Roman Knows

Julius Caesar used a simple encryption method to communicate with h
shifting letters of the alphabet a specified number of times. So, if we s
to the left, A becomes B and B becomes C, etc. If we shifted the alphab
C and B becomes D, etc.



Example:

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r
B	**C**	**D**	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**	**S**

The top row contains the plain text. The bottom row contains the ciph
messages using this method is that plain text has shifted one character
'a' become the letter 'b'. A message is shown below using the key abov

IFMMP = **hello**

1) Try the activity using the key below (plain text is lower-case and ci
decrypt the answer to Bod's (very bad) joke:

Question: Which fish swims very fast?

KEY 3

a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q
D	**E**	**F**	**G**	**H**	**I**	**J**	**K**	**L**	**M**	**N**	**O**	**P**	**Q**	**R**	**S**	**T**

Decrypt answer:

D		**W**	**X**	**U**	**E**	**R**	**W**		**F**	**K**	**D**	**R**	**J**

Answer	

Task F Hacked Off

Cracking is when you don't know the key and try to 'crack' a cipher. Hac
other users' online accounts by 'cracking' their passwords.

Scenario: A hacker has managed to crack Bod's password and infiltrated
hacker has cleaned out Bod's PayBot account of its funds (2 pence) and p
him cuddling his teddy bear on his Facebot page. Bod is understandabl

1) What immediate action could Bod take to make his accounts secur

Answer	

Task G Safety Triangle – Dangers

There are many dangers inherent in online activity, such as grooming, s

Scenario – A brush with danger
Bod has been contacted by Fluffy on his FaceBot page. Fluffy has used
flattery to gain Bod's trust and friendship. Fluffy pretends to like the sar
meet him.

1) What name is given for this type of behaviour?

a) Brushing ☐ b) Grooming ☐ c) Preparing

2) Should Bod meet up with Fluffy? Give your reasons.

Answer	

Scenario – The sum of his parts?
Fluffy has managed to befriend Bod, against his friends' advice an
send a compromising photograph of himself as a dare. Bod wants
anything wrong with supplying a friend with a photo of himself eve
to see it. Bod takes a photo of his internal circuits and sends it to F

This photo has been posted online and gone viral. Bod starts recei

3) What should Bod do?

Answer	

4) What is the term for someone who leaves malicious or hateful mes

a) Ogre ☐ b) Troll ☐ c) Gnome ☐

Scenario – Game's up
Gaming can be fun and Bod loves playing *Robot Invaders* on his Xb
there are dangers inherent in online gaming.

5) What could Bod do to help keep his identity secret?

Answer	

6) Tick the dangers that may exist in gaming.

a	Addiction
b	Enjoyment
c	Bad language
d	Communicating with others
e	Age-inappropriate material
f	Exciting and innovative content
g	Grooming
h	Making new friends

Activity 7.2 – Piracy on the High ©s

Piracy refers to illegally downloading and sharing digital content without a licence or the owner's permission.

Task A Software Piracy

In this task you will test your knowledge of software piracy.

Scenario: Bod wants to download some software from a website he ha

1) What dangers are there in downloading software from unknown si

a	Downloading a legal copy of the software
b	Downloading malware such as a Trojan or zombie
c	Downloading an installation manager
d	Downloading critical updates

2) What should Bod check for before downloading the software?

Answer	

Task B i-Patches

In this task you will test your knowledge of downloading software upda

Scenario: Bod regularly downloads important security updates for his op

1) Where can Bod go to find updates (patches) for his operating syste

   a) On the software manufacturer's website

   b) By clicking on a pop-up message on his screen

   c) On an unknown website that offers updates for all operating s

   d) From an online store selling computer accessories and softwar

Task C Fair Shares?

In this task you will test your knowledge of sharing files over the Intern

Scenario: Bod wants to download some music from Botify and share it w

1) Can Bod do this? Click the correct statement below:

a	Music downloads are not subject to licensing and copyright online content without permission.
b	Music downloads are subject to licensing and copyright law prevent Bod from sharing online content.
c	Music downloads are subject to licensing and copyright law online content if this is explicitly allowed.
d	Music downloads are subject to licensing and copyright law content but only with other licensed users.

Task D Copy Right (or Wrong)?

In this task you will test your knowledge of copyright.

Scenario: Bod has found a website with some text and photos that he wo own website.

1) What is the name for the act that protects owners' rights?

a) Data Protection Act ☐ b) Copyright Act ☐ c

2) What should Bod do before copying any content from the website?

Answer	

Activity 7.3 – How to Make your Cookie

There are many ways that we can create digital footprints when we acc
are downloaded from some websites to enable personalised content.
targeted marketing. Spyware is a malicious program that secretly mon
include tracking cookies, adware and Trojans. Keylogging software can
computer and used to track and monitor keystrokes and online activity

Task A That Takes the Biscuit

In this task you will test your knowledge of cookies.

1) Which statement below best describes a cookie?

a	A small text file that is downloaded onto a user's RAM when
b	A small text file that is downloaded onto a user's hard drive w
c	A small image file that is downloaded onto a user's hard drive
d	A small program file that is downloaded onto a user's hard dr website

2) How can cookies be useful? Indicate the positive and negative asp or a cross.

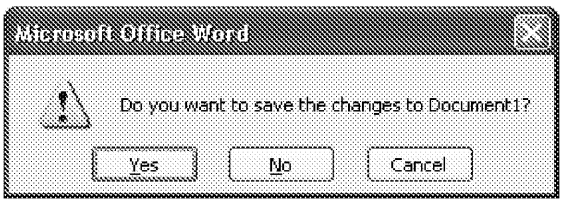
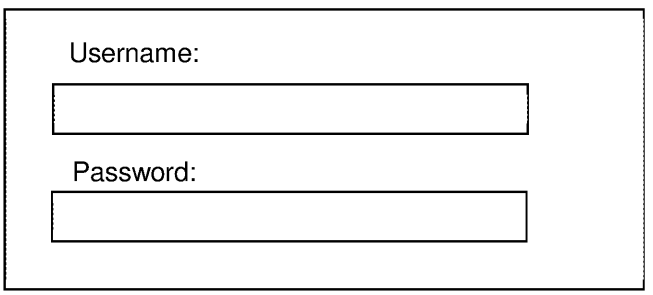
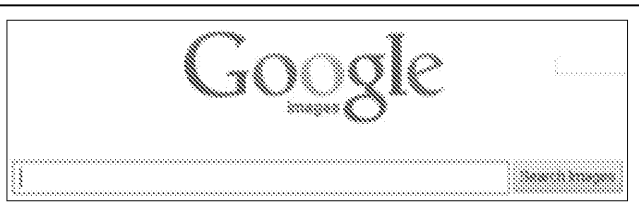
	Positive or Negative?
a	Cookies allow a website to personalise your details, such as g 'Welcome Back Bod'
b	Cookies can be used to track a user's online activities
c	Cookies make it easier for the customer to create and save sh
d	Cookies can be used for targeted marketing and your details to a third party without your permission
e	Cookies are also used to remember a customer's preferences they have previously viewed or purchased

Task B Ad Finitum

Adware is software that is downloaded onto a user's computer, someti
can be used to monitor online activity such as shopping preferences fo
marketing (Google tracks your online browsing habits to target adverti

Scenario: Bod keeps getting adverts popping up when he visits certain
annoyed that it's messing with his circuits.

1) Which of the images below represents a pop-up?

a	
b	
c	
d	

2) What can Bod do to prevent adverts from popping up on his screen

Answer	

Task C Horrible Histories

Our digital footprint varies subject to our online activities, e.g. use of so
online, involvement in forums, blogs and interaction on external websi
history can help to protect your personal and private data that is stored

1) How could Bod's digital footprint be detrimental to his future emp

Answer	

2) Explain how Bod can help keep his online reputation intact.

Answer	

3) How can Bod ensure that unauthorised intruders to his computer c
habits?

a	Only access reputable websites with secure HTTP protocols
b	Clear all website links in the Favourites centre
c	Clear his browser's history to help protect his personal and s stored each time he visits a website
d	By regularly scanning his computer for viruses

4) How can Bod prevent spyware and remove it from his computer?

a) Install firewall and anti-spyware software

b) Install a router and anti-spyware software

c) Install application software and a modem

d) Install system software and defragment his drives regularly

Task D Phishing Net

Phishing means impersonating another person with fraudulent intentio
by sending an email to a user falsely claiming to be an established, legit
such as a bank to scam the user into giving private information that wil

The email directs the user to a website where they are asked for perso
password, credit card details and bank account numbers. The email me
click a link that will take them to a website which is also false and is use

Scenario: Bod has received an email from the Facebot administrator ask
message that will take him to a page where he can confirm his login dete

1) What action should Bod take?

Answer	

2) Which of the following emails does not indicate a threat?

a)

From: accounts@YourBank.com

Subject: Danger!

Your online bank account has been hacked and you need to reset your password. Click the link below to reset your password **ASAP!**

http://YourBank.com

b)

From: accounts@Y

Subject: Your state

This is a courtesy n
YourBank to let yo
online statement i
view.
Please log on to ou
your secure userna
password.

Please do not repl

c)

From: accounts@YourBank.com

Subject: Attachment!

Attached: YourStatement.exe

Your statement is available to view. Click the attached file to open and save it to your hard drive.

d)

From: accounts@Y

Subject: Login det

Your login details n
changed. Please cl
to enter new login

http://www.Yoret

Tick the correct box below:

	✓
a)	
b)	
c)	
d)	

Task E How Not to Eat Spam

Spam is the name given to unsolicited mail.

Scenario: Bod has received several emails that are starting to block up h

1) What can Bod do to prevent spam mail?

Answer	

Activity 7.4 – Zombie Attack!

Viruses, Trojans and zombies are referred to as malware (malicious soft
downloaded unwittingly when installing pirated software, downloading
and swapping infected files.

Task A Guard Against Infections

Help Bod guard his system against infections.

1) Provide a description or term where indicated in the table below:

a)	What is a zombie?	
b)		Malware disguised as a reputable p
c)	What is a worm?	

2) What could Bod do to prevent malware?
   a) Use a firewall and scan his system regularly with antivirus soft
   b) Make sure he uses the correct shut-down procedure
   c) Only download free-to-share software
   d) Use a firewall and never go online

3) What are updates and why are they important?

Answer	

4) What is the correct definition of a firewall?
   a) A means of accessing the Internet
   b) It prevents unauthorised access to your computer (e.g. by a ha
   c) Utility software that scans a computer for threats
   d) A secure website that requires a username and password

5) Why should Bod be careful about opening files attached to an ema

Answer	

Activity 7.5 – Keeping IT Legal

There are various acts that protect personal information stored on a co
acts that protect computer systems from unauthorised access and dam

Task A Caught in the Act…

In this task you will test your knowledge of acts that affect computer us

Scenario: Bod has found out that an online store is keeping personal inf
database and selling it to third-party companies who are using it for ta
concerned that his computer has been infiltrated with intent to cause da
have been distributed online.

1)

a)	What is the name for the act that protects a computer from unauthorised access and malicious damage?	*Enter the te*

b)	What is the name for the act that allows Bod to request personal data held by a third party?	*Enter the te*

c)	It is illegal to distribute or be in possession of an indecent image of a person under what age?	*Tick the corr* 16 ☐

Activity 7.6 – Trust Issues

It is easy to find information on a variety of subjects online, some of it f
opinions, prejudice or bias of the writer.

Task A Fact or Fiction?

Bod uses a wiki to find information on robotics. This is what he finds:

WIKI

Robotics

First, let me start by saying that I think robots are great! Robotics bega
way of mechanising industry and agriculture. Unfortunately, some farm
of a fuss (like all rural folk, they were averse to technology and labour-
were soon sorted out by the authorities and robotics continued to flouris

There are inaccuracies, bias and prejudice within the above article. Use
work out whether the information is reliable and credible.

1) What do the following statements represent or indicate?

	Statement	
a)	First, let me start by saying that I think robots are great!	
b)	'like all rural folk, they were averse to technology and labour-saving devices'	
c)	Robotics began in 1811 in rural England as a way of mechanising industry and agriculture.	

2) What should Bod do next to verify the information on the page?

Answer	

Topic 1 – Fact Sheets

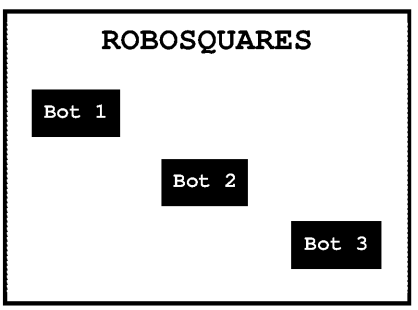
Computers do not employ computational thinking. Computers do not t
humans to process data and perform actions.

