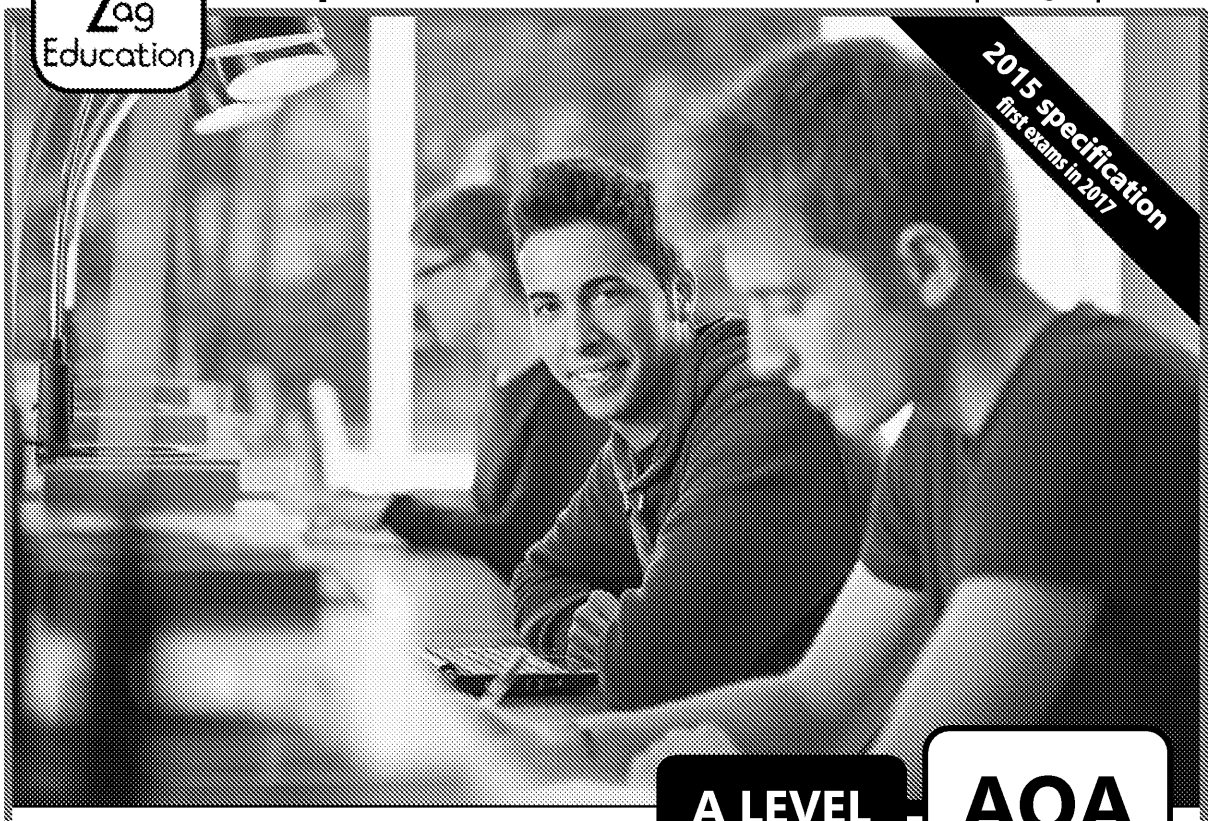
Zig Zag Education

Computer Science A Level | AQA | 7517



A LEVEL **AQA**

Topic Tests

for A Level AQA Computer Science

Paper 2 *Topics 4.5 – 4.13*

zigzageducation.co.uk

POD 6070

Contents

Teacher's Introduction

This resource is designed to support teaching and learning of the A Level AQA specification (for first teaching in September 2015; first exams from June 2017).

These end-of-topic tests are designed as factual tests to check your students' understanding as they complete each topic*. Their primary focus is not to provide exam-style practice, but instead to test the knowledge, skills and understanding required by the AQA specification in a variety of styles and complexities – ranging from simple short-answer questions through to longer essay-style questions.

**The tests could also be used for homework or revision, but their best use is as summative assessments.*

There are a total of 16 tests covering the prescribed specification content for *Paper 2* of the A Level AQA specification – each provided in worksheet format (with answer lines) and a more photocopy-friendly format (without answer lines), to give you flexibility of use.

The majority of tests are worth around 30-40 marks each, so that they can be completed within a single one-hour lesson. One exception is *13. Systematic Approach to Problem Solving* (a project-style assessment combining questions on theory with practical tasks), which you may feel the need to split up into smaller sections.

Example answers are provided for every test. *Note that credit should also be given for any valid responses that are not explicitly included in this resource.*

4.5. Data Representation – Test 1

1. a) Describe the representation of unsigned denary integers in binary fo

.....

.....

b) Fill in the table below with the binary and hexadecimal representations

Denary	Binary	Hexadecim
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

2. Calculate the result of each following binary expressions. Show your wor binary.

a) 0111 + 0010

b) 1011 * 111

3. a) Use the even-parity bit given to state whether an error has occurred
following numbers:

i. 0100101011 parity 1

.....

ii. 010111011 parity 0

.....

iii. 11111111 parity 1

.....

b) Explain how a checksum is used for error detection.

.....

.....

.....

.....

4. a) Explain why it is necessary to sample sounds when recording them to a

.....

.....

.....

b) Explain the difference between .wav, .midi and .mp3 files for storing

.....

.....

.....

.....

.....

c) Explain the difference between lossy and lossless compression for so
resulting file size and quality of the resulting file. Which form will m
more suitable for internet?

.....

.....

.....

.....

.....

5. a) Convert the following unsigned binary numbers into denary.

i. 01100110

ii. 10111001

iii. 11000101

b) Convert the following denary numbers into 8-bit unsigned binary.

i. 78

ii. 123

iii. 228

c) Convert the following 8-bit two's complement binary numbers into d

i. 00101101

ii. 10100111

iii. 11111111

d) Convert the following binary fractions into denary decimal numbers.

i. 0100.1100

ii. 0011.1110

ii. 1011.1001

6. Run-length encoding is a form of lossless compression. A simple way of
encoded data is as a series of pairs of bytes, with the first byte in each pa
the second byte in each pair representing the number of times the charac

Example: "HHHEEEELLLLOOOOOOOO" would be encoded as ['H', 3, 'E', 4,

a) Encode the string "GGOOOOODDBYYYEEEEE" using the format descr

b) Run-length encoding on its own does not compress text well. Give a
compression that is better suited to compressing text and describe h

.....

