

A Level Computer Science

H446/01 Computer systems

Sample Question Paper

Date – Morning/Afternoon

Time allowed: 2 hours 30 minutes



Do not use:

- a calculator



First name										
Last name										
Centre number										
Candidate number										

INSTRUCTIONS

- Use black ink.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION

- The total mark for this paper is **140**.
- The marks for each question are shown in brackets [].
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **24** pages.

Answer **all** questions.

1 A software company decides to release a duplicate file finder which it has named “De-Duplicator”. Duplicate files are files that are exactly the same (bit for bit identical). Space is often wasted on computers by having multiple versions of the same file. Duplicate file finders are programs that find and identify duplicate files on a hard drive so that they can be removed.

(a) A duplicate file finder is an example of a utility. Describe what is meant by a utility.

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.....[2]

(b) De-Duplicator creates a tree to represent directories and files on the system. It then traverses each directory and file represented in the tree. It does this using a depth-first traversal. State what order it will visit each of the **files** as shown in Fig.1 below.

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.....[3]

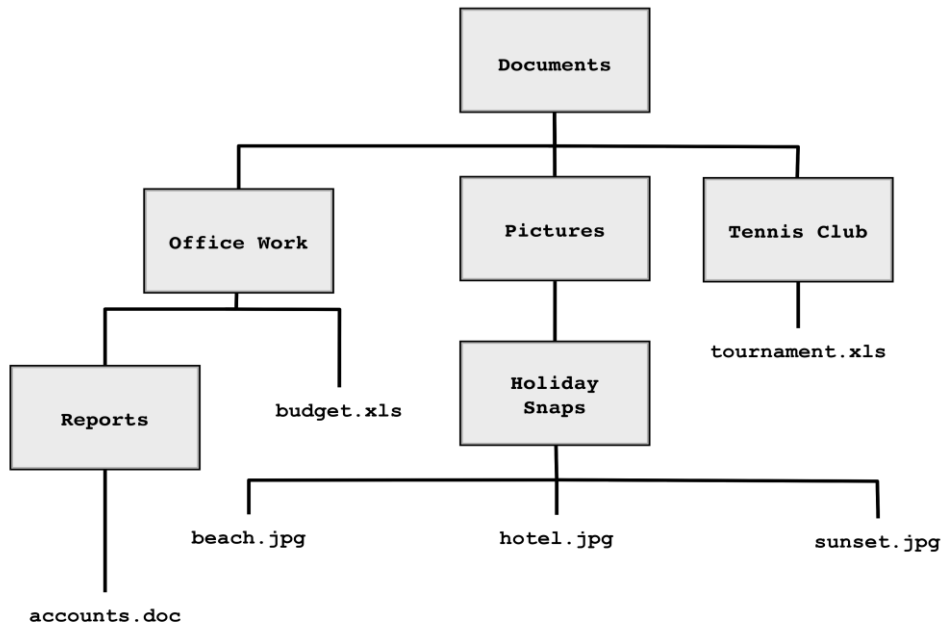


Fig.1

(c) Every time the program encounters a file it takes a hash of the file and checks it against a list. If the hash exists in the list, the file is marked to be deleted. If the hash does not exist it is added to the list.

(i) Explain **two** characteristics you would look for in a hashing algorithm for this purpose.

1.....

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.....[4]

(ii) After running the program a user finds that they still have apparent duplicates of some of their images. Explain why these apparent duplicates might still be present.

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.....[2]

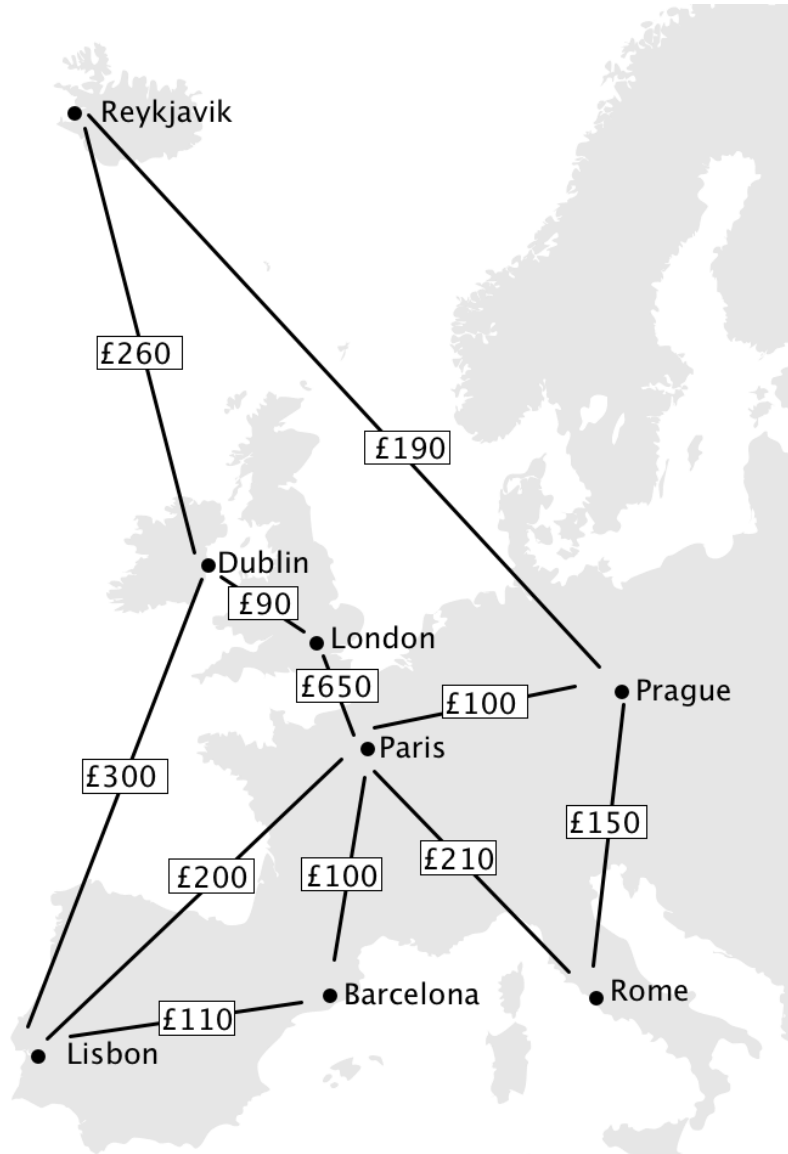
(d)* The software team that produces De-Duplicator decides to make a new version that can detect duplicated images the previous version could not. The software team must decide which methodology they will use for the project. Some members of the team suggest extreme programming whilst others would prefer to use the waterfall lifecycle.