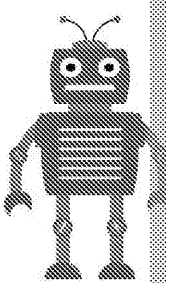
Humans use computational thinking to allow them to deal with comple
down into a sequence and language that a computer will be able to pro
language (called syntax) is not used, then the computer will be unable t
procedure that a computer uses is input–process–output. Incorrect or i
in errors and incorrect output. This is referred to as garbage in, garbage

Abstraction helps to manage complex problems by breaking them dow
(decomposing), using models of real-world scenarios (maps, storyboard
pattern recognition, and seeing similarities, differences and shared con

In order to drive a car, we do not need to know how the engine works.
smartphone we don't need to know the complex code used to write th
know how to write HTML to navigate a website.

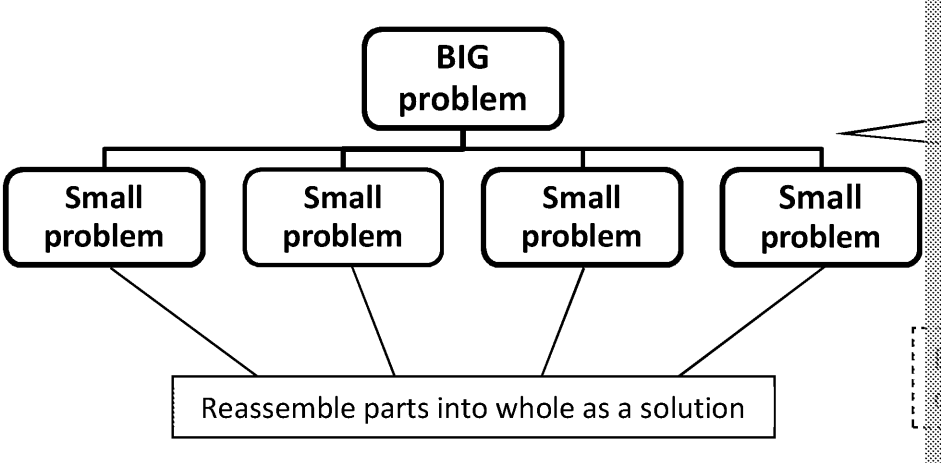
Representation can simplify processes. Within a computer game, a robo





Generalisation enables us to refine problems and make it easier to find
has been broken down into chunks or smaller problems (referred to as
techniques), a solution can be found and the chunks reassembled into a
(sequence). The problem can then be represented in the form of a diag
represents code (pseudocode). The code can then be tested (debugged
further. Before the representative pseudocode or diagram is converted
it can be made easier to search and sort. The language (syntax) must b

So, abstraction is about decomposing, solving smaller problems and then
recognising shared features and patterns, creating a model to represent
the steps are in a logical order (sequence), using selection to make decis



Bod needs to take a shower but cannot see the individual steps that ne
this action. His positronic net has been overloaded with unnecessary d
showering process.

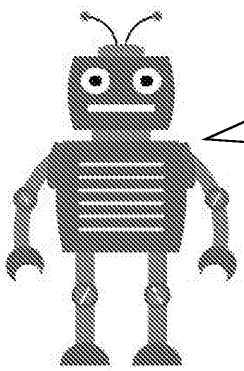
To help Bod, abstraction techniques should be used to filter out unnece

- X Type of shower (over bath or cubicle)
- X Size of bathroom
- X Power supply (gas or electricity)
- X Water supply (on a meter)
- X Type of soap (perfumed, fragrance free)
- X Towel size

To creat
filter ou

Bod needs to decompose the problem into smaller parts and understan
in taking a shower.

Bod hasn't quite got the hang of it yet…



- Towel dry
- Rub soap over body
- Turn off shower
- Step into shower cubicle
- Remove clothes
- Step out of shower cubicle
- Rinse off soap
- Turn on shower

The big problem of taking a shower can be **decomposed** using a step-b
correct **sequence**:

- ✓ Remove clothes
- ✓ Step into shower cubicle
- ✓ Turn on shower
- ✓ Rub soap over body
- ✓ Rinse off soap
- ✓ Turn off shower
- ✓ Step out of shower cubicle
- ✓ Towel dry

Alternative solutions could include turning on the shower *before* stepp
could also towel himself dry before stepping out of the shower cubicle.

If at a later date Bod decides to take a bath instead of a shower, he can
methods and recognise patterns such as the need to remove clothes fir
then towel dry.

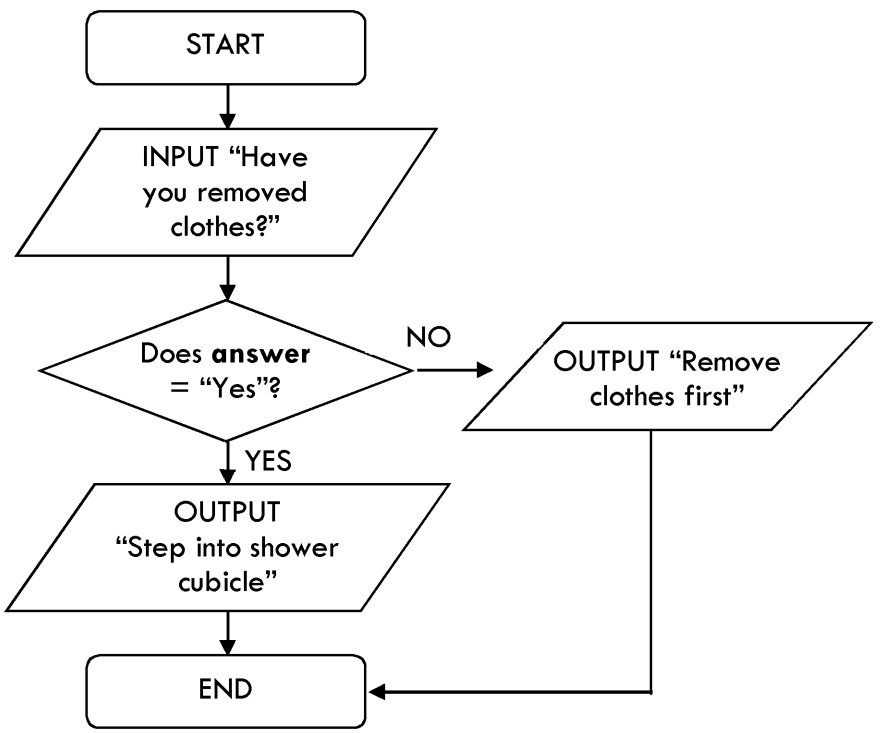
Using an algorithm, Bod can now create a model representing the prob
algorithm could use a diagrammatic approach in the form of a flow cha
(pseudocode) to represent programming language.

A simple model using **pseudocode** and **selection** may look like this:

```
OUTPUT "Have you removed clothes?"
INPUT user enters answer
STORE answer in answer variable
IF answer = "Yes" THEN
   OUTPUT "Step into shower cubicle"
ELSE "Remove clothes first"
```

Se
ELS

A **flow chart** may look like this:



Of course, the question that Bod should have asked was: can robots tak

After his experience, Bod has written an algorithm for a sub-program to help other robots avoid the same mistake.

```
OUTPUT "Are you a robot?"
INPUT user enters answer
STORE answer in answer variable
IF answer = "Yes" THEN
   OUTPUT "Circuits and water do not mix!"
ELSE "Please continue showering"
```

Sorting and Searching

A bubble sort uses a simple algorithm that compares data and changes
sort, however, takes longer to perform because it takes several passes

A bucket sort is quicker to perform than a bubble sort and separates da
into small buckets where smaller sets of data can then be compared (e
groups of four).

In a program containing thousands of pieces of data, it is difficult to fin
specific piece of data without the correct search algorithm. Sorting dat
first makes the searching task easier to perform. Imagine sifting throug
phone book that is not in any particular order – a time-consuming task
With a search algorithm you can search for and find data more easily a
quickly. For example, you may want to find a film in a list of film titles
specific tennis match in a list of tournaments. There are two types of se
technique – linear or serial searches, and binary searches.

A serial search is the easiest algorithm to write, and searches by keywo
until a match is found or it reaches the end without finding any matche
not require the data to be sorted first. Serial searches are slower becau
unsorted data individually, which could be very time-consuming if you
100 million names! A binary search is faster and uses a process of divic
a match is found. This method works best on data that has been sorte

Example: Bod wants to find the film title **RoboCod** in a list of unsorted
numbered. An algorithm written in pseudocode might look like the one
symbol is comments to describe the instruction). *There is more inform
WHILE, IF and ELSE statements in the Boolean Logic and the Programm*

1. Set up the criteria (find film title number 10)
2. Examine the first item in the search (start at item 1)
3. If search item is found, then end the loop with result 'Match found'
4. Otherwise, if item not found, examine the next data item (repeat)
5. If search is complete and search item is not found, return 'Match not

```
OUTPUT "Which film do you want to find?"
INPUT user inputs film number
STORE user input in the film_number variable
counter = 1          #a counter to count each recc
more_films = True  #this is to indicate whether
remaining
WHILE more_films = True:
   IF counter = film_number THEN
      OUTPUT "Match found"
      Exit the loop
ELSE
   add 1 to counter #examine next item
ELIF more_films = false THEN
      OUTPUT "Match not found"
```

Topic 2 – Fact Sheets

Textual v Visual Languages

There are textual languages and visual languages. Both types of langua
expressed differently; textual programming, including common textual
and Visual Basic.NET (and even spreadsheets to some extent), uses tex
expressions, while visual languages such as Scratch or Kodu display in a
elements and so can help to make the program easier to visualise, but
textual programming languages.

Differences may occur between textual languages in the way that Bool
within the text-editing environment itself. For example, within Python
the prompts >>> and the comparison operators **not equal to** and **equal**
other text languages.

Expressions and Values

```
>>> 1 + 2
3
```

In the above example, the numbers 1 and 2 are ***values***. The + sign is ca
where two values (in this case 1 and 2) are evaluated down to a single v
Arithmetical operators are used to calculate values within expressions.

Operator	Arithmetical	Example
+	addition	>>> 1 + 2 3
-	subtraction	>>> 2 - 1 1
/	division	>>> 2 / 2 0
*	multiplication	>>> 2 * 2 4

BODMAS

As in maths, there is an order in which arithmetical operators should be
to as BODMAS (brackets, over, division, multiplication, addition, subtra

For example, look at the following expression:

Without brackets

```
>>> 1 + 2 * 5
11
```

This expression has multiplied 2 by

With brackets

```
>>> (1 + 2) * 5
15
```

The brackets in this expression ha
calculation to be evaluated first, s
then multiplied by 3 to make 15

Data Types

The **string** data type is typed as **str()** in Python and can be used, along w
expressions using text. Study the examples below:

```
>>>str(1)
"1"
>>> print("My Computing lesson is " + str(1) + "
"My Computing lesson is 1 hour long."
```

```
>>>str(5)
"5"
>>> print("RoboMutt is " + str(5) + " years old."
"RoboMutt is 5 years old."
```

Rounding Up and Down

The **int** data type can be used to round numbers up and down:

Rounding down:

```
>>> int (6.6)
6
```

Rounding up:

```
>>>int (6.6) + 1
8
6.6 is rounded up to 7.  7+1=8
```

Variables

Values can be stored in variables in order to be used in later expressions
bonus could store the value **100**. An assignment statement stores a va
assignment statement comprises a variable name (such as **bonus**), an e
stored (such as **100**). In Python a variable starts with a lower-case lette
salary and *sAlary* are viewed as different variables. A variable name sh
your code more readable.

In the assignment statement below, the integer value 250 is stored in t

Assignment statement: salary = 250

Python example:

```
>>> salary = 250
>>> salary
250
>>> overtime = 150
>>> salary + overtime
400
>>> bonus = 100
>>> salary + overtime + bonus
500
```

The value 250 is sto
so when **salary** is en
as the result.

The variable **overtim**
when the expressio
the result returned
numbers, 400 (250 +

When a new assignm
the **bonus** variable v
added to a new exp

The value within a variable can be changed by entering a new assignme
remains the same, the value changes).

```
>>> salary = 300
```

Now the expression >>> salary + overtime + bonus will yield **550**.

Variable names should follow these conventions:

- Consist of one word
- Have no spaces
- Comprise letters, numbers and underscore
- Not begin with a number
- Not contain hyphens

Examples

- `salary`
- `monthly_salary`
- `salary_plus_overtime`
- `monthlySalary (camel case)`
- `_salary`
- `salary250`

Data Structures

Arrays

Instead of having a variable for each item of data, such as:

```
level_1
level_2
level_3
level_4
level_5
```

In an array, all data types must be the same.

... you could store each item within an array called `level[5]`, with 5 within the array.