.....

.....

.....

.....

.....

4.5. Data Representation – Test 2

1. The following questions should be carried out without using a calculator.

   a) Convert 204 (base 10) to binary and hexadecimal.

      i. Binary:

      ii. Hex:

   b) Convert 11000111 (base 2) to denary and hexadecimal.

      i. Binary:

      ii. Hex:

   c) Convert E7 (base 16) to denary and binary.

      i. Binary:

      ii. Hex:

   d) What is $\frac{3}{16}$ in two's complement notation?

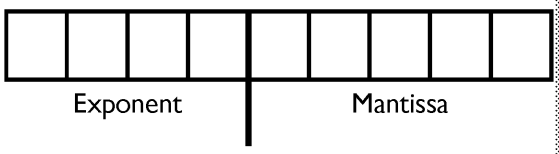
   .....

   e) If 1100.1100 is a two's complement fraction, what is it in denary?

   .....

   .....

f) Binary fractions can be inaccurate. To demonstrate this use a binary flo
complement exponent 4-bits wide and a two's complement mantissa 5
number 1.4. Explain how this inaccuracy could be reduced and any furt



.....

.....

.....

2. ASCII ic e are both methods of storing characters in a computer

a) Knowing that A is character 65 (base 10) in the ASCII table, give the A
letters:

i. F .....

ii. M .....

iii. X .....

b) How many ASCII characters are in the following phrase? Explain hov

I love AQA Computer Science

.....

.....

.....

c) The ASCII code for the letter 'E' is 100 0101. State the ASCII binary fo

.....

d) Give an advantage of ASCII over Unicode.

.....

.....

e) Gi dvantage of Unicode over ASCII.

.....

.....

f) How many characters can 7-bit ASCII represent?

.....

3. a) Using an example, describe how bit patterns may represent other for
sound.

.....

.....

.....

b) You are given a photo which has a resolution of 640 pixels by 480 pi
Assuming the file is a simple raw bitmap (i.e. it contains no header or
colour depth of the photo (show your working)

c) You are designing a logo for a new website. Part of the logo is made
Explain, giving reasons, why you should use bitmap rather than vecto
As part of your answer you should explain the differences between th

.....

.....

.....

.....

.....

d) Give examples of two pieces of information typically found in the meta

1..... 2.....

4. Encryption is incredibly important in the modern age. Two popular meth
Cipher and the Vernam Cipher.

a) Encrypt the phrase 'I love computing' using the Caesar Cipher and a

b) Decrypt th 'kwux akq zwksa' using the Caesar Cipher and a k

c) Give two disadvantages of a standard Caesar cipher as a method of e

.....

.....

d) The Vernam Cipher is highly regarded – why is that?

.....

.....

e) Explain how the Vernam Cipher works. You may assume a computer and binary is being used to represent each character.

.....

.....

.....

.....

.....

.....

f) Aside from keeping the key text safe and secure, what other two rules the security of this Vernam Cipher?

1.....

.....

2.....

.....

4.6. Computer Systems – Test 1

1. Identify which of the following are hardware and which are software?
   a) Hard disk

   .....

   b) Windows operating system

   .....

   c) A graphics card

   .....

   d) Monitor

   .....

2. List **five** different programming languages, indicating what each is genera
   (Note that no marks will be gained if you only list the name of the langua

   1 .....

   2 .....

   3 .....

   4 .....

   5 .....

3. a) What is the difference between imperative and declarative language

   .....

   .....

   .....

   b) Broadly speaking, there are five generati[illegible]omputer language.
   generations are machine depend[illegible]a[illegible]vity.

   .....

   .....

   .....

   .....

   .....

c) Which level does assembly language fall under?

.....

d) Here is an extract from a programming language. What level of lang
limitations does this level of language offer?

```
FD  71  431F    4153
F3  63  4267    4321
96  F0  426D
F9  10  41F3    438A
47  40  40DA
47  F0  4050
```

.....

.....

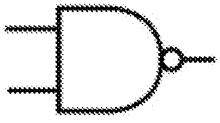
.....

.....

.....

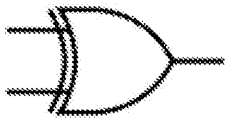
4. a) What are the functions of the following logic gates?

i.



.....

ii.



.....

b) What are the results of the following Boolean algebra equations?

i. 0 + 1 + 1 + 0

ii. 1 . 0

iii. (0 + 0 + 0) + (0 + (1 . 1))

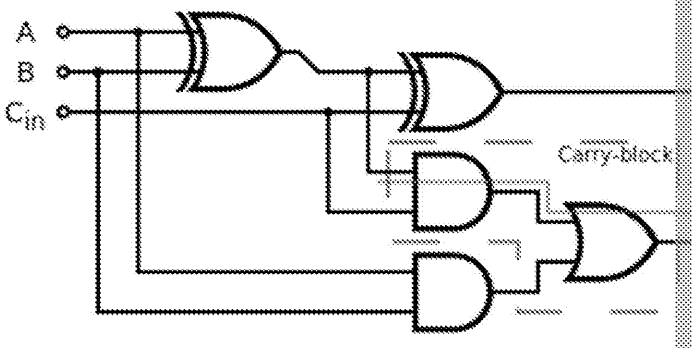
c) Construct the logic circuit that represents the following expression:

$$Q = ((A \cdot B) \oplus C)$$

5. a) What is an adder circuit used for?

.....

b) Does the following image represent a full adder or half adder?



.....

c) Draw the other type of adder circuit not shown in part b).

d) D-type flip-flops can be used in memory. Explain what the 'D' repres

.....

.....

4.6. Computer Systems – Test 2

1. a) Briefly explain, using an example for each, the difference between sy
application software.

.....

.....

.....

.....

.....

.....

b) Say for each of the following whether they are application- or system

i. Unix

.....

ii. Word processor

.....

iii. Virus scanner

.....

iv. Computer game

.....