Discuss the **two** methodologies **and** justify which you would recommend.

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.....[12]

- 2 Atlas Airlines runs flights across cities in Europe. It stores the prices of different flights in its computer system.



- (a) State a data structure that would be suited to represent the data above.

.....[1]

(b) A function `tripCost` has been written that takes in two cities and returns the price of a direct flight between them.

e.g. `tripCost("Dublin", "London")` returns 90.

A journey is represented by an array called `cities`. An example of a trip from Dublin to Rome is shown below:

Dublin
London
Paris
Rome

(i) Write a program in the language or pseudocode of your choice that uses the `cities` array to calculate and output the cost of a given journey as a monetary value. In the case above this would be £950.

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.....[5]

(ii) Rather than storing cities in an array you could use a linked list.

Describe a difference between an array and a linked list.

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.....[2]

- 3 The Big Brains exam board has produced a website that allows students to access revision videos.

All pages in the site contain the following tag in the head section.

```
<link href="themes/standard.css" rel="stylesheet" type="text/css" />
```

- (a) Describe **one** advantage of storing the CSS in an external file rather than it being embedded within HTML files.

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[3]

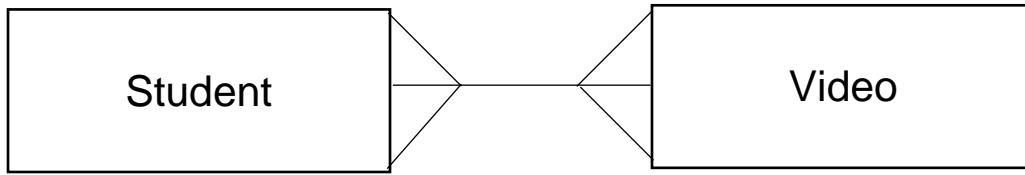
- (b) The exam board wants to limit access to those students with a school email account (i.e. one ending **.sch.uk**). When students sign up JavaScript is used to check that the email address they have entered is from a school account. The address is checked again when it reaches the server before login details are sent to the address.

Explain why it is important to check the email address with JavaScript and again when it reaches the server.

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[3]

- (c) The exam board wants to use a database to keep track of which videos each student has viewed. The structure it plans to use is shown below:



- (i) Identify **one** reason why this structure would not be suitable.

.....
[1]

- (ii) Draw a new version of the structure to solve this problem.

[3]

- (d) The video table consists of the following fields: VideoID, VideoName, Presenter, Topic.

- (i) Describe what is meant by the term *primary key*.

.....

[2]

- (ii) Write an SQL query that finds the name and presenter of all videos on the Topic of "The CPU".

.....

[4]

- 4 Livid Lizards is a computer game in which players get to fire lizards from a cannon to knock down walls. Players get to pick different types of lizards, each with qualities and special powers.

The game is coded using an object-oriented language. Below is the code for the lizard class:

```
class Lizard

    private speed
    private mass
    private size

    public procedure new(givenSpeed, givenMass, givenSize)
        speed=givenSpeed
        mass=givenMass
        size=givenSize
    endprocedure

    public function breakBlock(brick)
        if speed*mass>=brick.getStrength() then
            speed=((speed*mass)-brick.getStrength())/mass;
            return true
        else
            return false
        endif
    endfunction

    ...
    ...
    ...

endclass
```

- (a) Lizard is a class. Describe what is meant by a class.

.....

[2]

- (b) Identify an attribute in the Lizard class.

.....[1]

- (c) (i) Describe what is meant by the term *inheritance*.

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.....[3]

- (ii) Explain **one** way the game’s developers might use inheritance for Livid Lizards.

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.....[3]

- (d) The game uses a 2D graphics library. Explain why a linker would need to be used after compilation.

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.....[3]

- 5 The program, as shown in Fig.2 below, is written in assembly code using the Little Man Computer instruction set. It is *supposed* to take in two numbers and output the higher.

```
INP
STA  NUMA
INP
STA  NUMB
SUB  NUMA
BRP  NOTA
LDA  NUMB
BRA  QUIT
NOTA LDA  NUMA
QUIT OUT
HLT

NUMA DAT
NUMB DAT
```

Fig.2

- (a) State what type of translator program would be needed to convert the code above into machine code.