Lists

A list stores items in a structured sequence. The items within a list are to as comma delimited) and surrounded by square brackets:

`[red, green, blue]` list containing three list items

Variable RGB contains a list with three items:

```
>>> RGB = [red, green, blue]
>>> RGB
[red, green, blue]
```

Sequencing

Within a program, the clause or block begins after a condition where in

```
Print("Welcome, Bod")
If password == "Bod1":
   Print("Password correct")
Else
   Print("Re-enter password")
```

IF and EL program *selection*

Flow control is important when writing programs. IF, ELSE and ELIF are
control statements are followed by a colon and then an indented block

The following block of code uses the conditions (selection) IF, ELSE and
order for the code to work.

```
if name == "Bod":
    print("Hi, Bod.")
elif age > 5:
    print("You are too old to be Bod.")
else:
    print("You are neither Bod nor under 5.")
```

Consider writing the above code in a different sequence:

```
Print("Password correct")
If password == "Bod1":
   Print("Welcome, Bod")
Else
   Print("Re-enter password")
```

This code is
result in a
the wrong

WHILE and FOR

The WHILE condition is used to ensure that a program will continue rec
user inputs the correct answer. Below is an example of a condition-cor

Example:
Go Loopy: In the following code, Bod wants the user to answer **Rabbot**
best way to keep weeds down in your garden?' The program will contir
correct answer is entered (Rabbot), otherwise the user will be prompte

```
answer = " "
while answer != "Rabbot":
      answer = input("Keep trying")
print("Rabbot correct")
```

Sometimes you may want to repeat a block of code or section of a prog
iteration or *looping*.

Condition-controlled loops using **WHILE** will repeat over and over, crea
condition is met.

An infinite loop is shown below where the condition-controlled loop w
until 10 is entered as the answer:

```
age = ""
while age != "10":
       print("Please type your age")
          age = input()
print("About time!")
```

Count-controlled loops using **FOR** and **RANGE** repeat a specified numb

In the following example, a count-controlled loop repeats to find the to

```
total = 0
for count in range(4):
      price = int(input("Type in the price: "))
      total = total + price
print("The total price is: ")
print(total)
```

Functions and Procedures

Print()	*outputs to screen*
Len()	*finds length*
Input()	*user inputs data*
Def()	*defines a function*

The print() function can be used to output specific data to screen:

```
>>> Print("Hi Bod!")
"Hi Bod!"
```

The print() function can also be used to print blank lines.

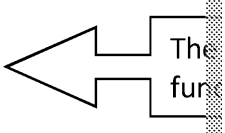
```
>>> Print("Hi Bod!")
"Hi Bod!"
>>> Print()
```

The input() function requests the user to enter data, such as a passwor

```
>>> print("Enter your password")
>>> password = input()
   If password = "Bod1":
>>> print("Access granted!")
   Else :
>>> print("Re-enter password")
```

When Python executes an instruction, it is *calling* the function.

```
>>> print("What is your salary?")
>>> salary = input()
```



The len() function is used within expressions to return the length of a v

```
>>> len("Bod")
3
>>> len()
0
>>> len ("Bod's dog is called RoboMutt")
28
```

The def() function is useful when creating code that will repeat a value a specific number of times.

When the program on the right runs, the cheer() function will be called two times and the output will appear as:

```
def chee
    print
    print
    print

cheer()
cheer()
```

```
Hip, hip hooray!
Hip, hip hooray!
Hip, hip hooray!
Hip, hip hooray!
Hip, hip hooray!
Hip, hip hooray!
```

❶ ❷

Converting Strings to Integer Data Types

The **input()** function always returns a string value and this must be conver
order for strings to be used in expressions, they must first be converted to

```
>>> salary = input()
300
>>> salary
"300"
```

The input for the vari
function has returned
type as denoted by th

```
>>> salary = int(salary)
>>> salary
300
```

The value 300 within
converted to an inte

Syntax Errors and Checking

Errors in code will result in syntax error messages, such as Invalid Syntax
up experiencing several error messages when programming, but this is no
when start or end brackets (parentheses) are missing or text strings are n
marks. Incorrectly typed functions and missing colons at the end of cond

```
>>> Print("Hi, Bod!"      missing parenthesis
>>> Print(Hi Bod)         missing quotation marks
>>> Pint("Hi Bod!")       function 'print' incorrectly typed
>>> Print(("Hi Bod!")     additional parenthesis not needed
```

The hash symbol (#) is used to indicate a comment. Comments help to
to understand.

```
Print("How old are you?")  #ask for player's age
```

Or

```
if name == "Bod": #name is a variable assigned e
    print("Hi, Bod.")
```

When put in front of a line of code, the hash removes that line of code
when tested.

```
#Print("How old are you?")
```

The # stops this
run during testi

Topic 3 – Fact Sheets

Pseudocode

Pseudocode is a type of simplified code that represents a programming
algorithms (an algorithm is a logical sequence of steps for performing a
makes it easier to work out a problem and find solutions before coding

Pseudocode does not have a specific syntax and is not a programming l
of code that helps to simplify problems in the planning stages of a prog
tags (called notations) such as:

- **INPUT** – user should enter some text (e.g. `INPUT "user inp`
- **OUTPUT** – this indicates something that is output to screen (e.
- **WHILE** – this is used to repeatedly request information until a
  referred to as a condition-controlled loop (see Topic 2)
- **FOR** – this is used within count-controlled loops and will be re
  Topic 2)
- **IF, THEN, ELSE** – used to test a statement and make a decision

If we want to write a program that will ask for the user's name and retu
pseudocode may look like this:

```
OUTPUT "Enter your password"
INPUT user inputs password
STORE password in password variable
IF password = "Bod1" THEN
   OUTPUT "Welcome Bod"
ELSE
   OUTPUT "Incorrect! Please re-enter password t
```

Conditions – True or False

A condition is a statement or calculation which is either true or false. F
statement '1 is greater than 2' is false, whereas the statement '2 is grea

Statements can use operators such as AND, OR and NOT. For example,
greater than 1' makes a false statement. The statement '1 is greater th
makes a TRUE statement because one of the conditions is true. The NO
statements further. For example, 'Chester NOT Liverpool' will find data
criterion and not Liverpool.

Expressions

In programming there are expressions, operators and conditions. The
expressed as the operator **>** (e.g. 2 > 1). This statement uses a compari
makes a decision based on the criteria. As Boolean is based on algebra,
letters (called variables because the value is subject to change); for exa
Boolean operators vary in different languages, such as Python.

Expression	Comparison operator
Equals	=
Greater than	>
Less than	<
Greater than or equal to	>=
Less than or equal to	<=
Does not equal	<>
Expression	**Boolean operator**
And	AND
Or	OR
Not	NOT

Truth Tables and Logic Gates

Truth tables help you to see how the input of a logic gate relates to it
operators AND, OR and NOT. Logic gates are switches within circuits
FALSE = 0.

AND = each input must match criteria
OR = one or both inputs must match criteria
NOT = output is opposite of input

Example of truth table using Boolean operator AND where A AND B e

A	B	Z
0	0	0
1	0	0
1	1	1
0	1	0

Example of truth table using Boolean operator OR where A OR B equ

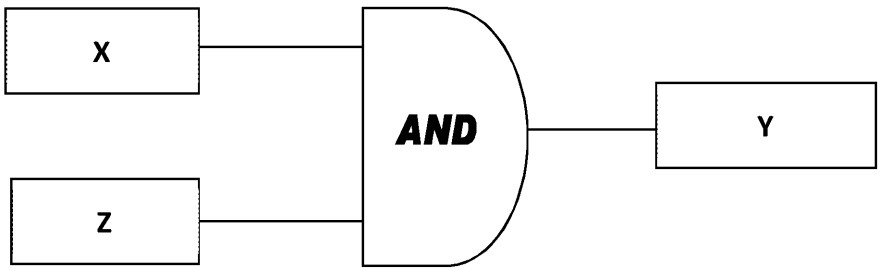
A	B	Z
0	0	0
1	0	1
0	1	1
1	1	1

Example of truth table using Boolean operator NOT where A is NOT e

A	Z
0	1
1	0

Examples of logic gates:

AND gate: X AND Z must each meet the criteria Y otherwise FALSE (0)

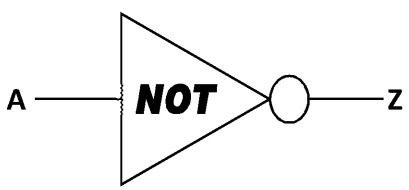


Look at the example below of a truth table that has been turned into a
EQUAL Z

A	Z
0	1

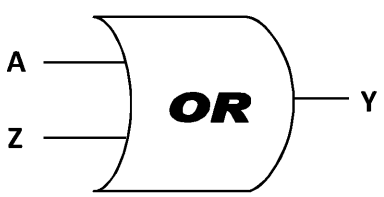
NOT gate:

Output is opposite of input



OR gate:

One or both inputs must match criteria



Topic 4 – Fact Sheets

Computers store and process data using binary code. There are only tw
and 0 ('bi' means 2). Binary is used within electrical circuitry, where 1 i
are made up of binary digits (bits). Eight bits make up a byte. Each byte

Binary code is called **base 2**. This is because there are only two numbers (1 and 0) and it is converted using the power of 2 (i.e. each number to the left is doubled).

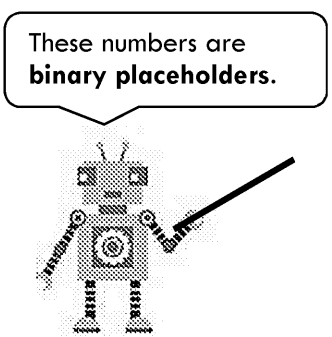
The power of 2:

When a zero is added to a binary number it doubles; for example, 10101 = 21 but when a 0 is added to the binary n

Convert Binary to Denary

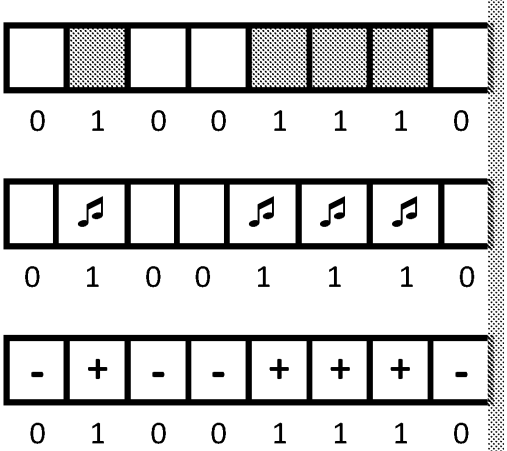
Jump to it! Create an eight-column table in which to enter our binary p
column. Enter the number 01. To get the next number in the sequence.
This gives the result = 2. Jump to the seventh column and enter the nu
number: add 2 + 2 = 4 and enter 04 in the sixth column. Repeat this un

A binary code consists of 0s and 1s. This is an example: **01001110**. Fro
number beneath the placeholders. The 0s represent off and the 1s repr
the 1 columns only (64, 08, 04, 02). This gives the **denary** number 78.



	+64	+32	+16	+8	+4	+2	
128	**64**	32	16	**08**	**04**	**0**	
0	1	0	0	1	1	1	
Off	**on**	off	off	**on**	**on**	**o**	
	64+			**08+**	**04+**	**0**	

If we look up this number against the ASCII code table, we see that it re
could also do it another way, using different coloured squares to repre
sequence of lights. We could also use sounds to represent 1s and silen



We know that computers use binary – base 2. What system does a hun

Converting Denary to Binary

Denary is the decimal system that humans use – this system is called **ba** numbers and it uses the power of **10**. The denary system uses 0, 1, 2, 3

Denary numbers increase tenfold when a zero is added. For example, a makes 20 (2 * 10 = 20).

Converting denary to binary is performed in the following way:

Convert the denary number **120** to binary.

First enter your placeholders (128, 64, 32, 16, 8, 4, 2, 1) and then work o first left-hand column (128) can go into 120. It can't, so enter a 0 below

Repeat this process with the rest of the placeholders:

- Can 64 go into 120? Yes it can, so enter a 1 below 64 and carry a number (120 – 64 = 56).
- Can 32 go into 56? Yes – add a 1 beneath 32 and carry over the
- Can 16 go into 24? Yes – add a 1 beneath 16 and carry over the
- Can 8 go into 8? Yes – add a 1 beneath the 8 placeholder.

When there is no number remaining, so add zeros beneath the 04, 02 a

The binary number is 0111100. To check we've got that right, add up th a 1 entered in their column. The denary number is 120!

128	64	32	16	08	04	02	01	
01	**1**	**1**	**1**	**0**	**0**	**0**		= 120

Adding Binary

Example: To add binary numbers, you must follow the process below:

0 + 0 = 0
0 + 1 = 1
1 + 1 = 10
1 + 1 + 1 = 11

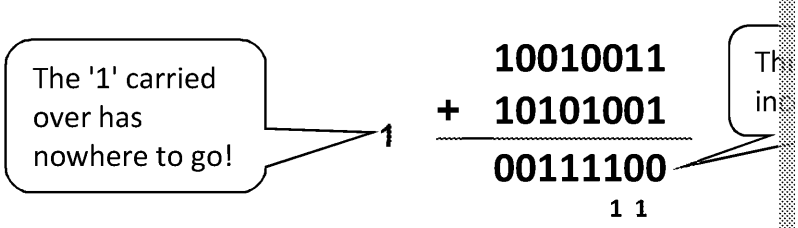
So:

00010011
+ 10101001
10111100
1 1 Carry over

Overflow Errors

Overflow errors occur when two binary numbers are added together ar
than the two numbers being added. These extra digits cannot be carrie
have nowhere to go. The extra digits create an 'overflow' which can ca
result in an incorrect answer.