2. You are working as a project manager for a company. Describe *four* diffe
when selecting a programming language for a major project to be writte
a good working knowledge of all languages.

1 .....

.....

2 .....

.....

3 .....

.....

4 .....

.....

3. Name and briefly describe the three different types of translator program

Type: .....

Description: .....

.....

Type: .....

Description: .....

.....

Type: .....

Description: .....

.....

4. a) Describe the function of applying the following logical operators to a

i. NOT

.....

ii. OR

.....

b) Complete the following truth table for the XOR operator.

Condition A	Condition B	A XC
True	True	
True		Tru
	True	Tru
False	False	

5. a) What are the two De Morgan's laws?

1.....

2.....

b) Wh[illegible] De Morgan's laws important in designing circuit boards?

.....

.....

c) Show that one of these laws is consistent by producing the truth table

A	B	A AND B	NOT (A AND B)

A	B	NOT A	NOT B	NOT A OR NOT B

4.7. Computer Organisation and Architecture

1. Explain, using an example, what is meant by a 'peripheral'.

.....

.....

.....

2. A motherboard is often referred to as the 'heart' of the computer system. and electricity around the computer system to the various components, i does with blood in the body.

   a) Name three hardware components that can be physically connected

   1. .....

   2. .....

   3. .....

   b) Give three technological factors to consider when choosing a motherb

   1. .....

   2. .....

   3. .....

3. a) Briefly explain the functional role of each of the following.

   i. CPU

   .....

   .....

   ii. ROM

   .....

   .....

   iii. RAM

   .....

   .....

   b) What does the ALU (Arithmetic Logic Unit) do?

   .....

   .....

   .....

c) Modern computers often contain chips with multiple cores. Explain w
cores' and describe two scenarios where increasing the number of co
performance of a system.

.....

.....

.....

.....

.....

.....

4. Explain the diff[illegible] between a Von Neumann architecture and a Harva
archit[illegible] give an example of an application the architecture is typically

.....

.....

.....

.....

.....

.....

5. Name three basic-assembly / machine-code instructions and briefly desc

Instruction: .....

Description: .....

.....

Instruction: .....

Description: .....

.....

Instruction: .....

Descri[illegible] .....

.....

6. The financial sector requires robust backup systems that can be relied up company has been offered two alternative configurations – one containin other containing a traditional hard disk drive. Give two reasons why a so over the hard disk drive.

1 .....

.....

2 .....

.....

7. Explain, with reasoning, each st... ...etch–Execute Cycle in detail.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

4.7. Computer Organisation and Architecture –

1. a) Explain why RAM is primary storage and a hard disk is secondary sto

.....

.....

.....

b) Explain the concept of 'addressable memory'.

.....

.....

.....

2. Fill in the missing details on the following:

Name	Role
Data bus	
	Carries the details that are required in order to keep oper at the correct time
Address bus	

3. Explain how the following can affect the performance of a processor.

a) Clock speed

.....

.....

.....

b) Word length

.....

.....

.....

4. Use the following list of machine-code instructions to answer the next tw

`LDR Rd, <memory ref>`	Load the value stored in the memory `<memory ref>` into register `d`.
`STR Rd, <memory ref>`	Store the value that is in register `d` int `<memory ref>`.
`ADD Rd, Rn, <operand2>`	Add the value specified in `<operand2>` store the result in register `d`.
`SUB Rd, Rn, <operand2>`	Subtract the value specified by `<oper` and store the result in register `d`.
`MOV Rd, <operand2>`	Copy th[illegible] pecified by `<operand`
`CMP Rn, <operand2>`	[illegible]are the value stored in register `<operand2>`.
`B <label>`	Always branch to the instruction at po
`B<condition> <label>`	Conditionally branch to the instructio program if the last comparison met th `<condition>`. Possible values for `<c` • EQ: Equal to. • NE: Not equal to. • GT: Greater than. • LT: Less than.
`AND Rd, Rn, <operand2>`	Perform a bitwise logical AND operati and the value specified by `<operand2`
`ORR Rd, Rn, <operand2>`	Perform a bitwise logical OR operatio and the value specified by `<operand2`
`EOR Rd, Rn, <operand2>`	Perform a bitwise logical exclusive or value in register `n` and the value speci result in register `d`.
`MVN Rd, <operand2>`	Perform a bitwise logical NOT operat `<operand2>` and store the result in
`LSL Rd, Rn, <operand2>`	Logically shift left the value stored in r specified by `<operand2>` and store t
`LSR Rd, Rn, <operand2>`	Logically shift right the value stored in specified by `<operand2>` and store t
`HALT`	Stops the execu[illegible] of the program.

a) Explain what 'immedi[illegible]ng' is and show how immediate ad example that [illegible] instruction.

.....

.....

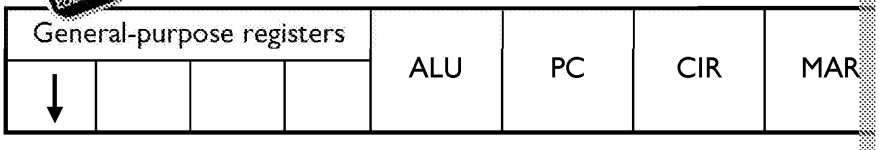
Example: .....

b) Consider the following code written in a high-level language:

```
IF X < 7
   THEN B ← 15
END IF
```

Write a sequence of assembly-language instructions that would perform
program code above. Assume that register R1 currently stores the value
stores the value currently associated with B and that register R3 is availab

5) This d sl ws memory used by the processor.



M

What do the following abbreviations stand for?

a) PC .....

b) CIR .....

c) MAR .....

d) MBR.....

6. Common secondary storage devices used by computers include hard disk
solid state drives (SSD).

Give one advantage and one disadvantage for each type.

Storage Device	Advantage	
HDD		
Optical discs		
SSD		

7. A school is considering changing from using paper registers to storing all computer.

   a) Briefly describe two technologies that could be used to help enter da

   1.....

   .....

   2.....

   .....

   b) Outline the potential advantages and disadvantages of storing the in than in a register.

   .....

   .....

   .....

   .....

   .....

   .....