.....[1]

- (b) The program does not work correctly. Describe what the program actually does, using the numbers 4 and 9 being entered as an example.

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.....[2]

- (c) Explain how you would correct the program so it outputs the higher of the two numbers entered.

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.....[2]

- (d) Programs can also be written in high level languages. In pseudocode write a procedural program that takes in two numbers and outputs the higher of them.

.....

 [4]

A processor executes this program following the Fetch-Decode-Execute cycle. To do this it needs to make use of registers.

One of the registers used is the Program Counter (PC). Ordinarily it would be incremented by one each cycle.

- (e)
 - (i) Identify an instruction in the Little Man Computer program shown in Fig.2 that would cause the PC to change in a different way.
 [1]

- (ii) State which register the contents of the PC would be copied to in order for the processor to access the next instruction.
 [1]

6 People burn calories as they move around. 'FitFeet' trainers come with an attachable device. This device estimates the calories burnt by the user whilst wearing the trainers. Users can then upload this information to their computers.

(a) Describe a sensor that the device might include to help monitor calories burnt.

.....
.....
.....[2]

(b) The device stores its data on flash memory. Explain why flash storage would be more appropriate than a magnetic hard drive for this device.

.....
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.....[3]

(c)* The company wants users to be able to register with its website. Users will provide details such as their weight, height, any allergies and pre-existing medical conditions. The system will use this information along with the data on their calories burnt to recommend meal plans for the user.

Discuss the legal **and** ethical issues the company needs to consider for such a system.

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[9]

7

- (a) Two equal (unsigned) integers, shown below, are added together. Calculate the result, showing your working.

$$\begin{array}{r}
 00010101 \\
 00010101 \quad + \\
 \hline
 \end{array}$$

[2]

- (b) State which bitwise manipulation on 00010101 would have achieved the same result as the calculation on part (a).

.....[1]

- (c) Convert the denary number -52 into an 8-bit binary number using two's complement.

.....

.....

.....[2]

- (d) Describe why two's complement may be preferable to sign and magnitude.

.....

.....

.....[2]

- (e) Using floating point representation with 4 bits for the exponent and 4 bits for the mantissa add together the following floating point binary numbers and write the answer as a normalised floating point number with 4 bits mantissa and 4 bit exponent.

0110 0010 and 0100 0011

.....

.....

.....[3]

- (f) Demonstrate subtraction in binary using 8-bit two's complement using the equivalent of the denary calculation 47-23. You must show all working.

.....

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.....[4]

8 A gaming company decides to release a new video games console. The console will use a modified version of an operating system called Linux.

(a) Describe **two** functions an operating system might be expected to carry out on the console.

1.....
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2.....
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..... [4]

(b) Linux is open-source.

Explain how Linux being open-source would benefit the games company.

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..... [2]

(c) As well as a CPU the console contains a GPU for 3D graphics. Explain why a GPU is more suitable than a CPU for this task.

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..... [3]

(d) Explain **two** reasons why games designed for other companies' consoles may not work on this machine.

1.....

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2.....

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[4]

9 Zuhair wants to create a Local Area Network (LAN) for himself and his family, in his home.

(a) Describe what is meant by a LAN.

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[2]

(b) TCP/IP uses packet switching.

Explain what is meant by packet switching.

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[4]

10 The truth table below has two inputs, A and B, and two outputs, S and C.

INPUTS		OUTPUTS	
A	B	S	C
0	0	0	0
0	1	1	0
1	0	1	0
1	1	0	1

(a)

(i) Write a logic expression for S in terms of A and B.

.....

[1]

(ii) Write a logic expression for C in terms of A and B.

.....

[1]

(iii) Use the expressions for S and C to draw a single logic circuit for the truth table.

[2]

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...day June 2014 – Morning/Afternoon

A Level Computer Science

H446/01 Computer systems

SAMPLE MARK SCHEME

Duration: 2 hours 30 minutes

MAXIMUM MARK 140

This document consists of 32 pages

MARKING INSTRUCTIONS**PREPARATION FOR MARKING****SCORIS**

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal <http://www.rm.com/support/ca>
3. Log-in to scoris and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

TRADITIONAL

Before the Standardisation meeting you must mark at least 10 scripts from several centres. For this preliminary marking you should use **pencil** and follow the **mark scheme**. Bring these **marked scripts** to the meeting.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
 - a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
 - b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.
6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
 - if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
 - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).
8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
If you have any questions or comments for your Team Leader, use telephone, email or the scoris messaging system.
9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. Annotations

Annotation	Meaning

11. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper and its rubrics
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

USING THE MARK SCHEME

Please study this Mark Scheme carefully. The Mark Scheme is an integral part of the process that begins with the setting of the question paper and ends with the awarding of grades. Question papers and Mark Schemes are developed in association with each other so that issues of differentiation and positive achievement can be addressed from the very start.

This Mark Scheme is a working document; it is not exhaustive; it does not provide 'correct' answers. The Mark Scheme can only provide 'best guesses' about how the question will work out, and it is subject to revision after we have looked at a wide range of scripts.