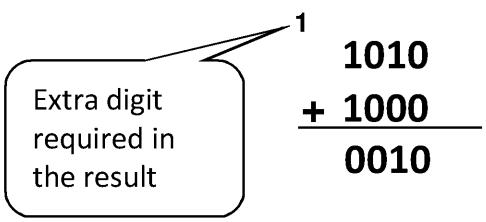
Example: Sometimes the result contains more digits than the two num



The sum below looks straightforward enough:

10 + 8 = 18

But if we try it using binary, an extra digit is produced:



This can cause an overflow error and cause the computer to crash or gi

Topic 5 – Fact Sheets

Topic Summary: Hardware consists of the parts of a computer or devic
Software refers to the programs which run on a computer or device.

Software can be application software, such as word processing or sprea
for mobile phones, a computer game, printer drivers, media players tha
or the operating system on your phone or computer, such as Windows
installs and manages other software on your computer devices). In ord
console to work (hardware), they require software (programs) to be ins

Hardware refers to GPS systems, circuit boards, display screens, periph
cards, and disk drives.

Networking in computer terms means connecting devices together in o
information. Networks can be local (within the same building), wide ar
or global (Internet), and can be connected via cables and wires or be w
network of globally connected computers and devices each with their o
Web is part of the Internet and enables users to find information on a v
engines or web addresses.

Data must be correctly input before it can be processed and then outpu
into a computer will result in incorrect data being output. This is referr

Software

Software consists of programs that are installed on a computer or devi
software available. The **operating system software** manages devices a
application software includes the programs that enable users to edit p
letter in a word processor or perform calculations in a spreadsheet. **Ut**
software, disk fragmenter or file compression programs.

Operating System Software

A computer needs to have operating system software before applicatio
Word, can be installed. The operating system manages computer prog
enable interaction between the computer and the user. The most com
graphical user interface used by Microsoft Windows (e.g. the desktop o
toolbars). The operating system also manages input and output from p
keyboard or mouse.

Application Software

In order for your computer, smartphone or games console to work, the
be installed. Software can be apps for your phone, a computer game, p
enable you to download music, or software such as word processing, sp
programs. These are referred to as *application software*.

Input and Output Devices

Data can be input via a keyboard, mouse, touchscreen, microphone or s
as *input* devices. Once data has been input and processed by the centra
the *fetch–execute cycle,* it is output, either to the screen, to a speaker c
Output devices include screens, speakers and printers.

An **input** device may be a display screen (also output), mouse, sensor, k
barcode reader, touchscreen (also output), microphone, scanner, touch
controller.
An **output** device may be a printer, display screen, touchscreen, projec
speaker or headset.

Display Monitors

A monitor or computer screen is used to display data on-screen. Displa
relevant to personal computers, tablets and notebooks, and also GPS d
resolution of a monitor will affect the quality of graphics on the compu
playing graphic games or watching movies. To play computer games, p
photographs, or display videos or other graphical content, a graphics ca
screen are required. The resolution of the display screen will affect the
computer, particularly important when playing graphic games.

In addition to hard drive size and the graphics card, the refresh rate of a
(for colour detail) are also important considerations. Widescreen monit
entertainment and game playing. Some monitors also offer 3D capabil
A graphics card has a dedicated GPU – a graphical processing unit – wit
cooling and its own RAM supply. A graphics card can be integrated wit
an expansion slot.

Networks

A network is a group of connected digital devices, such as a home comp
mobile phone network or a landline phone network. A network can be
connectivity) or wireless (using radio wave frequency for connectivity).
connect to the Internet via 'hotspots'.

A router or modem connects computers to the Internet and a switch/h
network. A router has a default password or network key, which shoul
purposes. A router should also have a firewall to prevent unauthorised
modem include ADSL, cable and wireless broadband (e.g. 3G/4G).

There are different types of network, such as a local area network (LAN
site/building (a WLAN is a wireless local area network); a wide area net
devices between multiple sites/buildings (the Internet is a WAN); and a
wireless personal area network (PAN and WPAN) to enable connectivit

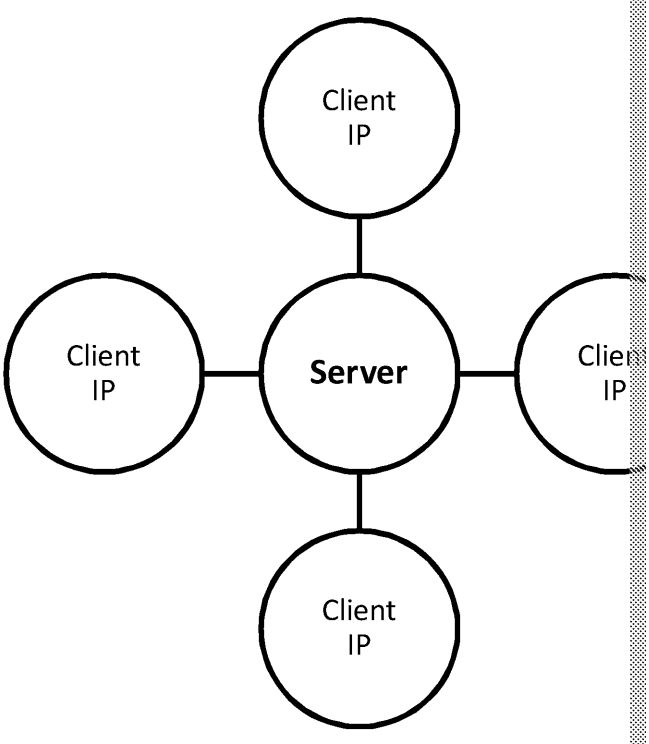
Types of Network

LAN **Local area network:** multiple computers can share resou
and printer; home entertainment systems can be connec
household via means of wireless or wired connections. T
network (or WLAN: wireless local area network).

WAN **Wide area network:** multiple workstations are connecte
which holds the programs and other resources) over a LA
together over multiple sites, creating a WAN (wide area
connected to a network is called a stand-alone compute

PAN A **PAN** or **WPAN** (personal area network or wireless pers
connectivity over a short distance, using a short-range ra
mobile devices such as mobile phones, laptops and GPS
need to be compatible). Bluetooth (which uses a PAN) e
phone by use of a Bluetooth headset. Because Bluetoot
range radio frequency bandwidth, it is vulnerable to secu

WWW **The Internet:** an interconnected network of computers c
Wide Web) which can be accessed globally. The Interne



Network Connections

Different types of connection enable communication across a network
a wired (Cat5/Ethernet) or wireless connection (using radio waves). Ne
through secure or public unsecured channels. Devices, such as mobile
be connected to another device such as a computer in order to transfe
cables (wired) that insert into a USB port or via wireless connection me
USB or FireWire interface means that the device does not have to be di
to transfer data). Internet-enabled devices can also connect wirelessly
(mobile broadband connectivity) and Wi-Fi. A device can also be conne
over a short distance using Bluetooth.

The Internet

The Internet is an interconnected network of computers containing we
can be accessed globally. The Internet uses a WAN.

Accessing the Internet enables a user to access the World Wide Web (W
collection of websites which are available on the Internet, which can be

An Internet Service Provider (ISP) provides an Internet connection for a
called a URL (Uniform Resource Locator) which is entered into the addr
If you do not have access to the specific URL of a website you will need

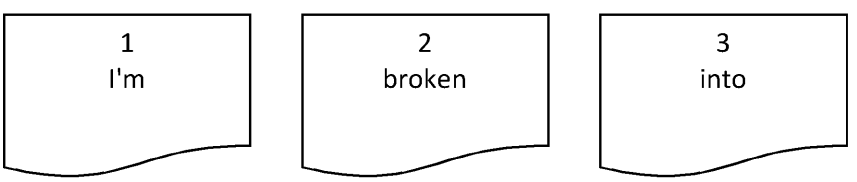
A search engine is an Internet search tool which is designed to search w
specified keywords or phrases (called search criteria) entered by a user

An IP (Internet Protocol) address uniquely identifies a computer. The In
interconnected computers, which communicate via unique IP addresse

Packet Switching

Packet switching is the transmission method by which emails and web
chunks of data (512 bytes each) over a network. This means that a large
– each piece is numbered and contains coded details about the destina
along with error control bits. A router works out the fastest route and s
route. Each piece or packet may pass through multiple routers on its w
each packet is reordered correctly using the individual numbers provid
journey. This method is useful for large packets of data. However, pack
issues.

Real-time data, such as VoIP, IM and live audio/video, do not use this m
switching where there are no delays.



Memory

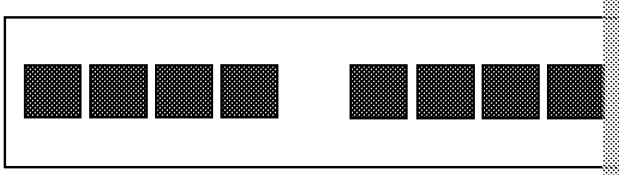
RAM

RAM is referred to as primary memory, with the hard drive and other s
as secondary storage. Data is stored on a computer in binary code (see

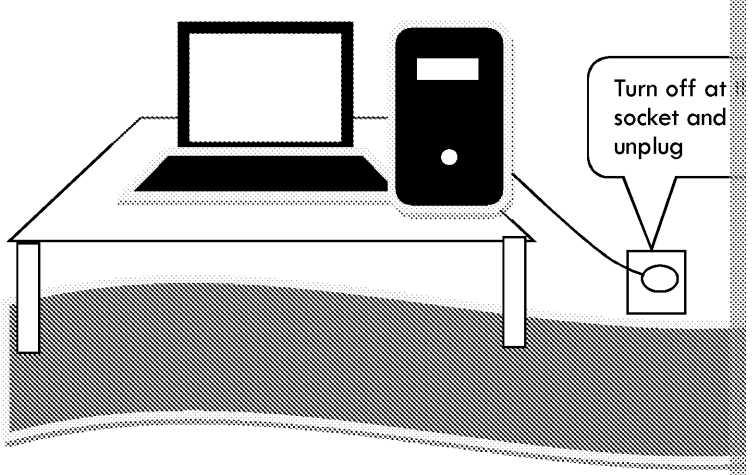
RAM (random access memory; also referred to as *volatile memory*) is a
loses data when the computer is switched off. A software program is s
each program into RAM before running each line of the program conse
temporary memory is required for each software program that is run, v
performance. To ensure that your computer runs quickly and smoothly
software programs, you should ensure that there is enough RAM (mem
and installed easily). Installing more memory is the easiest way to incre
without changing the processor.

To check the amount of RAM available on your computer, press the Wi
key to see properties. RAM memory sticks come with many different sp

computers and laptops. DDR, DDR2 and DDR3 refer to double-density d
after this, measured in megahertz. Modern computers usually use DDR
refers to the maximum bandwidth that the RAM supports. Most moth
for RAM sticks. It is important that you know how many sockets are ava
motherboard and that you purchase the correct number of sticks in ma
want to upgrade RAM by 4 GB and your motherboard has two slots, the
avoid affecting the clock speed and performance of your computer.



When installing RAM, ensure that you turn off at the plug first (just pow
enough – it must be disconnected from the power socket), and dischar
anti-static wristband is recommended). Do not stand on a carpet to ins



Cache Memory

Cache memory is memory utilised by the CPU to reduce the time taken
Cache memory is a smaller and faster memory, storing frequently acce
During memory checks, if data is in cache memory there is no need to c
the process quicker.

Fetch–Execute Cycle and the CPU

The clock cycle determines the speed of the processor. The clock speed is measured in cycles per second, with one cycle (per second) equivalent to 1 hertz. The fetch–execute cycle fetches instructions and processes them ready for output. In slower computers, only one instruction can be executed at a time, sequentially. With modern computers, multiple instructions can be processed in parallel concurrently (this is referred to as a pipeline), making the process quicker. Clock speed (frequency at which the CPU runs, measured in hertz) affects the speed at which the microprocessor executes commands. Multiple processing cores enable simultaneous processing of multiple tasks, so a quad-core processor will execute instructions faster than a dual-core processor (although it will also use more power).