8. Some computer systems allow processes to put themselves to sleep for a can use this functionality to add a delay between function calls. For exam '...' every 60 seconds:

```
WHILE TRUE
    SLEEP(60)
    PRINT("...")
ENDWHILE
```

   Explain how interrupts could be used to implement this `sleep(n)` system c contains a programmable circuit that can raise an interrupt after a given peri that your system can cope with situations where the timer circuit raises an in

   .....

   .....

   .....

   .....

   .....

   .....

   .....

   .....

4.8. Consequences of Uses of Computing – Te

1. a) Define the term 'hacking'.

.....

b) Describe what is meant by the terms 'black hat hacker' and 'white ha
why each of these does what they do.

.....

.....

.....

.....

.....

.....

2. Developments in Computer Science have led to the use of drones in warf
use of drones.

You may wish to consider areas such as their accuracy, alternatives, the le
cost of engagement.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

3. There has been a huge push in recent years in the development of comm
software by companies such as Google, Facebook and Apple.

If a human is shown two pictures, they will be able to identify with an acc
the same person is shown in both pictures. Facebook has developed an a
97.25%.

Discuss the uses of this technology and any ethical issues surrounding its

You may wish to consider what the technology would be used for, privacy
information and the impact of wearable technology.

4.8. Consequences of Uses of Computing – Te

1. a) Peer-to-peer networks are frequently used to share files on the Inter

   i. Explain what a peer-to-peer network is.

   .....

   .....

   ii. Give two reasons why peer-to-peer networks are more popular networks for distributing pirated videos.

   .....

   .....

   .....

   b) Ex hat digital rights management (DRM) is.

   .....

   .....

   c) Give four ways DRM might restrict the way a video file can be used.

   .....

   .....

   .....

   .....

2. Robots have long been used in manufacturing facilities; however, until re significant impact in other industries.

   a) Explain why it is easier to make a robot that works on an assembly li a robot that cleans someone's house.

   .....

   .....

   .....

   b) Robots are now comm y u in distribution warehouses, picking customers. De e advantages and two disadvantages of usin

   .....

   .....

   .....

   .....

   .....

   .....

c) Self-driving cars have huge potential to change the way people trave
legislators with a number of challenges. Describe two challenges tha
overcome before self-driving cars can become commonplace.

.....

.....

.....

3. In January 2015 the British Prime Minister David Cameron announced nev
the use of strong forms of encryption. He said:

*'Are we going to allow a means of communication which it simply isn't pos
question is no, we must*

Discuss the advantages and disadvantages of having strong forms of enc
membe the public. Provide examples of the sorts of communication
encrypt for positive or negative reasons.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

4. 'According to a well-written and thorough article in the *Virginia Journal o*
been saying for over three years has been determined to be true: WarDriv

In September 2004, this statement was written by Marius Milner. Marius
developed NetStumbler, which is a tool used to map Wi-Fi networks usin
process is known as 'WarDriving'.

Marius Milner also worked for Google and his code for gathering this info
the street-view cars which were used to gather data on mapping network
from open networks as street-view information was being gathered.

Discuss the ethics and legality of WarDriving. Y[illegible]ay wish to consider h
WarDriving yourself, what information c[illegible]gathered, what the end g
information, what happens to t[illegible]ation later, and where it is stored

Preview of Questions Ends Here

4.9. Communication and Networking – Test 1

1. a) i. A serial connection is one where only one bit can be sent at a time.

   ii. A parallel connection is one where multiple bits are sent simultaneo

   b) Serial would be a better choice because in a long-distance parallel cable signal meaning that data transmission has to be slowed right down (1). T cable also means that it costs significantly more (1).

2. a) i. Asynchronous transmission is transmission without a shared clock b

   ii. Start and stop bits. These mark the beginning and end of a transmi synchronise with the transmitter.

   b) Two of the following three description p[illegible]wed by the advantage
   Synchronous transmission uses [illegible]g stream or block to send the
   The data is sent one bit [illegible]er the other so there are no gaps in t
   There are no 'start [illegible] stop bits'
   Adv[illegible]ransmission because fewer bits have to be transmitt

3. a) Cl[illegible]erver networking uses a computer known as a server to provide requests to the server and the server responds.

   b) Peer-to-peer networking is where there is no central computer taking o computers communicate directly with each other on an equal footing.

   c) Internetworking is where multiple networks are joined together with rou

4. a) A gateway is a device which converts between two different types of net example, it is required in order to convert between the ADSL/cable conn Ethernet system used in the local network (1 mark).

   b) i. A router passes packets to destinations outside of the local networ packets from other routers to the appropriate computer on the loca communication to computers that the user's computers are not dir

   ii. The Wi-Fi standard is faster and has a longer range than Bluetooth, Internet and local network access. Wi-Fi means that the network ca of the physical boundaries of a property meaning that it needs to b using the most appropriate technology.

   c) Any IP address in the range 192.168.1.2–192.168.1.254 such as 192.168.1

   d) *This would be a banded question.*

Level	Description
3	A detailed, coherent, description of the basic mechanism t good level of understanding. To s[illegible]ix marks, either the the basic mechanism must be [illegible]rehensive, or there ma minor errors or o[illegible]s in the description of the basic m these ar[illegible]ted for by also describing some aspec [illegible] mechanism.
2	[illegible]adequate description, including at least three points fr below. Some aspects of the basic mechanism may be miss description is logically organised so that it makes sense w whole and therefore demonstrates a reasonable understa system works.
1	A small number of relevant points.