The Examiners' Standardisation Meeting will ensure that the Mark Scheme covers the range of candidates' responses to the questions, and that all Examiners understand and apply the Mark Scheme in the same way. The Mark Scheme will be discussed and amended at the meeting, and administrative procedures will be confirmed. Co-ordination scripts will be issued at the meeting to exemplify aspects of candidates' responses and achievements; the co-ordination scripts then become part of this Mark Scheme.

Before the Standardisation Meeting, you should read and mark in pencil a number of scripts, in order to gain an impression of the range of responses and achievement that may be expected.

In your marking, you will encounter valid responses which are not covered by the Mark Scheme: these responses must be credited. You will encounter answers which fall outside the 'target range' of Bands for the paper which you are marking. Please mark these answers according to the marking criteria.

Please read carefully all the scripts in your allocation and make every effort to look positively for achievement throughout the ability range. Always be prepared to use the full range of marks.

LEVELS OF RESPONSE QUESTIONS:

The indicative content indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.

Using 'best-fit', decide first which set of BAND DESCRIPTORS best describes the overall quality of the answer. Once the band is located, adjust the mark concentrating on features of the answer which make it stronger or weaker following the guidelines for refinement.

- **Highest mark:** If clear evidence of all the qualities in the band descriptors is shown, the HIGHEST Mark should be awarded.
- **Lowest mark:** If the answer shows the candidate to be borderline (i.e. they have achieved all the qualities of the bands below and show limited evidence of meeting the criteria of the band in question) the LOWEST mark should be awarded.
- **Middle mark:** This mark (or marks) should be used for candidates who are secure in the band. They are not 'borderline' but they have only achieved some of the qualities in the band descriptors.

Be prepared to use the full range of marks. Do not reserve (e.g.) high Band 3 marks 'in case' something turns up of a quality you have not yet seen. If an answer gives clear evidence of the qualities described in the band descriptors, reward appropriately.

	AO1	AO2	AO3 - Only AO3.3 is assessed in the external assessment
High (thorough)	Precision in the use of question terminology. Knowledge shown is consistent and well-developed. Clear appreciation of the question from a range of different perspectives making extensive use of acquired knowledge and understanding.	Knowledge and understanding shown is consistently applied to context enabling a logical and sustained argument to develop. Examples used enhance rather than detract from response.	Concerted effort is made to consider all aspects of a system / problem or weigh up both sides to an argument before forming an overall conclusion. Judgements made are based on appropriate and concise arguments that have been developed in response resulting in them being both supported and realistic.
Middle (reasonable)	Awareness of the meaning of the terms in the question. Knowledge is sound and effectively demonstrated. Demands of question understood although at times opportunities to make use of acquired knowledge and	Knowledge and understanding applied to context. Whilst clear evidence that an argument builds and develops through response there are times when opportunities are missed to use an example or relate an aspect of knowledge or understanding to	There is a reasonable attempt to reach a conclusion considering aspects of a system / problem or weighing up both sides of an argument. However the impact of the conclusion is often lessened by a lack of supported judgements which accompany it. This inability to build on and develop lines of argument as

	understanding not always taken.	the context provided.	developed in the response can detract from the overall quality of the response.
Low (basic)	Confusion and inability to deconstruct terminology as used in the question. Knowledge partial and superficial. Focus on question narrow and often one-dimensional.	Inability to apply knowledge and understanding in any sustained way to context resulting in tenuous and unsupported statements being made. Examples if used are for the most part irrelevant and unsubstantiated.	Little or no attempt to prioritise or weigh up factors during course of answer. Conclusion is often dislocated from response and any judgements lack substance due in part to the basic level of argument that has been demonstrated throughout response.

The breakdown of Assessment Objectives for A Level Computer Science:

	Assessment Objectives
AO1	Demonstrate knowledge and understanding of the principles and concepts of computer science, including abstraction, logic, algorithms and data representation.
AO1.1	Demonstrate knowledge of the principles and concepts of abstraction, logic, algorithm, data representation or other as appropriate.
AO1.2	Demonstrate understanding of the principles and concepts of abstraction, logic, algorithm, data representation or other as appropriate.
AO2	Apply knowledge and understanding of the principles and concepts of computer science including to analyse problems in computational terms.
AO2.1	Apply knowledge and understanding of the principles and concepts of computer science.
AO2.2	Analyse problems in computational terms.
AO3	Design, program and evaluate computer systems that solve problems, making reasoned judgements about these and presenting conclusions.
AO3.1	Design computer systems that solve problems.
AO3.2	Program computer systems that solve problems.
AO3.3	Evaluate computer systems that solve problems, making reasoned judgements about these and present conclusions.