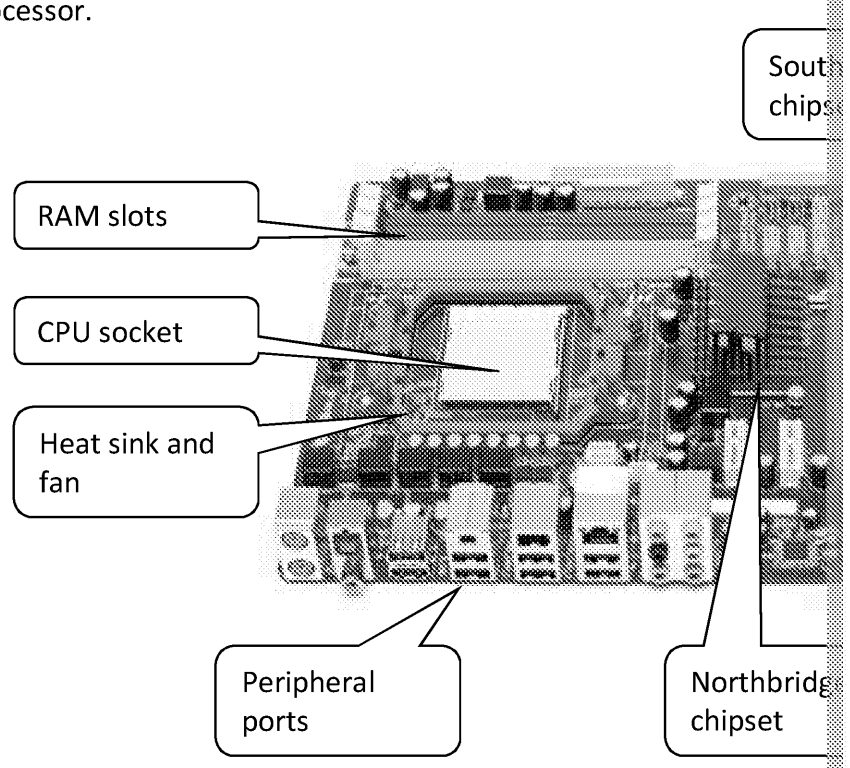
The CPU is the brains of a computer that carries out stored program ins
speed of a processor is measured in gigahertz (GHz), also referred to as

There are different processors for different types of computer, such as
performance and handling multiple tasks and applications, a computer
processor.

The CPU contains the control unit, the arithmetic unit (ALU – also know
registers.

The ALU is the part of the CPU which performs the arithmetic (e.g. addi
and division) and logical operations (identifies and compares). The ALU
registers. It then performs an operation on that data and stores the re

The control unit directs the operations of the CPU and decodes instruct
commands which are then executed and the results stored in the mem
coordinates the input and output devices of a computer system and co
the processor.



ASCII Character Set

Common Printable Characte		
DECIMAL	DECIMAL	
0011 0000		
0011 0001		
0011 0010		
0011 0011		
0011 0100		
0011 0101		
0011 0110		
0011 1001		
0011 1000		
0011 1001		
0010 0000	32	
0010 0001	33	
0010 0010	34	
0010 0011	35	
0010 0100	36	
0010 0101	37	
0010 0110	38	
0010 0111	39	
0010 1000	40	
0010 1001	41	
0010 1010	42	
0010 1011	43	
0010 1100	44	
0010 1101	45	
0010 1110	46	
0010 1111	47	
0011 0000	48	
0011 0001	49	
0011 0010	50	
0011 0011	51	
0011 0100	52	
0011 0101	53	
0011 0110	54	
0011 0111	55	
0011 1000	56	
0011 1001	57	
0011 1010	58	
0011 1011	59	

Common Printable Charac	
DECIMAL	DECIMAL
0011 1100	60
0011 1101	61
0011 1110	62
0011 1111	63
0100 0000	64
0100 0001	65
0100 0010	66
0100 0011	67
0100 0100	68
0100 0101	69
0100 0110	70
0100 0111	71
0100 1000	72
0100 1001	73
0100 1010	74
0100 1011	75
0100 1100	76
0100 1101	77
0100 1110	78
0100 1111	79
0101 0000	80
0101 0001	81
0101 0010	82
0101 0011	83
0101 0100	84
0101 0101	85
0101 0110	86
0101 0111	87
0101 1000	88
0101 1001	89
0101 1010	90
0101 1011	91
0101 1100	92
0101 1101	93
0101 1110	94
0101 1111	95
0110 0000	96
0110 0001	97
0110 0010	98
0110 0011	99

Common Printable Charac	
DECIMAL	DECIMAL
0110 0100	100
0110 0101	101
0110 0110	102
0110 0111	103
0110 1000	104
0110 1001	105
0110 1010	106
0110 1011	107
0110 1100	108
0110 1101	109
0110 1110	110
0110 1111	111
0111 0000	112
0111 0001	113
0111 0010	114
0111 0011	115
0111 0100	116
0111 0101	117
0111 0110	118
0111 0111	119
0111 1000	120
0111 1001	121
0111 1010	122
0111 1011	123
0111 1100	124
0111 1101	125
0111 1110	126
0110 0000	127

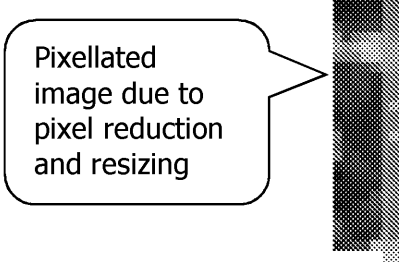
Topic 6 – Fact Sheets

Summary

It is important to know how computers store and process data, i.e. tha
to binary and that analogue signals are converted to digital signals so th
process them. Sound also needs to be converted into binary in order fo
computer. This is done by converting an analogue signal to a digital sig

Binary digits are known as **bits** and 8 bits represent one character (a by
ASCII code or Unicode so that they are readable by humans. A compute
assembly language.

When a photograph is taken by a camera it is processed as a bitmap im
elements called pixels. The more pixels you have in a photograph, the
therefore the better the quality of photograph. This comes at a price –
resolution means larger file sizes. There are different file formats whic
quality. For example, a RAW file is a format with a large file size that ha
camera, and a JPEG format is processed by the camera and compressed
resulting in lower quality and file size.



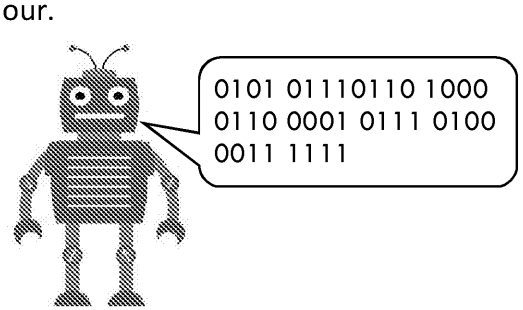
Binary

Computers store and process data using binary code. There are only tw
and 0 (bi means 2). Binary is used within electrical circuitry, where 1 is
are made up of binary digits (bits). Eight bits make up a byte. Each byte
understand data such as text, images or sound, a computer must first c

As humans we use a denary or decimal system of 0–9. Computers only
which represent *on* and *off*. This system is referred to as **base 2** or **bina**
zero.

Denary	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Binary	0000	0001	0010	0011	0100	0101	011

Each pixel in an image is made up of binary numbers – see **Topic 4 Bina**
images using colour.



File Sizes

The file size refers to the physical dimensions, such as the height and w
electronic files (e.g. kilobytes or megabytes). It is important to consider
to how it will be used.

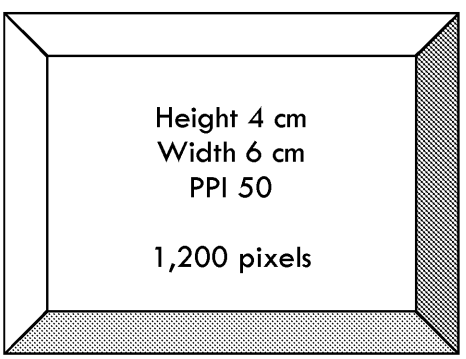
TIP: *The height and width of a graphic intended for inclusion on T-shirt
for CD labels or album covers.*

Getting it right at this stage in the planning process will prevent unnecessary delay and time wastage in the production stage. The height and width of an image is defined in pixels (picture elements), inches, centimetres and millimetres. It is recommended that you use inches or centimetres for printed images, but for images that will be displayed on-screen use pixels. You should ensure that you select the correct resolution, because too high a resolution will result in a larger file size and too low a resolution can result in pixellated images.

You may create a piece of artwork that will be used in a variety of diffe
page, an image for a printed brochure, or an image that will be sent via
or poster. For each of these uses, you need to be aware of the image re
artwork is displayed when used in the ways described above. A banner
a different resolution to printed artwork.

TIP: *Image resolution is the number of pixels per inch (ppi) or pixels per*

Each pixel stores a colour for the image and takes up memory. So more
better colour quality but increases file size. An artwork canvas using a h
and a resolution of 50 pixels per centimetre would contain 1,200 pixels

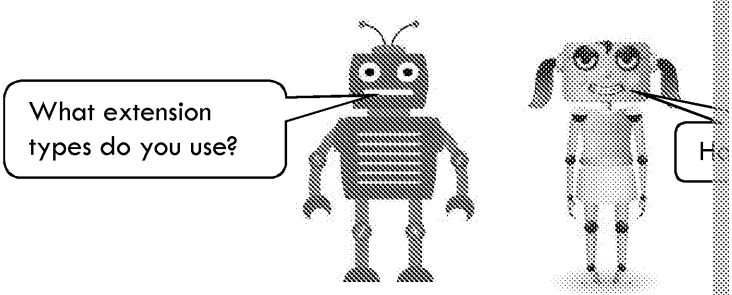


You can resize an image once the dimensions have been defined, but th
The information for each pixel colour is stored as a certain number of c
bit image can only display black or white, whereas a 24-bit image can d
(most effects can only be applied to images with 16 million colours). Us
in a larger file size. GIF (Graphical Interchange Format) images are more
they support (256 colours).

Compression

To make the file size of a photograph smaller, it is sometimes necessary
However, by doing so, you may decrease the file quality. There are ma
a picture by removing some of the pixels – this is referred to as **lossy** co
an example of lossy compression. Lossless compression is where a file
picture elements and without loss of picture quality (resolution).

File format refers to the file type of the saved graphic. It is important to
be used before deciding on the file format. For example, will the graph
material or other surface or will it be used for on-screen digital artwork
format that you choose will affect the file size and quality of the graphi
the web then it is best to save as either GIF (Graphics Interchange Form
Experts Group), as these formats are recognised by most web browsers



File Formats

- **GIF**: In Paint Shop Pro you can optimise GIF files for maximum qualit
format supports animations, but note that GIF only supports 256 co
for reproducing colour photographs and more suited for solid colou
'lossless' data compression, which means that the file size can be co
quality.
- **JPEG**: The JPEG format is the standard format for digital photograph
images. This format is suitable for email and the web as it compress
aware that this may also cause loss of image data each time that yo
- **PNG**: The PNG format is generally used for web images and manage
without losing image data.
- **RAW** is a file format used by professional photographers to edit unc
image data.
- **TIF or TIFF** (Tagged Image File Format) is a standard file format for p
between programs, and is used with postscript printing. The TIFF file
email and web due to the larger file size.
- **BMP** or bitmapped graphic format is used by the Windows operatin
BMP files are not compressed so tend to be larger than other graphi
bitmapped images are not recommended for use on the Web or oth
this image format is resolution dependent, resizing the image is pro
degradation in the quality of the image.

Bitmaps

Bitmaps are made up of coloured squares called pixels – picture eleme
are bitmap images. Information about each pixel is stored by the comp
higher file sizes.

TIP: *The resolution of an image refers to the number of pixels (picture e
make up the picture.*

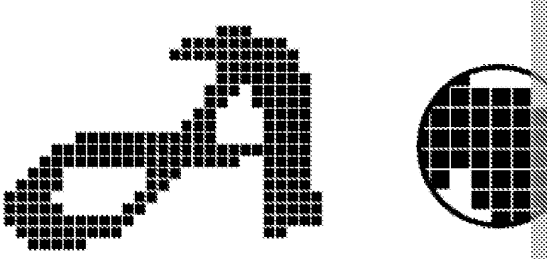
More pixels mean better quality but also higher file sizes. Resolution o
higher than an image which will be viewed on-screen, such as on a web
magnified, the pixels are displayed as squares of colour and the edges
rather than smooth. When you edit a bitmap graphic, you edit the pixe
shape. Bitmap images are commonly used for digital artwork and photo
colours is required.

Image resolution affects the way that the image is displayed – too low
This means large pixels that lower the quality and give a distorted, blur
image. Too high a resolution will increase the file size of the image and
requirements. It is important to ensure that the resolution is appropria
image.

A vector image is comprised of lines and shapes, and image resolution
decreasing the file size. The colour depth is subject to the number of bi

TIP: *Bear in mind that more colour equals larger file sizes.*

Vector image



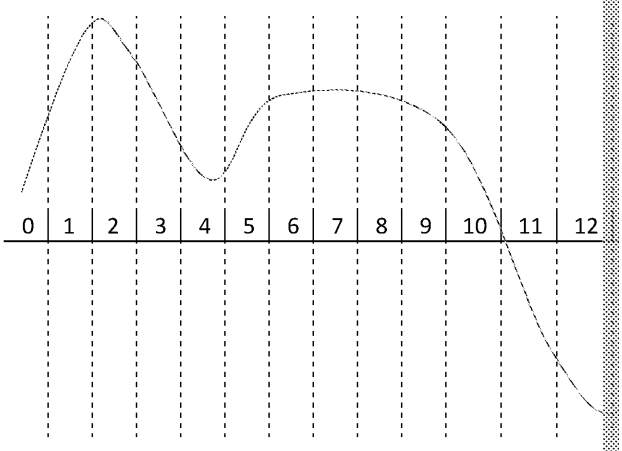
Bitmap image

Sampling Sound Waves

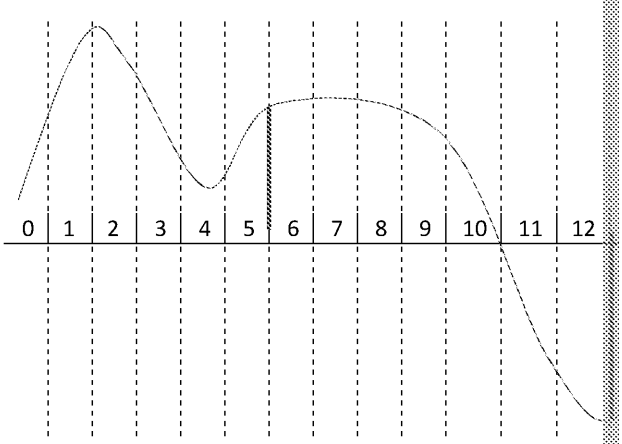
Analogue signals are continuous signals that a computer cannot process
binary values. To ensure that the digital sound represents the original so
sound wave must be sampled at multiple bits per second (called the sam
analogue signal is picked up by a microphone and sent to an analogue-to
analogue sound wave is sampled at multiple times per second in measur

More samples taken per second equals better quality sound but also a l
digital sound wave can be remixed and then converted back through a s
that the binary digits can be played back as sound waves.