Indicative content

Basic mechanism:

- computer monitors/listens for (data signal)
- if (data) signal present / another transmission in progress then co
- when no (data) signal present start to transmit
- wait to receive acknowledgement packet (to confirm data receive
- if no acknowledgement received (within reasonable time period) t
  - wait a random time period
  - then retransmit

CTS/RTS (if implemented):

- before starting to transmit, computer sen[illegible] equest to Send (R
- access point will respond with a Clear to Send (CTS) signal to only
- only the computer that r[illegible] the CTS signal will transmit

Back-off mecha[illegible]:

- [illegible]ait[illegible] period is random to reduce likelihood of two computers t
- [illegible]ait / to reduce likelihood of another collision
- [illegible] a collision occurs again then wait a longer random time before
- use of exponential back-off algorithm to determine wait time

4.9. Communication and Networking – Test 2

1. a) 2 bits per signal change

   b) i. An even parity bit is appended to a bit pattern (1). If the bit pattern the parity bit will be 1, else it will be 0. This means that the final bit bit) will always have an even number of 1s (1). If a bit pattern arrive the bit pattern must have been corrupted (1).

   ii. No

   iii. Can only guarantee detection when there is an odd number of erro then the bit pattern will still pass the error-detection check.

   c) This means that it takes a small amount of time for 1 bit to go from one

2. a) A thin client is a low performance computer designed to do minimal pro most processing tasks.

   b) The advantages are that resources can be used more efficiently since us sporadically rather than constantly and most maintenance is server base be updated without user intervention (1). On the downside, the server m and slow everyone using it down. It is also a sing[illegible]oint of failure unles thought through and implemented (1).

   c) A web service is a server app[illegible]tio[illegible]which gives clients' applications inf updated with dyna[illegible]onte[illegible]which they could not otherwise get, for

3. a) A [illegible]l i[illegible]ther a piece of software or a piece of hardware which sits b (o[illegible]network connection) and filters incoming packets. Malicious or should be rejected by the firewall so they can't affect the computer.

   b) Packet filtering – When using the packet-filtering method, the firewall w from the Internet and will then use a set of rules to filter those packets. This set of rules will be used to determine whether or not the packet is a Proxy server – Proxy servers act as a barrier to stop the users on a privat with a computer that hosts a web page on the Internet.
   The proxy server requests the information from the web server and then private network.

c) A virus is a small computer program (attached to another file or piece o
damage or harm to the target computer system.
The first thing that will be done when the program is executed is it will c
then hide itself to help prevent detection.
After being copied to the local disk the virus can reside in memory and r
carries out the intended disruption/damage, e.g. displaying messages to
corrupting files or wiping/formatting the entire hard disk.

d) A worm is a program designed to copy/replicate itself to spread across a
Internet.
A worm is a complete program as opposed to a virus which gets attache
run and travel without any human action.

e) The Trojan will appear to be a useful software application but will actuall
run on your computer.
Trojans, therefore, are usually spread because they trick the user into runnin
software or file from a trustworthy source.
Trojans do not spread by infecting other files and they do not self-replica
be detected trojans and viruses or worms.

4. a) *1 mark for naming each of the following:*
   - Authentication – This means verifying that someone is who they cla
   person, however, it could be a computer). A username and passwor
   - Authorisation – This means only giving access to the things which a
   For example, online shoppers should not have the ability to change
   - Accounting – This means keeping a record of who did what, when a
   security to be identified.
   - Accept any other correct/reasonable measures.

   b) *2 marks per section – 1 mark for a section where a good but incomplete u
   demonstrated.*

   Each party in using a public/private key encryption scheme has two keys
   them, and a public key, which is freely available. These keys are related t
   decode messages encoded by the public key and the public key can dec
   private key. Importantly, however, the public key cannot be used to dec
   and the same goes for the private key. To send an encrypted message to
   will encode the message using the public key of the receiver. Only the c
   to decode the message and so only they can decode it. [2]

   Digital certificates are an extra layer of authentication. They are used to
   claim to be. They are issued by certification authorities which are trusted
   public key of the sender. [2]

   Digital signatures are appended to a message by the sender. A hash is t
   using the sender's private key. The receiver appends the signature to the m
   thing using the receiver's public key. The receiver then decrypts the mes
   using the public key of the sender (verified using a digital certificate) de
   generates a hash from the data and compare it to the one decoded from

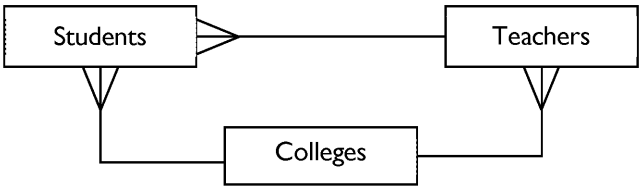
5. *1 mark per valid feature, advantage and disadvantage for each type, e.g.:*
Bus: topology where all the devices are connected together using a single co
They require less cabling and do not require a central server/switch, potentia
However, only one device can transmit at once and conflicts may occur maki

Star: topology where all the devices are connected directly to a central server
general (1). However, if the central server/switch breaks then the entire netwo
less resilient (1). It is, however, easier to track down errors with star networks,
secure since all the devices on the network can 'see' the data being transmitt

4.10. Databases – Test 1

1. a) One to many

b)



2. a) A primary key is an attribute which uniquely defines a tuple/row.
   b) A foreign key is an attribute which is found in m[illegible]e tables. It must be tables.
   c) A composite key is a primary k[illegible] up of multiple attributes, used w enough to uniquely ID a tuple

3. a) i. [illegible]ea[illegible]able called *users* in the database *db* with the fields *User word*.
   It sets the primary key and unique index of the new table to be *Use*
   ii. Last names can be the same between different people. The primary

   b) i. Selects the whole table *users*
   ii. Selects the *UserName* and *Password* fields from *users*
   Displays them in descending order by *UserName*
   iii. Selects the *UserName* and *LastName* of the person with the *UserNa*

4. a) *1 mark for the table name outside the brackets and 1 mark for the correct*
   Players(PID, GivenName, Surname, Character, Level, Race, Items)

   b) Database normalisation minimises repetition and ensures that all the att another. This avoids, for example, the need to update multiple database attribute, which reduces the chance of mistakes creeping in.

   c) *All three entities must be present for full marks. 1 mark for each entity with one table having the correct data, 1 mark for all three tables having the co for alternate ways of representing the solution (e.g. entity definitions) or al*

PID	GivenName	Surname
001	Alan	Smith
002	Yvette	Jones
003	Ibrahīm	Hassan
004	Lili	Yu

PID	Character	Level	Race
001	Alzabeck	32	[illegible]
002	Thornzc[illegible]	[illegible]	Dwarf
00[illegible]	Tey[illegible]	12	Dwarf
[illegible]	xethorn	6	Human
00[illegible]	Tamto	24	Elf

Character	Items
Alzabeck	Potion
Alzabeck	Armour
Alzabeck	Axe
Thornzor	Armour
Tey[illegible]or	Sword
Teylar	Staff
Teylar	Potion
Axethorn	Axe
Axethorn	Horse
Tamto	Potion
Tamto	Horse