Question		Answer	Marks	Guidance
1	(a)	<ul style="list-style-type: none"> A utility performs a specific task (1) and is usually related to the upkeep of the system (1). Examples of a utility include a virus checker (1)/disk defragmenter (1). 	<p>2</p> <p>AO1.1 (2)</p>	Up to 2 marks for a valid description.
	(b)	<ul style="list-style-type: none"> Accounts.doc, budget.xls (1). Followed by beach.jpg, sunset.jpg, hotel.jpg (in any order) (1). Followed by tournament.xls (1). 	<p>3</p> <p>AO2.1 (3)</p>	For 3 marks. If answer includes directory names ignore the directories and just mark order of files.
	(c) (i)	<ul style="list-style-type: none"> Low chance of collision (i.e. different inputs giving same output) (1 – AO1.2) to reduce risk of different files being marked as the same (1 – AO2.1). Quick to calculate (1 – AO1.2) as lots of files need to be hashed/needs to be quicker than a bitwise comparison to make it worthwhile (1 – AO2.1). Provides a smaller output than input (1 – AO1.2) so quicker to compare hashes than original data (1 – AO2.1). 	<p>4</p> <p>AO1.2 (2)</p> <p>AO2.1 (2)</p>	<p>1 mark for each correct identification (AO1.2) up to a maximum of two identifications</p> <p>1 mark for each valid explanation (AO2.1) up to a maximum of two explanations.</p> <p>No credit for function being one way as this serves no benefit in this scenario.</p>
	(ii)	<ul style="list-style-type: none"> Hashing works on the data/bits (1) and so two images may appear the same but not be identical at a bit level (1). This could be because they are different file types (1) / different sizes (1). Even the change of a single bit may result in a completely different hash (1). 	<p>2</p> <p>AO2.1 (2)</p>	Up to 2 marks for a valid explanation. Accept any other sensible examples of changes to images that might not be immediately apparent to someone viewing the image.

Question	Answer	Marks	Guidance
(d)	<p>Mark Band 3–High Level (9-12 marks)</p> <p>The candidate demonstrates a thorough knowledge and understanding of both methodologies; the material is generally accurate and detailed.</p> <p>The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation.</p> <p>The candidate is able to weigh up both sides of the argument which results in a supported and realistic judgment as to which methodology should be used.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p>	<p>12</p> <p>AO1.1 (2)</p> <p>AO1.2 (2)</p> <p>AO2.1 (3)</p> <p>AO3.3 (5)</p>	<p>If only one methodology considered – MAX 6 marks.</p> <p>AO1: Knowledge and Understanding</p> <p>The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive:</p> <ul style="list-style-type: none"> • The waterfall lifecycle involves linear stages whereas XP takes on an agile, iterative approach. • The waterfall lifecycle establishes requirements in early stages and subsequent stages focus on these - new requirements can be adopted throughout XP. • The waterfall lifecycle focuses on the end user at the start and then they may be consulted at different points throughout the project whereas an end user is integral throughout XP. • In the waterfall lifecycle the development phase focuses on code that meets the requirements/design. In XP the quality of the code is an important factor - paired programming helps focus on this. • The waterfall lifecycle although adopted for large projects it can be inflexible and limits changing requirements.

Question	Answer	Marks	Guidance
	<p>Mark Band 2-Mid Level (5-8 marks) The candidate demonstrates reasonable knowledge and understanding of both methodologies; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation. The candidate makes a reasonable attempt to come to a conclusion showing some recognition of influencing factors that would determine which methodology should be used.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and supported by some evidence.</i></p> <p>Mark Band 1-Low Level (1-4 marks) The candidate demonstrates a basic knowledge of methodologies with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.</p> <p>The candidate provides nothing more than an unsupported assertion. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks No attempt to answer the question or response is not worthy of credit.</p>		<p>AO2.1: Application The selected knowledge/examples should be directly related to the specific question.</p> <ul style="list-style-type: none"> • Discussion of how the methodologies would impact upon the choices made regarding abstraction, any pre-conditions and how they are addressed. • Discussion around how the methodologies would impact the order of steps in any procedures and how sub-procedures would be implemented • How the methodologies could potentially affect how decisions and the logic involved are dealt with and how concurrency is dealt with • Discussion of other social factors that affect the use of the different methodologies. <p>AO3.3: Evaluation Having considered the different sides to the argument candidates will need to reach a supported judgment based on the evidence included in their response.</p> <p>There should be no bias in marks as to which methodology is chosen but especially in the top mark band there must be a clear link between the points candidates have made and justification.</p> <p>e.g. The waterfall lifecycle establishes requirements in early stages and subsequent stages focus on these. New requirements can be adopted throughout XP. The requirements in this project are likely to be static making the Waterfall model a more appropriate approach.</p>

Question	Answer	Marks	Guidance
			<p>OR</p> <p>In the waterfall lifecycle the development phase focuses on code that meets the requirements/design. In XP the quality of the code is an important factor. Paired programming helps focus on this.</p> <p>For this utility to be successful it must work more efficiently than its competitors and code developed through XP is more likely to achieve this, therefore XP is a more appropriate approach.</p>

Question		Answer	Marks	Guidance
2	(a)	<ul style="list-style-type: none"> Graph (1). 	<p>1</p> <p>AO1.1 (1)</p>	<p>For 1 mark.</p> <p>Accept 2D array.</p>
	(b) (i)	<ul style="list-style-type: none"> Creates a variable to represent total cost and initialises it to 0 (1). Iterates up to the penultimate item of array (1). Adds to the total cost... (1). ...Uses the correct arguments in the tripCost function (1). Outputs the total cost formatted with a £ prefix (1). 	<p>5</p> <p>AO3.2 (5)</p>	<p>For 5 marks – 1 mark for each correct step in process.</p> <p>Any program that has the functionality specified in the question should receive full marks.</p> <p>Example:</p> <pre>totalCost=0 for i=0 to cities.Length-2 totalCost=totalCost+ tripCost(cities[i],cities[i+1]) next i print ("£"+totalCost)</pre>
	(ii)	<ul style="list-style-type: none"> A linked list is a dynamic data structure (1) whereas an array is static (1). An array can have any element accessed directly (i.e. random access) (1) whereas a linked list needs to be traversed until the desired element is found (1). Contents of an array are stored contiguously in memory (1) whereas the contents of a linked list may not be (1). 	<p>2</p> <p>AO1.2 (2)</p>	<p>Up to 2 marks for a valid description.</p>