TIP: *The bit rate is the number of bits required for each second of sound*



Original sound wave



Reduced sampling rate = lost peaks and poor quality
no resemblance to original sound

Sound File Formats

Common sound file formats are: AIFF (Audio Interchange File Format), s
files on a computer and is commonly used with Apple Macintosh comp
file format); and WAV (Waveform Audio Format).

MP3 and Windows Media Audio are also audio file formats, both of wh
means that the files are smaller in size and so quicker to transfer over t
compression, they can lose some sound quality compared to the larger

TIP: *WAV format has a larger file size (lossless) but better quality. MP3*
lossy compression which results in smaller file sizes and some loss of qu

ASCII and Unicode

ASCII is an 8-bit character encoding standard that enables binary values

As it is based on American English, ASCII doesn't support foreign charac
be created – Unicode – so that computers could communicate globally

To do this a unique number is assigned to each character or symbol. Cu
stores 7,716 characters compared to ASCII's standard 128-character se

Unicode is based on ASCII and uses the first 0–127 numbers to represe
the larger character set, Unicode needs more storage space than ASCII
recognised by all email or communication systems.

High- and Low-Level Languages

Programming languages, such as Java, Python and C++, are **high-level l**

TIP: *High-level languages are easier to understand and modify than low
resemble human language.*

Programmers use high-level languages to program software application
be translated into machine code so that it can be processed by the CPU

Computers use binary code to process information and communicate wit
hardware, such as your smartphone or tablet, and the 'brains' of the com
understand high-level language but must first be translated into machine
numbers. Assembly code is a low-level programming language which is si

Used to write hardware programs, low-level languages are quicker to e
requires in-depth knowledge of the hardware on which it is written.

The translation process is usually written into software programs and c
interpreters and compilers.

The **assembler** converts assembly code into machine code (binary). Th
machine code into sequential instructions which the CPU executes. Int
referred to as scripting languages, very useful for scripting dynamic we
level programing language Python. The **compiler** translates the entire

Examples of compiled code are Java and C++. Interpreted code is easie
compiled code as they can be detected in the interpretation stages rat
program to be compiled.

Translator
Translates the entire program into machine code
Interpreter
Translates the machine code into sequential instructions which the CPU executes
Assembler
Converts assembly code into machine code

Topic 7 – Fact Sheets

Topic Summary

We lock doors, secure windows and close our gates behind us when we l
employ further measures to restrict access, such as alarm systems, guard
secure fencing and intercoms or keypads on gates. Yet it is quite commo
the Internet without first enabling any security features to ensure their i
safety and security measures are similar to keeping your home secure an

Housekeeping:

- Keep personal data safe by not posting your age, name of scho
online.
- Keep passwords safe – don't share your passwords with anyon
are strong (not easily guessed or cracked) and changed regular
- Install a firewall and antivirus software to keep your computer f
- Only access reputable websites and be careful what you down
- Always use legal software and regularly check for updates.
- Don't respond to emails from unknown senders and don't click
email messages.
- Always use the correct privacy settings on social media and us
access for friends and family only.
- If subject to cyberbullying or disturbed by requests from stran
appropriate and trusted adult.
- Always ask permission before posting any information or phot

Passwords

An online customer is typically asked for a password with a minimum n
should be changed regularly and kept secret. It is important that you u
means using random letters, symbols and numbers that cannot be easi

An example of a strong password: **TnJKL18$*@**

- ☑ A weak password is one that can be easily guessed or 'cracked'
- ☑ Never give your password to anyone else. A bank will never as
password, so do not reply to requests via email for your perso
likely to be a scam called **phishing** which is used in identity the
- ☑ It is important that you sign out or log out once you have finish

Online Accounts

Look for **https** in the website address to ensure it is secure, or look for a p
required field is a form of validation which ensures that the user has give
required fields, which are usually indicated by a * symbol, must be filled i

Some of the fields may be textboxes for the user to type in information
No, or drop-down lists/menus from which the user can pick an option.

You will also be asked to create a username and password. The passwo
entering it. A secret question makes it harder for a fraudster to gain ac

A challenge response authenticates that a user is human and not automated software. This is known as a CAPTCHA Test and comprises a box containing a mix of letters and numbers which the user must read and enter into another box.

Malware

Viruses, Trojans and zombies are referred to as malware (malicious soft
downloaded unwittingly when installing pirated software, downloading
and swapping infected files. Malware can also be sent via email and ca
receiving emails from unknown senders. Infections may occur from ope
or clicking on email links or images.

A zombie can make your computer perform actions without your know
disguised as a reputable piece of software, and a virus can infect your c
files and causing your computer to slow down or crash.

It is vital to use antivirus software and scan your system regularly to pre
Updates are available with legal copies of antivirus software so your co
new viruses and threats. Using illegal (pirate) copies may mean that yo

To prevent unauthorised access to your computer, use a firewall. A fire
of information by hackers or viruses. A firewall can be used to block an

Legal Stuff

There are various acts that protect personal information stored on a co
computer systems from unauthorised access and damage. The Data Pr
data that is stored on a computer. The Computer Misuse Act protects
unauthorised access and malicious damage.

It is illegal to distribute or be in possession of an indecent image of a pe
Posting offensive or indecent images online can get a user barred from

The Freedom of Information Act ensures that users can ask to see any i
them and get inaccuracies in their data corrected.

Information Reliability and Credibility

It is easy to find information on a variety of subjects online, some of it t
opinions, prejudice or bias of the writer. To ensure that information is r
that it is free from personal opinions, is from a reputable source and is
critical evaluation and ensures that information is trustworthy, up to da
assume that a search engine will only find credible, up-to-date and fact
will search its vast database for the keywords provided by the user and
those criteria, regardless of reliability. Remember that wiki pages can b
browser and so may contain inaccurate information and be based on o

The UK Council for Child Internet Safety (UKCCIS) brings together organ
charities and government, to work together on making the Internet saf
Microsoft, BT, CEOP and the NSPCC.

Topic 1 – Answers

Activity 1.1 – Model Behaviour

Task A Throwing Shapes

1) c
2) d
3) a
4) b

Task B Mind Your Step

1) INPUT: Enter password, DECISION: Does password = Bod1?

Task C Divide and Conker

1) c
2) 1. A game of conkers comprises two players
   2. Two conkers are hit together until one breaks
   3. If a player misses the conker, he/she is allowed another go (max 2 g
   4. The player with conker still intact wins
3) Yes, step 3 is repeated. The term is iteration.
4) **Note:** the algorithm can be written in plain language. The task is to ensu
   down a problem correctly and understands selection, sequence and itera

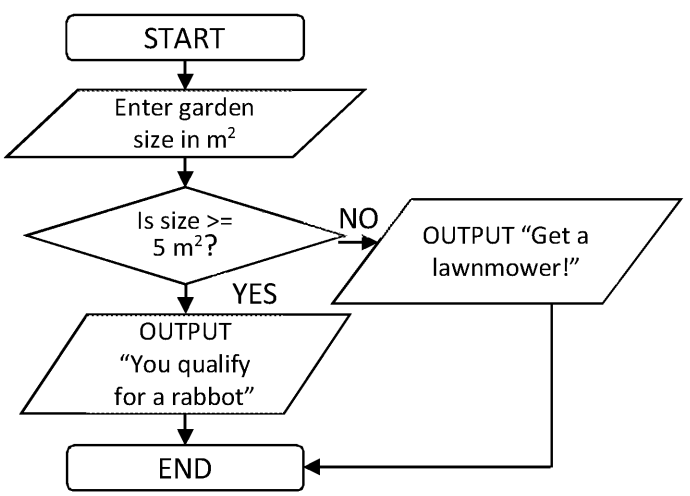
```
INPUT ("Is it a mishit?")
Store answer in the answer variable
IF: answer == "Yes" THEN:
OUTPUT ("Take another go")
Repeat step 4, twice
ELSE: ("Wait your turn!")
```

Task D Square Dancing

1. Move forwards four steps
2. Turn right 90°
3. Repeat step 1 three times
4. Repeat steps 1 to 3 eight times

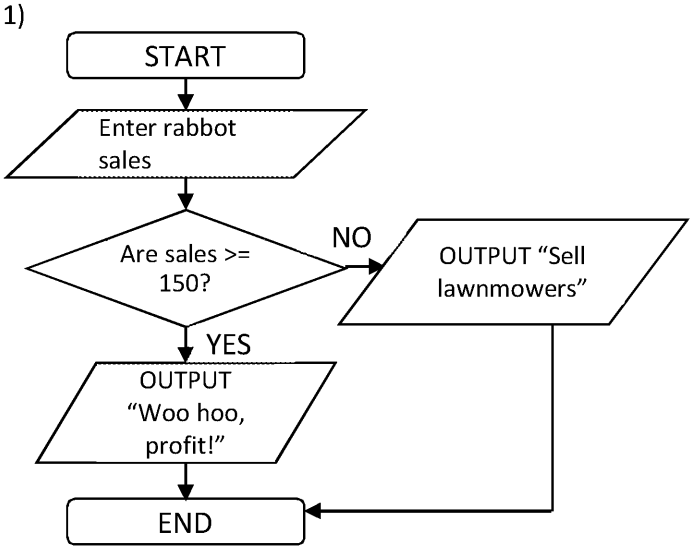
Task E Lawn Rangers

1) b
2) c
3)



Task F Rise of the Machines

1)



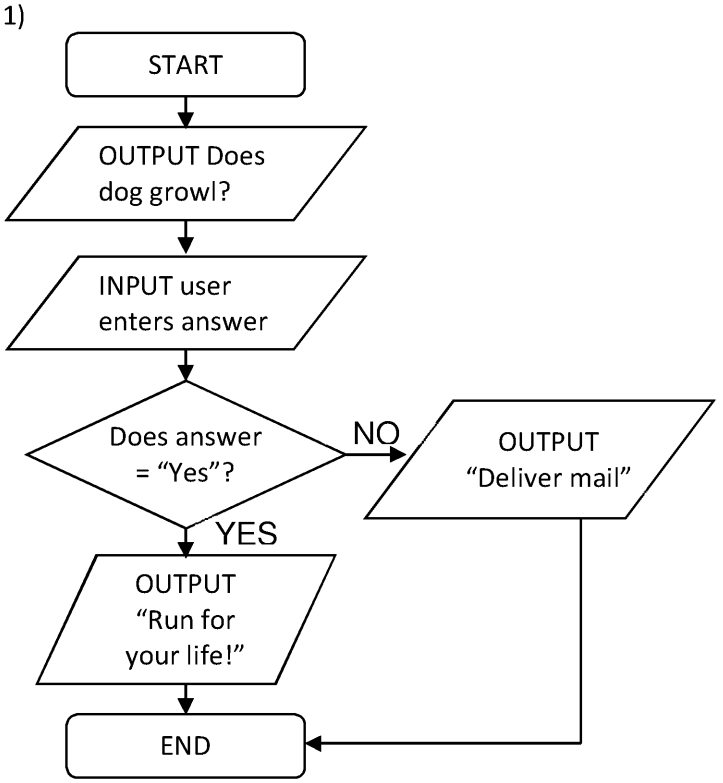
Task G Dogmatics

1)

```
OUTPUT "Has visitor arrived?"
INPUT user enters answer
STORE answer in answer variable
IF answer == "Yes" THEN
      OUTPUT "Bark"
ELSE
      OUTPUT "Don't bark"
```

Task H Post Traumatic

1)



Activity 1.2 – Sort Codes

Task A

1) *Original order:*

09	14	11	08	12	13	10	15	01	02

First pass:

09	11	08	12	13	10	14	01	02	07

2) Second pass: 9, 8, 11, 12, 10, 13, 1, 2, 3, 4, 5, 6, 7, 14, 15
Third pass: 8, 9, 11, 10, 12, 1, 2, 3, 4, 5, 6, 7, 13, 14, 15
Fourth pass: 8, 9, 10, 11, 1, 2, 3, 4, 5, 6, 7, 12, 13, 14, 15
Fifth pass: 8, 9, 10, 1, 2, 3, 4, 5, 6, 7, 11, 12, 13, 14, 15
Sixth pass: 8, 9, 1, 2, 3, 4, 5, 6, 7, 10, 11, 12, 13, 14, 15
Seventh pass: 8, 1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12, 13, 14, 15
Eighth pass: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15
Final pass 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 (no change

3) a) More than 3 passes

Task B Passing the Book

1) 02 Eye Robot
01 Batteries Included
03 Full Metal Jacket (and Trousers)
05 Mars Bar Attacks
06 Pasturama
04 How to Train Your Human
07 RoboCod: A Fishy Robot Tale

2) a) *2nd pass*
01 Batteries Included[1], 02 Eye Robot, 03 Full Metal Jacket (and Trou
How to Train Your Human, 06 Pasturama, 07 RoboCod: A Fishy Robo

3rd pass
01 Batteries Included, 02 Eye Robot, 03 Full Metal Jacket (and Trous
Human[1], 05 Mars Bar Attacks, 06 Pasturama, 07 RoboCod: A Fishy R

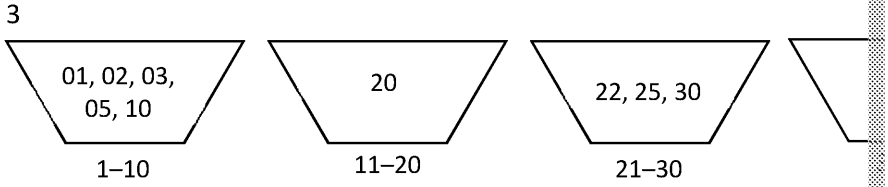
4th and final pass (no changes required)
01 Batteries Included, 02 Eye Robot, 03 Full Metal Jacket (and Trous
05 Mars Bar Attacks, 06 Pasturama, 07 RoboCod: A Fishy Robot Tale

2) b) 4 passes

Task C Bucket List

1) 3

2)



Activity 1.3 – Sole Searching

Task A Breakfast Serial

1)

```
OUTPUT "Which cereal do you want to find?"
INPUT user inputs cereal name
STORE user input in the cereal_name variable
counter = 1          #a counter to count each record a
more_cereals = True #this is to indicate whether the
remaining
WHILE more_cereals = True:
    IF counter = cereal_name THEN
        OUTPUT "Weetabot"
        Exit the loop
ELSE
    add 1 to counter
```

Task B Too Clever by Half

1) List of sorted film titles
   Look for title RoboCod
   Divide the list in half
   Compare title at midpoint to RoboCod
   Is RoboCod before or after midpoint?
   Discard data from half of list not containing RoboCod
   Divide the titles until RoboCod is found
   Output RoboCod

2) Three (first divide list in half, then discard first half and divide again, divi

   Batteries Included
   Eye Robot
   Full Metal Jacket (and Trousers)
   How to Train Your Human

   Mars Bar Attacks
   Pasturama
   RoboCod: A Fishy Robot Tale
   The Third Robot

   Divide the list in half. RoboCod appears after the midpoint in the second half.

   Mars Bar Attacks
   Pasturama
   RoboCod: A Fishy Robot Tale
   The Third Robot

   Discard the first half. Divide the remaining film titles. Discard the first half.

   RoboCod: A Fishy Robot Tale
   The Third Robot

   Divide again to find RoboCod.

Topic 2 – Answers

Activity 2.1 – Second Language

Task A Express Yourself >>>

1) a
2) c
3) b
4) 2+2
5) 3*2
6) 3-2
7) 6/3

Task B Place an Order

1) 15
2) 22.5

Activity 2.2 – What's Your Type?

Task A String Along…

1) c
2) c
3) b
4)

```
>>>str(50)
"50"
>>> print("The flapjack cost " + str(50) + " penc
"The flapjack cost 50 pence.  Bargain!"
```

Task B Whole-some

1) a
2) b
3) c

Task C Make your Point

1) b
2) a

Activity 2.3 – Make a Statement

Task A Variable Conditions

1) d
2) a
3) c
4) a
5) b
6) a
7) >>> pocket_money = 5
8)

```
>>> pocket_money = 5
>>> pocket_money
5
>>> Paper_round = 10
>>> Paper_round
10
>>> pocket_money + paper_round
15
```

Activity 2.4 A Structured Approach

Task A Hip, Hip Array!

1) c
2) c
3) a
4) d

Activity 2.5 A Sequence of Events

Task A Go with the Flow

1)

```
if name == "Bod":
print("Hi Bod")
   else:
print ("Who are you?")
```

2) a
3) d
4) b

Task B WHILE away the time

1)

```
name = " "
while name = ! "Bod"
      name = input("What is your name?")
print("Welcome Bod!")
```

2)

```
answer = 1
while answer > 1:
       answer = input("Take a break!")
print("Concentrate harder!")
```

Task C Plus FORs

1)

```
total = 0
for count in range(4):
       price = int(input("Type in the price: "))
       total = total + price
print("The total price is: ")
print(total)
```

Task D Following Procedures

1) c
2) a
3) b
4) d
5)

```
>>> overtime = int(overtime)
>>> overtime
250
```

6)

```
>>> len("Bod is a robot")
14
```

7)

```
def whatever () :
      print("meh")
whatever()
whatever()
whatever()
```

Activity 2.6 – Testing, Testing…

Task A Make a Hash of It

1) c
2) d

Task B Syntax Errors

1) Missing quotation mark – "Bod
   Spelling error – prit
   Missing colon – else
   Missing bracket – ("Who are you?"

Topic 3 – Answers

Activity 3.1 – Whether Conditions

Task A Expressions of Interest

1)

x > y	**TRUE** 2 is greater than 1
x <> y	**TRUE** 2 does not equal 1
x >= y	**TRUE** 2 is greater than or equal to 1
x < y	**FALSE** 2 is not less than 1
y < x	**TRUE** 1 is less than 2
y > x	**FALSE** 1 is not greater than 2

2)

x != y	**TRUE** 8 does not equal 10
x == y	**FALSE** 8 is not equal to 10

Task B IF Only…

1)

```
OUTPUT "Enter rabbot age?"
INPUT user enters age
STORE answer in age variable
IF answer <= "3" THEN
      OUTPUT "No need for a service!"
ELSE "Your rabbot needs an overhaul"
```

Task C Get with the Program

1)

```
weetabot = int(input("How many bowls of Weetabot
if weetabot > 1:
       print("Wow! That's a lot of Weetabot!")
else:
       print("One a day is enough!")
```

Task D Or ELSE….

1)

```
age = int(input("How old are you?"))
if age >= 5:
       print("You are old enough to play!")

elif age > 10
     print("You are too old to play!")
else:
     print("You are too young to play!")
```

Task E Put Your OR In

1) Rabbot, Bod, RoboMutt
2) Bodette
3) Bodette

Task F What's Your Game?

1)

```
errors = int(input("How many errors have you made
score = int(input("What is your score?")

if score >= 10 and errors < 3:
      print("You have attained Level 1")
else:
      print("Try harder!")
```

Task G Acid Test

1)

```
soil = int(input("What is the soil pH?")
position = int(input("What is the position?")

if soil >=8 and position ==10:
       print("Ideal planting conditions!")
else:
       print("Plant elsewhere")
```

Task H The Hole Truth

1)

```
width = int(input("What is the width?")
depth = int(input("What is the depth?")

if width ==15 and depth ==15:
   print("Good job!")
elif width <15 and depth <15
   print ("Dig deeper!")
else:
   print("Oops, too much!")
```

Activity 3.2 – Circuit Performers

Task A Logical Assumptions

1) a
2) b
3) d

Task B Turning the Tables

1)

A	B
0	1
1	0

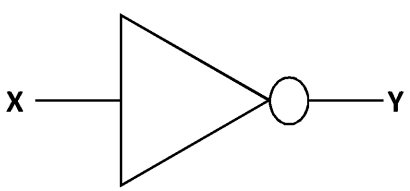
2)

…	C	X
0	1	1
1	0	1
1	1	1
0	0	0

3)

A	C	X
0	1	0
1	0	0
1	1	1
0	0	0

4)



5)

A	E	V
0	1	0
1	0	0
1	1	1
0	0	0

6)

Age 12 or under?	Age over 60?	Discount?
Yes	No	Yes
No	Yes	Yes
No	No	No

Topic 4 – Answers

Activity 4.1 – Get Cracking!

Task A Starter for 10

1) 148, 17, 195

128	64	32	16	08	04	02	01	
10	0	1	0	1	0	0		=148

128	64	32	16	08	04	02	01	
00	0	1	0	0	0	1		=17

128	64	32	16	08	04	02	01	
11	0	0	0	0	1	1		=195

Task B Mind Your Language

1) Hi

128	64	32	16	08	04	02	01
0	1	0	0	1	0	0	0

128	64	32	16	08	04	02
0	1	1	0	1	0	0

Task C Cracking Jokes

1) A lunar tick!

Task D Optical Illusion

1) 01000010, 01101100, 01101001, 10010001, 10010100, Blink

0	1	0	0	0	0	1	0

0	1	1	0	1	1	0	0

0	1	1	0	1	0	0	1

0	1	1	0	1	1	1	0

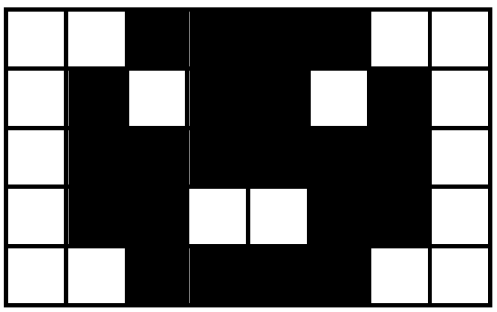
0	1	1	0	1	0	1	1

Task E Mug Shots

1) a) binary 0011 1010 0010 1001
   b) denary: 58, 41,
   c) :)

Task F Making Faces

1)



Task G Tap Into your Potential:

1) 0001 1000 0011 1100 0001 1000 0111 1000 0100 0000

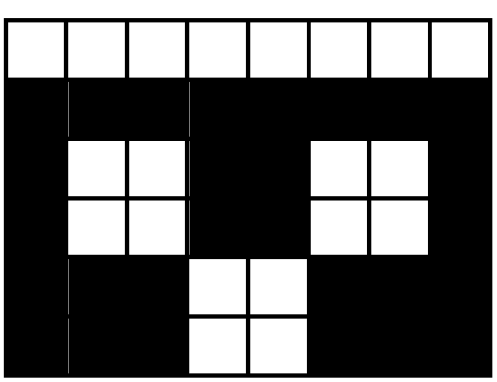
Activity 4.2 – Number Crunching

Task A Become a Convert

1) 120 = 01111000
   45 = 00101101
   80 = 01010000
2) binary code for learner's age
3) binary code for friend's age

Task B Picture This

1)



0000 0000 0
1111 1111 255
1001 1001 153
1001 1001 153
1110 0111 231
1110 0111 231

Task C Alien Race

1) 20 km

Task D Beat the Clock

1) Denary 30 to binary 0001110

Activity 4.3 – Adding Binary

Task A Sum It Up

1) 00100111

```
  00011000
+ 00001111
----------
  00100111
    1  1
```

Task B How to Get Ahead in Robotics

1) 0011
2) 0100
3) 0111

Task C Eye Robot

1) 0010
2)

```
  0001
+ 0010
------
  0011
```

Task D Beat the clock 2

1) 01011010

Task E Go with the Overflow

1) Yes – the binary digits are too long
2) a
3) c

Topic 5 – Answers

Activity 5.1 – Gadget Show

Task A One's Own Devices

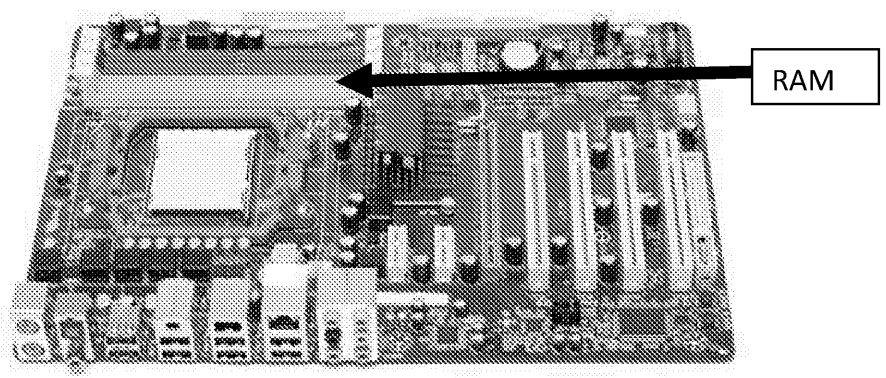
1)

	Hardware
Tablet	✓
Smartphone	✓
Smartphone app	
Games console	✓
Space Invaders game	
Spreadsheets	
Disk drive	✓
Printer drivers	
Circuit board	✓
Memory	✓
Word processing	
Digital camera	✓

2) Smartphone, disk drive, memory, taking photos and small video clips, ga
3) Learners should come up with their own hardware devices and uses (ma software)

Task B Memories are Made of This...