4.10. Databases – Test 2

1. a) *Table names can vary from the suggestions below but should be sensible.*
1 mark for each of the three tables with an extra mark for correctly having the Order table for the relationships
Order(OrderNum, CustNum, StockNum, OrderDate, OrderTime, Dispatch
Customers(CustNum, Title, FirstName, Surname, Address, PostCode)
Stock(StockNum, StockName, Price, Manufacturer)

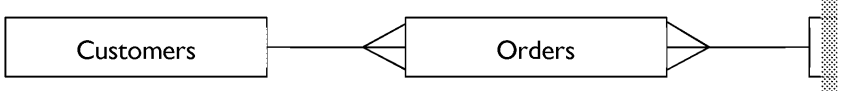
b) i. *All primary keys must be present to get the mark and must match th*
Don't penalise twice for mistakes in part a).
OrderNum, CustNum, StockNum

ii. A primary key is an attribute which uniquely identifies a tuple/row.

iii. *Both foreign keys must be present to get the mark and must match t*
Don't penalise twice for mistakes in part a).
CustNum and StockNum in the Orders table

iv. A foreign key is an attribute which is found in multiple tables. It mu
tables.

c) *1 mark for all tables being present*
1 mark for the correct ordering and connections between them
1 mark for identifying the one–many relationships
Tables may differ from below but must match pupil's answer for part a).



d) *1 mark for all fields being defined in each table*
1 mark for a sensible Data Type and Format for each field
1 mark for sensible Validation Rules / Input Masks / Default Values used
1 mark for correct identification of keys
The items below are suggestions only – any logical answers can gain cred
Tables must match the pupil's earlier database format.

Customer Table

Field	Data Type	Format	Validation Rule / Input
CustNum	AutoNumber		"CUST"00000
Title	Text	Length = 4	
FirstName	Text	Length = 15	
Surname	Text	Length = 15	
Address	Text	Length = 30	
PostCode	Text	Length =	LL09 0LL

Stock Table

Field	Data Type	Format	Validation Rule / Input
StockNum	AutoNumber		"STCK"00000
StockName	Text	Length = 25	
Price	Currency	£0.00	Default: 0 Validation: >=0
Manufacturer	Text	Length = 25	

Order Table

Field	Data Type	Format	Validation Rule / Input M
OrderNum	AutoNumber		"ORDR"00000
CustNum	Number	Long Integer	
StockNum	Number	Long Integer	
OrderDate	Date/Time	Short Date	Default: Now() Validation: <=Date()
OrderTime	Date/Time	Short Time	Default: Now() Validation: <=Now()
Dispatched	Yes/No		

e) i. SELECT * FROM Stock

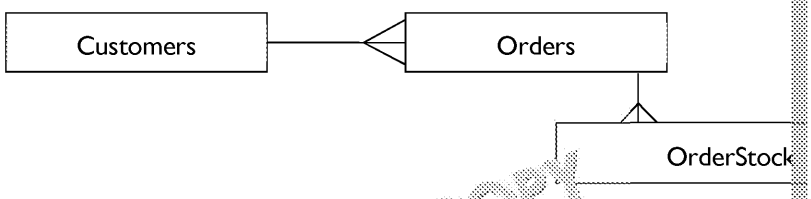
ii. *1 mark for the correct table being used*
1 mark for ordering by surname
SELECT FirstName, Surname, PostCode FROM Customers ORDER

iii. *1 mark for correct fields and table used*
1 mark for correct criteria of the search
1 mark for correct sorting
SELECT OrderNum, OrderDate, OrderTime FROM Orders WHERE Di
OrderDate ASC

f) i. *1 mark for the problem and 1 mark for the knock-on effect*
An order can only have one item of stock assigned to it.
So if a customer wants to buy more than one thing, several entries
created.

ii. *1 mark for identifying a fourth table could be created*
1 mark for further explanation
Create a fourth table
That can store multiple entries of StockNum for the same OrderNu

iii. *1 mark for link between Orders and Stock being broken*
1 mark for new table added with sensible name
1 mark for correct one–many relationship between Orders and new t
1 mark for correct one–many relationship between Stock and new ta



4.11. Big Data – Test 1

1. a) *1 mark for each de... for a 1 mark for a further expansion*
Velocity – ... that data is required with response times needing t
m...
Va... the data can be in a variety of formats, including structured, un
multimedia

b) If the data isn't structured it becomes a lot more difficult to analyse.
Relational databases would usually be used to store huge amounts of da
suitable as a lot of this data can't be stored in columns and rows.

c) It is a problem because relational databases do not scale well across mu
Functional programming provides a solution because it makes it easier t
distributed code.

d) *1 mark for a relevant advancement and 1 mark for further expansion*
Accept any relevant technology that requires/creates huge amounts of da
and exchanging data with very fast response times being required, e.g.

- Smartphones – constantly connected with data constantly being sent tracking whereabouts (using GPS/location data) and usage statistics
- Networked sensors – sensors being used in industry, gathering inform data needs to be stored and organised so that it can be used properl
- CCTV – huge volumes of video footage is being collected all of the ti that it can be used effectively

e) *First 2 marks for some explanation of how Big Data contributes to experie*
With the data now being gathered we have a ... of historical data of information will better inform our dec... the future and only ser ability to utilise our 'experient... w...n'.

12 marks then aw... to the table below.

	Description
3	A line of reasoning has been followed to produce a coherent, r substantiated and logically structured response. The response areas indicated in the guidance below and in at least two of th is sufficient detail to show that the student has a good level of of the impact of Big Data. To reach the top of this mark range, understanding must be shown of all three areas.
2	A line of reasoning has been followed to produce a coherent, r substantiated and logically structured response but the respon cover two of the areas indicated in the guidance below.
1	A few relevant points have been made but there is no evidence reasoning has been followed. The points may only relate to on four areas from the guidance or may be made in a superficial v substantiation.

Indicative content:
Any sensible suggestions that involve huge volumes of data being gathere decisions, processes or strategies are creditworthy.

Agriculture

- Data being gathered on cultivation techniques and how they can be huge volume of data on the success and statistics of different metho
- Benefits of this could be increased levels of food production with an hunger/starvation around the world and cheaper food.