Question		Answer	Marks	Guidance
	(c)	<ul style="list-style-type: none"> • Takes in code of airport (1). • Iterates through the array (1). • Checks the value of the code column at each iteration (1). • To see if it is equal to code given (1). • When it is, it takes the airport name from the name column (1). • And prints it to the screen (1). 	<p style="text-align: center;">6</p> <p>AO3.2 (6)</p>	<p>For 6 marks – 1 mark for each correct step in process.</p> <p>Any program that has the functionality specified in the question should receive full marks.</p> <p>Array could be 0 or 1 based.</p> <p>Examples include:</p> <pre>code=input("Please enter code") i=0 while airports[1,i]!=code i=i+1 endwhile print("The airport is: "+airports[2,i])</pre> <p>OR</p> <pre>code = input("Please enter code") name="" for i=0 to 7 if airports[1,i]==code then name=airports[2,i] endif next i print("The airport is: "+name)</pre>

Question		Answer	Marks	Guidance	
3	(a)	<ul style="list-style-type: none"> Content and formatting are kept separate (1). Changes can be made to the external style sheet and affect the whole site (1) saving time (1) and ensuring consistency (1). Stylesheets can be changed for different themes, or different devices (1). 	3 AO1.2 (3)	Up to 3 marks for a valid description.	
	(b)	<ul style="list-style-type: none"> The JavaScript check is carried out client-side/in browser (1) meaning address can be checked and stopped prior to reaching server (1) reducing unnecessary load on the server (1). JavaScript can, however, be amended and circumvented (1) therefore address must be checked at the server to ensure this has not happened (1). 	3 AO1.2 (3)	Up to 3 marks for a valid explanation.	
	(c)	(i)	<ul style="list-style-type: none"> Many to Many relationships are not allowed/in 3NF (1). 	1 AO1.2 (1)	For 1 mark.
		(ii)	<ul style="list-style-type: none"> Table added between student and video (1). Student to middle table 1:M relationship (1). Middle table to video M:1 relationship (1). 	3 AO3.1 (3)	For 3 marks.

Question		Answer	Marks	Guidance
	(d) (i)	<ul style="list-style-type: none"> A field that has a unique value/a unique identifier (1) for every record in that table (1) - in this case VideoID (1). 	<p>2</p> <p>AO1.1 (2)</p>	Up to 2 marks for a valid description.
	(ii)	<ul style="list-style-type: none"> SELECT VideoName, Presenter (1) FROM Video (1) WHERE Topic (1) ="The CPU" (1). 	<p>4</p> <p>AO3.2 (4)</p>	<p>For 4 marks.</p> <p>Do not award first mark if any other field or SELECT *</p> <p>SELECT VideoName, Presenter FROM Video WHERE Topic="The CPU"</p>
4	(a)	<ul style="list-style-type: none"> A template (1) defining methods and attributes (1) used to make objects (1). 	<p>2</p> <p>AO1.1 (2)</p>	Up to 2 marks for a valid description.
	(b)	<ul style="list-style-type: none"> Speed (1)/mass (1)/size (1). 	<p>1</p> <p>AO1.1 (1)</p>	For 1 mark.
	(c) (i)	<ul style="list-style-type: none"> Inheritance is when a class takes on the methods (1) and attributes (1) of a parent class (1). The inheriting class may override some of these methods/attributes (1) and may have additional extra methods and attributes of its own (1). 	<p>3</p> <p>AO1.1 (3)</p>	Up to 3 marks for a valid description.

Question		Answer	Marks	Guidance
	(ii)	<ul style="list-style-type: none"> The company may wish to use inheritance to create different types of lizards (1 – AO1.2) using the lizard class as the base class (1 – AO2.1) and different types of lizard inheriting from it (1 – AO2.1). 	3 AO1.2 (1) AO2.1 (2)	Up to 3 marks for a valid explanation. Maximum 1 mark for demonstrating understanding (AO1.2). Up to 2 marks for applying knowledge and understanding (AO2.1).
	(d)	<ul style="list-style-type: none"> The user running the program will not necessarily have the library installed on their machine (1) therefore the relevant code needs to be included within the final executable (1) - it is the job of the linker to combine this code (1). 	3 AO1.2 (3)	Up to 3 marks for a valid explanation.
5	(a)	<ul style="list-style-type: none"> An assembler (1). 	1 AO1.2 (1)	For 1 mark.
	(b)	<ul style="list-style-type: none"> Program outputs smaller number (1) so in the case of 4 and 9 outputs 4 (1). 	2 AO2.1 (2)	Up to 2 marks for a valid description.