1) c
2) unplug from socket and remove carpet
3)



Task C Play and Display

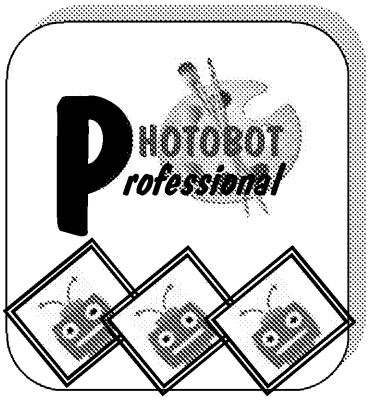
1) d
2) The resolution of the display screen will affect the quality of graphics on important when playing graphic games

Activity 5.2 – Application Forms

Task A All Systems Go!

1) a, c, d
2) a
3) c, a, b

4)



5) speakers, keyboard, mouse, monitor

Task B Program Guide

1) a) Word processor
   b) database
   c) spreadsheets
   d) photo editing software
   e) media centre

Activity 5.3 – The Ins and Outs of IT

Task A Putting IT in and getting IT out

1) input: ears, output: mouth
2) a) mouse
   b) keyboard
   c) speaker
   d) printer
3)

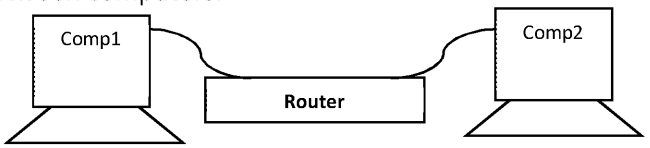
Device	Description
Joystick	Games controller
Plotter	Graphic printer which interprets commands from computer and draws lines, usually with a pen
Stylus	Digital pen
Biometric scanner	Face recognition, DNA and fingerprinting
Webcam	Enables users to view each other during a call (usi VoIP)
Headset	Enables a user to listen to audio output while kee their hands free
Touchscreen	Enables a user to manipulate and view informatio without a keyboard or mouse (e.g. smartphone o

4) Touchscreens are used to display (output) information as well to input in include headsets (microphone/speaker) and game controllers with vibra

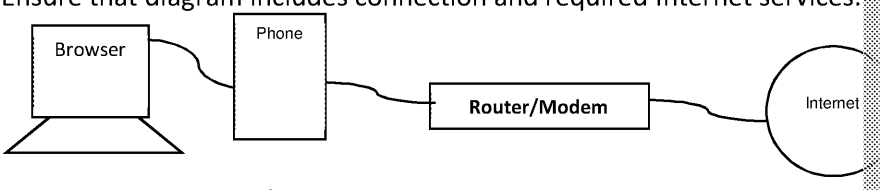
Activity 5.4 – Joining the Dot(com)s

Task A Feeling WAN?

1) Diagram should show server/client network within same room or buildin
detailed with images, or with less detail with squares and lines represent
Can be wired, wireless or hybrid.
2) One server – provides resources for clients to share. Resources, such as
between computers.
3)



4) Ensure that diagram includes connection and required Internet services.



5) Internet Service Provider
6) a) This task needs to be supervised by the teacher if performed in class
family or friends to participate. Make sure they understand the pur
6) b) This is based on how search engines work with keywords. Make sur
between finding web pages via a URL and via a search engine. For t
should know that they may need to refine their search using Boolea
enclosed in quotes.
7) **Example** 'teacher's desk' -desktop

Task B Making Connections

1) a
2) Hotspot

Task C Caught in the Web

1) http://www.rabbotics.co.uk
2)

Task D Making a Packet

1) a), b) and c)
Hi
The disco will be held on Saturday at 7pm till late. Tickets cost £5 on the
Look forward to seeing you there!
Cheers
Bod
2)

a	b	c	d	e	f	
	✓				✓	

Activity 5.5 – Cycle Paths

Task A Fetch and Execute

1) Learner must be aware that clock speed is measured in cycles per second
2) This needs supervision – teacher can change actions if wished **but learner fetching and executing commands sequentially**.
3) This task needs supervision. The teacher can change actions if wished **but are fetching and executing commands in parallel concurrently (pipelining**
4) This task needs supervision – different tasks can be allocated if wished – fetch–execute cycle is dependent on the clock speed.
5) & 6) These tasks are to make learners aware that increasing core process processing and speeds up multiple tasks.
7) a) Control unit
   b) ALU
   c) Register
8) This task is to make learners aware that instructions must be correctly in

Task B Cache Value

1) & 2) These tasks are designed to make learner aware that cache memory time taken to access main memory (RAM).

Topic 6 – Answers

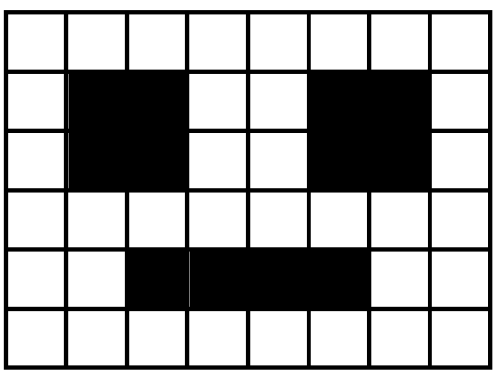
Activity 6.1 – Taking Instruction

Task A Size Wise

1) 224 MB
2) 1 MB (approximately – 1 MB is actually 1024 KB)
3) 223 MB
4) 173 MB
5) 213 MB
6) Yes, there is only 193 MB available
7) 96
8) 2 GB

Task B Conversion Rate

1)



2) 100001 111111 101101 111111 001100

Task C Colour Ways

1)

11	00	01	10	10	01	00	11
00	11	01	10	10	01	11	00
01	01	11	11	11	11	01	01
11	11	11	01	01	11	11	11
01	01	11	11	11	11	01	01
00	11	01	10	10	01	11	00
11	00	01	10	10	01	00	11

2) b (256)

Task D Shady Characters…

1) 144 bits
2) 2,097,152 bytes
3) 2,048 KB
4) 2 MB

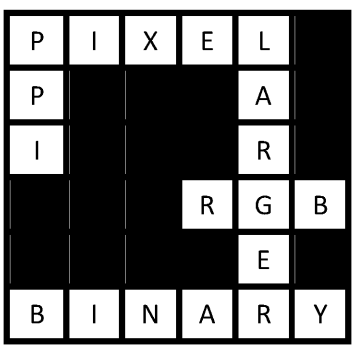
Task E ASCII Silly Question!

1) 0101 1010 0110 1001 0110 0110 0101 1010 0110 0001 0110 0110 0100 0
   0011 0110 0001 0111 0100 0110 1001 0110 1111 0110 1110
2) Taking a shelfie!
3) b (256)
4) a
5) b
6) a

Activity 6.2 – Things that Go BMP!

Task A Make a Resolution

1)



2) 000001 011101 0111101 111000111101 000000
3) Pixel density would be reduced, resulting in a pixellated image

Task B At a Loss

1) b
2) a

Activity 6.3 – Speed of Sound!

Task A Making Waves

1) b
2) Lost peaks and poor quality with no resemblance to original sound
3) Learner should produce own sound wave and indicate where loss of sou
4) analogue, continuous, rate, hertz, digits

Task B Small is Beautiful

1) b
2) Three (Lossy compression, Internet transfer, Smaller file size)

Activity 6.4 – Highs and Lows

Task A Open to Interpretation

1) So it can be processed by my CPU
2) Assemblers, Interpreters, Compilers
3)

Your answer	Description
Interpreter	This translates instructions sequentially, is easier to deb web pages
Compiler	This translates the entire program into machine code, n
Assembler	This translates low-level language instructions into mac the CPU

4) b

Topic 7– Answers

Activity 7.1 – Safety Barriers

Task A Friend or Foe

1) Fluffy is using flattery on his FaceBot page (e.g. pretending to like what B is a stranger, not a friend, and Bod should be wary about connecting with people he does not know. Bod should ask the name of the mutual 'frien trust.
2) It is very unwise of Bod as anyone can see content that is posted on a pu information and photographs. This puts not only Bod, but also friends a viewers.
3) a, c and d. Bod shouldn't display his address or age. He also should not b friends as he is putting them at risk.
4) Bod has a public profile enabling strangers to view content, such as pers his friends' and family's security at risk. With the information on Bod's p friends, saying that he is a friend of Bod's so they accept him.
5) When Bodette tags a photo it automatically goes into Bod's photo albu tagged) and she should be wary of his level of security. Bod has a public seen by strangers on Bod's FaceBot page.
6) An advantage of location tagging is increased safety – Bod's location can adult through this service. However, a disadvantage is that this can also his location to strangers.

Task B Safety PINS

1) a) bod1 is a weak password which could be easily cracked by a fraudster
2) A strong password will contain upper-case and lower-case letters, numb
3) Keep passwords safe – don't share your passwords with anyone else and (not easily guessed or cracked) and changed regularly

Task C Safety Net

1) a and c. Bod should look for the web page address starting with **https** an
2) b
3) a) A required field
4) To confirm that the email address is correct
5) a
6) This comprises an image of either text or numbers that users are asked t automated program

Task D Being Cryptic

1) c) Encryption is used to make text illegible while in transit, so unauthoris it.
2) b) Decipher
3) c) A decryption key

Task E Roman Knows

1) A turbot charged fish!

Task F Hacked Off

1) Let the accounts administrator know and immediately change all his pas

Task G Safety Triangle – Dangers

1) b) Grooming
2) Bod should not meet up with Fluffy as he is a stranger and is using groom
   Bod does no know Fluffy's true identity or age and should be wary of bei
3) Bod should report what has happened to the social media service provid
   image can be removed, and also let a trusted adult know what has occur
   the police (it is illegal to possess or distribute indecent images of anyone
   the incident via **www.ceop.police.uk/safety-centre**. Bod could also spea
   Bod should start using privacy and security settings on his FaceBot page
   messages from Fluffy and other users. Bod needs to understand that ph
   sends them to someone else.
4) b) Troll
5) Use an avatar or nickname (never give your age or gender)
6) Tick a, c, e, g Addiction, Bad language, Age-inappropriate content, Groom
   gender or age and use gaming as a way of making contact with younger

Activity 7.2 – Piracy on the High ©s

Task A Software Piracy

1) d) You could download malware. Using illegal (pirate) copies may mean t
   updated.
2) That it is a reputable and secure site and that the software is free to dow
   purchase or licences required.

Task B i-Patches

1) a) On the software manufacturer's website

Task C Fair Shares?

1) c) Music downloads are subject to licensing and copyright law. Bod can
   explicitly allowed.

Task D Copy Right (or Wrong)?

1) b) Copyright Act
2) Ensure that the content is free to download and share and not subject to
   contact the copyright owner and ask their permission.

Activity 7.3 – How to Make your Cookies Crumble

Task A That takes the biscuit

1) c) A small text file that is downloaded onto a user's hard drive when they
2) a) Positive: Cookies allow a website to personalise your details, such as g
   Bod'. b) Negative: Cookies can be used to track a user's online activities.
   for the customer to create and save shopping lists. d) Negative: Cookies
   and your details can be passed on to a third party without your permissio
   used to remember a customer's preferences, based on what they have p

Task B Ad Finitum

1) c
2) Use pop-up blocker settings on his browser

Task C Horrible Histories

1) By posting inappropriate content on social media sites or allowing others prejudicial remarks, designed to inflame or upset others. By allowing str to view and use his personal details (e.g. impersonation).
2) Use privacy and security settings on social media. Use an avatar on gam safe. Use appropriate language and be respectful of others' views on for
3) c) Clear his browser's history to help protect his personal and private dat a website.
4) a) A firewall and anti-spyware software should be installed to identify an

Task D Phishing Net

1) Bod should not reply to the message but should inform his service provid
2) b

Task E How Not to Eat Spam

1) Never reply to unsolicited mail or you may end up on an active spam list mail. Do not click any web links or adverts within an email message from spammers use 'web beacons' designed to send a message back to the se Therefore, it is safer to delete suspect messages without opening. Bod c that will filter and send suspect mail into a spam folder.

Activity 7.4 – Zombie Attack!

Task A Guard Against Infections

1) a) A zombie is malware that controls a computer and makes it perform a b) Trojan c) A worm is self-replicating malware that can be shared with c infected files
2) a
3) Manufacturers make available important security updates and software antivirus software that is not regularly updated will allow malicious softv
4) b
5) Because it could contain a virus or worm that will infect his computer an via email, so Bod could also infect his friends' computers.

Activity 7.5 – Keeping IT Legal

Task A Caught in the Act...

1) a) Computer Misuse Act
   b) The Data Protection Act
   c) 18

Activity 7.6 – Trust Issues

Task A Fact or Fiction?

1) a) Personal opinion and bias, b) Prejudice, c) Inaccuracy
2) He should cross-reference the information with other, reputable sources subject. He could look up the date when robotics began and also the da happening in the UK at that time.