Medicine

- An indication of data regarding p... ts, ...sses, cures and sympto
- Coordination of historical d... ...scover new trends and links betw successful cures ...
- Linking th... ...to improved training of doctors, medical guidelin ... s...ems for improved diagnosis

Ind... (can be an industrial or a business example)

- Data gathered on an industrial stage is massive – a jet engine will ge example. This data can be used to affect the manufacturing process a efficiency of different industrial processes
- Historical data to feed into cost v quality, sales patterns, industrial tec (both efficiency on the industrial level and coordinating with data re down the line)
- Can improve industrial techniques, advertising and marketing strateg streamline business

4.11. Big Data – Test 2

1. a) A higher-order function is a function that takes one or more functions a
   b) No side effects / state (1), data is immutable so source data cannot b

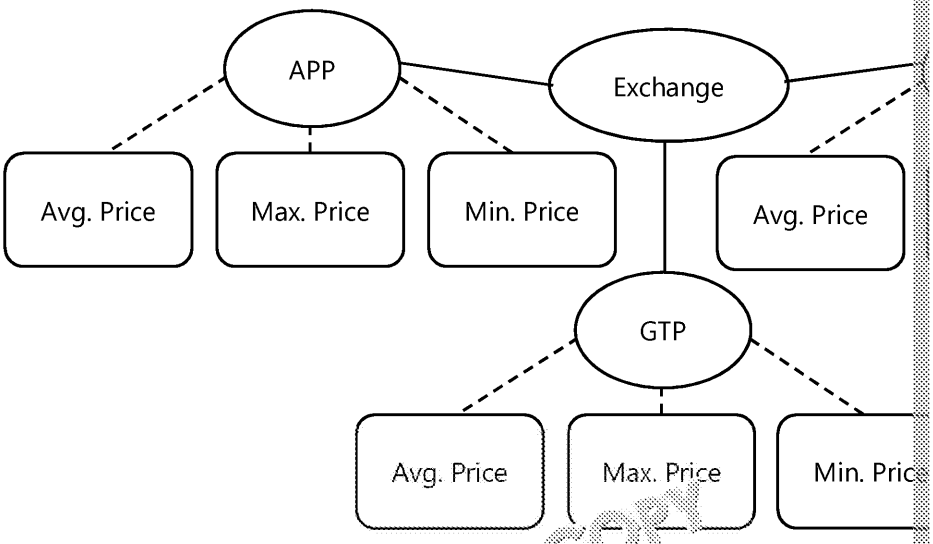
2. a) A model where data is divided into the smallest possible (1) meaningful
   b) Any timestamp, stock name and individual price, e.g.: 612090, MGX has
   c) Graph schema model entities as nodes (1) with properties (1) and edges
   d) A graph similar to the following (1 mark for nodes, 1 for properties and

3 *1 mark for the explanation of each technology, max 3 marks.*
1 mark for referencing a lack of structure in the data
1 mark for referencing the issue with relational databases not being suitable

Accept any relevant expansion of the use of the technology, e.g.

- Smartphones – constantly connected with data constantly being sent an tracking wh[illegible]ts (using GPS/location data) and usage statistics
- N[illegible]ed sensors – sensors being used in industry, gathering informat ne[illegible]be stored and organised so that it can be used properly with d
- CCTV – huge volumes of video footage is being collected all of the time it can be used effectively

If the data isn't structured it becomes a lot more difficult to analyse.
Relational databases would usually be used to store huge amounts of data b a lot of this data can't be stored in columns and rows.



e) Each stock exchang[illegible]ould be a node (1) with an edge to each stock representi[illegible]ices of each stock would need to be modified to i e.[illegible]e that they relate to (1)

4. *12 marks awarded from the table below.*

Level	Description
3	A line of reasoning has been followed to produce a coherent, r substantiated and logically structured response. The response c areas indicated in the guidance below and in at least two of the sufficient detail to show that the student has a good level of ur the impact of Big Data. To reach the top of this mark range, a g understanding must be shown of all three areas.
2	A line of reasoning has been followed to produce a coherent, r substantiated and logically structured response but the respon cover two of the areas indicated in the guidance below.
1	A few relevant points have been made but there is no evidence reasoning has been followed. The points may only relate to one four areas from the guidance or may be made in a superficial w substantiated.

Indicative content:
Students should identify the types of data that could be collected and how they

Data that could be collected from users' search requests includes:
- Most frequent search requests – more valuable for ads
- Advertising-link clicks – more valuable search term for ads or better ad
- Search-result clicks – good search result
- Last search result clicked in session – best search result
- More than one page of results looked through – links on the first page ma
- Search terms that match certain demographic – target ads at that demogr
- Geographic data – tailor search results to a region, e.g. a French site is like than in the UK

Data that could be collected by trawling websites includes:
- Information on the number of times a website is linked to (PageRank)
- The number of pages that make up a website
- The number of images on a website
- The last time a website changed

A good answer will make reference to the use of machine learning to slowly ad algorithms. Students could also discuss the use of experimentation to gather da best suit a particular search request.

4.12. Functional Programming

1. a) *1 mark for the Head and 1 mark for the Tail*

Head	2
Tail	[4, 6, 8 ,10]

b) *1 mark for c[illegible]g output and 1 mark for the correct list*
[4, 6, 8, 10]

c) *1 mark per point*
Explaining that map applies the function double to each list element
Explaining that map applies double to the head of the list
And then a recursive call is made on the tail of the list

2. a) *1 mark per point*
The filter function processes a data structure/list
And produces a new data structure/list
Of values from the original structure that satisfy a criteria / for which a g returns a true value

b) *1 mark for a list being output and 1 mark for the correct list*
[2, 4, 6, 8, 10]

c) [1, 3, 5, 7, 9]

3. a) *1 mark per point*
This is functional composition.
It combines two functions to get a new function.