Question	Answer	Marks	Guidance
(c)	Award first mark: Changing LDA NUMB to LDA NUMA (1). Award second mark: Changing NOTA LDA NUMA to NOTA LDA NUMB (1).	2 AO2.1 (2)	For 2 marks. Accept changes annotated on provided code. Accept any other amendment that fixes program.
(d)	<ul style="list-style-type: none"> • Takes in two numbers (1). • Compare the numbers (1). • If first number is biggest outputs first number (1). • If second number is biggest outputs the second number (1). 	4 AO3.2 (4)	For 4 marks – 1 mark for each correct step in process. Example: <pre> INPUT "Please enter Number A" numA INPUT "Please enter Number A" numB IF numA>numB THEN PRINT numA ELSE PRINT numB ENDIF </pre>

Question		Answer	Marks	Guidance
	(e) (i)	<ul style="list-style-type: none"> BRA (1)/BRP (1). 	1 AO2.1 (1)	For 1 mark. Accept 'Branch' or 'Branch if Positive'.
	(ii)	<ul style="list-style-type: none"> Memory Address Register (MAR) (1). 	1 AO2.1 (1)	For 1 mark. Accept MAR on its own.
6	(a)	<ul style="list-style-type: none"> Altimeter (1 – AO1.2) when the wearer is ascending/descending (1 – AO2.1). Accelerometer (1 – AO1.2) measure forces on device when it moves (1 – AO2.1). Gyroscope (1 – AO1.2) to measure if wearer turns (1 – AO2.1). 	2 AO1.2 (1) AO2.1 (1)	Up to 2 marks for a valid description. Maximum 1 mark for demonstrating understanding (AO1.2). Maximum 1 mark for applying knowledge and understanding (AO2.1). Do not accept 'movement sensor' or 'motion sensor'.
	(b)	<ul style="list-style-type: none"> Device is likely to undergo lots of sudden movement (1 – AO1.2) magnetic hard drives can be susceptible to damage if moved quickly (1 – AO3.3) due to the head coming into contact with the platter (1 – AO3.3) whereas flash memory has no moving parts and so is not affected (1 – AO3.3). The device is likely to be small (1 – AO1.2) - hard drives require enough space for their moving parts (1 – AO3.3) whereas flash memory, having no moving parts, requires much less space (1 – AO3.3). 	3 AO1.2 (1) AO3.3 (2)	Up to 3 marks for a valid explanation. Allow maximum 1 mark for mention that little data is needed and so large capacity of magnetic storage not needed. Maximum 1 mark for demonstrating understanding (AO1.2). Up to 2 marks for evaluation (AO3.3).

Question	Answer	Marks	Guidance
(c)*	<p>Mark Band 3–High Level (7-9 marks)</p> <p>The candidate demonstrates a thorough knowledge and understanding of a wide range of legal and ethical issues the company needs to consider; the material is generally accurate and detailed.</p> <p>The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation.</p> <p>The candidate provides a thorough discussion which is well-balanced. Evaluative comments are consistently relevant and well-considered.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Mark Band 2-Mid Level (4-6 marks)</p> <p>The candidate demonstrates reasonable knowledge and understanding of a range of legal and ethical issues the company needs to consider; the material is generally accurate but at times underdeveloped.</p> <p>The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation.</p> <p>The candidate provides a sound discussion, the majority of which is focused. Evaluative comments are for the most part appropriate, although one or two opportunities for development are missed.</p> <p><i>There is a line of reasoning presented with some structure. The information presented is in the most part relevant and</i></p>	<p>9</p> <p>AO1.1 (2)</p> <p>AO1.2 (2)</p> <p>AO2.1 (2)</p> <p>AO3.3 (3)</p>	<p>If only legal or ethical considered – MAX 5 marks.</p> <p>AO1: Knowledge and Understanding</p> <p>The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive:</p> <p>Ethical</p> <ul style="list-style-type: none"> • System has no knowledge of individuals. • May not take into account specific circumstances not covered in the data taken in. • Putting their health at risk. • Individuals may have medical conditions they are unaware of. • Individuals may have eating disorder. • Unable to take this into account. • Discussion of how the data is used to make judgments. • Potential damage caused by incorrect meal planning. • Are religious or cultural concerns accounted for? <p>Legal</p> <ul style="list-style-type: none"> • System will store personal data including sensitive, medical data. • Therefore Data Protection Act applies and company has to store this data securely. • If recommendations given have a negative effect on a user’s health. • Company may find itself being sued or subject to criminal prosecution.

Question	Answer	Marks	Guidance
	<p><i>supported by some evidence.</i></p> <p>Mark Band 1-Low Level (1-3 marks) The candidate demonstrates a basic knowledge of legal and ethical issues with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.</p> <p>The candidate provides a limited discussion which is narrow in focus. Judgments if made are weak and unsubstantiated.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks No attempt to answer the question or response is not worthy of credit.</p>		<p>AO2.1: Application The selected knowledge/examples should be directly related to the specific question. The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive:</p> <ul style="list-style-type: none"> • Discussions around data mining and its uses/limitations. • Discussion of how the data is used to come up with a meal plan. • Discussion of how issues can be avoided in the design of the system. <p>AO3.3: Evaluation Candidates will need to consider a variety of issues in relation to the question and will make some evaluative comments about the issues and solutions they are discussing. The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive:</p> <ul style="list-style-type: none"> • Discussion of how any moral issues highlighted before, can it be avoided and how effective these solutions are. • Discussion of how any ethical issues highlighted before, can it be avoided and how effective these solutions are. • Discussion of how the system is evaluated and how effective the evaluation is. • Consideration of potential testing and prototyping.

Question		Answer	Marks	Guidance
7	(a)	00101010 1 1 1	2 AO1.2 (2)	For 2 marks - award 1 mark for correct answer and 1 mark for carrying bits.
	(b)	<ul style="list-style-type: none">• Shift left (1).	1 AO1.2 (1)	For 1 mark.