b) *1 mark for the domain and 1 for the codomain*

Domain	A
Codomain	C

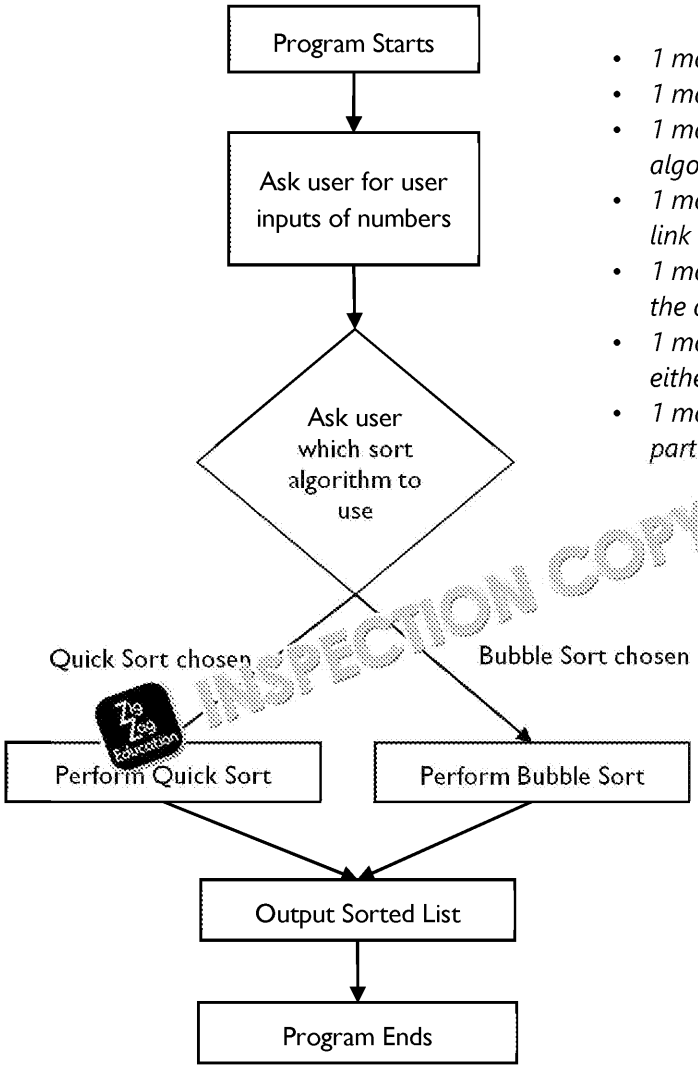
c) $g \circ f = (x - 5)^2$

4. a) *1 mark per point*
The fold function [illegible] recursive data structure/list/tree/ hierarchic
Appl[illegible] to each element
B[illegible] passing onto the next element
To [illegible] a final output value

b) *1 mark per point*
The function takes a list of the first n numbers starting from 1 (take n [1.
Then find their product
With 1 as the identity

4.13. Systematic Approach to Problem Solving

1.



- *1 mark for a start and e*
- *1 mark for accepting th*
- *1 mark for a decision el*
  algorithm the user wish
- *1 mark for running a bu*
  link of the flow chart m
- *1 mark for running the*
  the decision – the link c
- *1 mark for outputting t*
  either as it is here or un
- *1 mark for using the co*
  particularly the diamon

2. *1 mark for a Boolean variable to monitor swaps*
1 mark for correct initialising and use of the Boolean variable
1 mark for a loop that loops while swaps are being made
1 mark for a loop inside the previous structure that loops through each el
1 mark for comparing the values of the array to see if the previous elemer
1 mark for swapping if the previous element was higher

```
Swapped ← true
  WHILE swapped = true
    swapped = false
    FOR i ← 1 to length(A) - 1
      IF A[i-1] > A[i] then
        swap(A[i-1], A[i])
        swapped ← true
      ENDIF
    ENDFOR
  ENDWHILE
```

3. Cater i[illegible]he[illegible]e to suit the algorithm chosen, giving credit for flag variabl[illegible] loops b[illegible] the correct location and/or comparison of variables and swap[illegible] As a general indication, 7 marks can be given only for a fully working solutio[illegible] only if there is some attempt at swapping elements in the list.

4. *1 mark for a loop that will carry on until no swaps have been made*
1 mark for a Boolean value/flag being used and reset at the beginning of each
1 mark for an iterative loop that will go through the array
1 mark for correctly swapping elements of the array
1 mark for changing the Boolean value/flag as required

Any working implementation is acceptable

5. *Mark as for Question 4*
5 marks for working procedure or function
–1 mark for each mistake

6. *1 mark for a loop that iterates 10 times and asks for the user's input*
1 mark for the user's input being added correctly to an array A
1 mark for the user being presented with the correct options to select a sorting
1 mark for checking the user's selection and selecting the correct algorithm
1 mark for the array A being passed to the algorithm correctly
1 mark for a mechanism to receive the sorted array
1 mark for printing the sorted array back to the user on screen

7. *1 mark for the name and 1 for the description for two of th[illegible] following*
Direct – you turn off the old system one day a[illegible] ne[illegible]w one on the next
Parallel – you run both systems in their e[illegible]re[illegible]t the same time so that if th[illegible] one to fall back on
Pilot – where you impl[illegible]h whole system in an isolated location (e.g. in[illegible] see how it gets [illegible] works it can be rolled out further

8. *1 mark [illegible] correct list from each algorithm*
0 marks if the output does not match the source code
[5, 10, 26, 31, 43, 55, 73, 82, 92, 104]

9. *1 mark for each type of maintenance and 1 mark for each description*
Corrective – maintenance to fix any bugs/errors that didn't show up during te[illegible]
Adaptive – changing the functionality of the system so that it can adapt to an[illegible] run (e.g. changes in an algorithm required due to a change in the operationa[illegible]
Perfective – updating and improving the program to make it more efficient r[illegible] doesn't work

10. *1 mark for each point below*
When the first iteration of the bubble sort algorithm is complete the, highest
It is, therefore, unnecessary to check this element again on the next iteration
This causes unnecessary processing
For each iteration of the bubble sort, you could reduce n by 1
So that it checks one less element of the array each time

11. *Up to 2 marks for describing a problem and up to 1 marks for a suggestion of h*
Problem: the user could enter data other than integers when asked to enter t
This will lead to the program crashing when comparing the values of the elem
Fix: adding a validation routine when the user enters their data to check they
If they have, then integer is accepted and if they have not, they are asked to re

Preview of Answers Ends Here