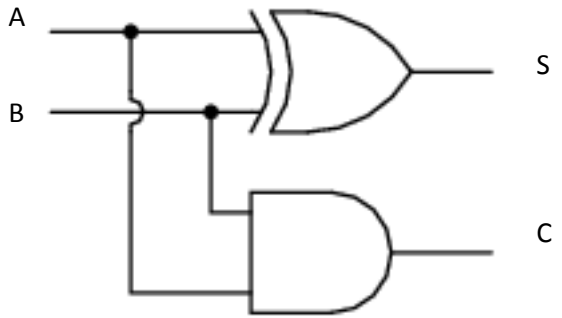
Question		Answer	Marks	Guidance
	(c)	11001100	2 AO1.2 (2)	For 2 marks (award 1 mark per nibble).
	(d)	<ul style="list-style-type: none"> It is not easily possible to carry out calculations using sign and magnitude (1) whereas they will work with two's complement (1). 	2 AO1.2 (2)	Up to 2 marks for a valid description.
	(e)	Matching exponent to 2^{11} (2^3) we get 0110+1000 Mantissa is 111 exponent 0011 normalised answer is 0111 0011	3 AO1.2 (3)	For 3 marks (award 1 for matching exponents) 1 mark for mantissa and 1 for exponent.
	(f)	<ul style="list-style-type: none"> 23 in binary 00010111 (1) -23 2's complement 11101001 (may be two steps to get this, negate bits plus 1) 47 in binary 00101111 add them together 00011000 	4 AO1.2 (4)	For 4 marks - 1 mark per bullet or equivalent stages.
8	(a)	<ul style="list-style-type: none"> Provide a user interface (1 – AO1.1) for the user to load games etc. (1 – AO1.2). Control hardware (1 – AO1.1) such as graphics card, games controllers etc. (1 – AO1.2). Act as a platform from which software can be run (1 – AO1.1) such as games and apps (1 – AO1.2). Control access (1 – AO1.1) so that different users can access the system (1 – AO1.2) and have their own data such as scores and achievements (1 – AO1.2). 	4 AO1.1 (2) AO1.2 (2)	1 mark for each correct identification (AO1.1) up to a maximum of 2 marks. 1 mark for each valid description (AO1.2) up to a maximum of 2 marks.

Question		Answer	Marks	Guidance
	(b)	<ul style="list-style-type: none"> This means that a lot of the core functionality they need is already available (1) so the company just has to make amendments/additions specific to their system (1) saving time and money (1). 	<p>2</p> <p>AO1.2 (2)</p>	Up to 2 marks for a valid explanation.
	(c)	<ul style="list-style-type: none"> CPUs are general purpose processors (1) whereas GPUs are designed specifically for graphics (1). And so likely to have built in circuitry/instructions for common graphics operations (1). GPUs are able to perform an instruction on multiple pieces of data at one time (1) often we want to do this when processing graphics (e.g. transforming points in a polygon or shading pixels) (1) which means it can perform transformations to onscreen graphics quicker than a CPU (1). 	<p>3</p> <p>AO1.2 (3)</p>	Up to 3 marks for a valid explanation.
	(d)	<ul style="list-style-type: none"> Different console makers will use Digital Rights Management (DRM) (1 – AO1.2) to protect games from being able to be run on anything other than their machines (1 – AO2.1). Different consoles will have different processors (1 – AO1.2) each with their own instruction sets (1 – AO2.1) and word sizes (1 – AO2.1). Different consoles have different operating systems (1 – AO1.2) and so games may be dependent on libraries in one operating system that don't exist in another (1 – AO2.1) or may make different system calls (1 – AO2.1). Games might be on a different media (1 – AO1.2), for example, might be on Blu-ray when console may only have a DVD player (1 – AO2.1). 	<p>4</p> <p>AO1.2 (2)</p> <p>AO2.1 (2)</p>	<p>Up to two marks for identifications (AO1.2).</p> <p>Up to two marks for valid explanations (AO2.1).</p>

Question		Answer	Marks	Guidance
	(e)*	<p>Mark Band 3–High Level (7-9 marks) The candidate demonstrates thorough knowledge and understanding of a wide range of considerations in relation to the statement; the material is generally accurate and detailed. The candidate is able to apply their knowledge and understanding directly and consistently to the context provided. Evidence/examples will be explicitly relevant to the explanation. The candidate is able to weigh up both sides of the argument which results in a supported and realistic judgment as to whether video games have a negative effect on those who play them.</p> <p><i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Mark Band 2-Mid Level (4-6 marks) The candidate demonstrates reasonable knowledge and understanding of a range of considerations in relation to the statement; the material is generally accurate but at times underdeveloped. The candidate is able to apply their knowledge and understanding directly to the context provided although one or two opportunities are missed. Evidence/examples are for the most part implicitly relevant to the explanation.</p>	<p>9 AO1.1 (2) AO1.2 (2) AO2.1 (2) AO3.3 (3)</p>	<p>AO1: Knowledge and Understanding The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive: For Statement</p> <ul style="list-style-type: none"> • Video games often have violent content. • Can glamorise criminal or violent acts making impressionable people more violent. • Some people can become addicted to video games. • To the detriment of other areas of their life such as work or socialising. • Makes people more sedentary affecting their health. <p>Against Statement</p> <ul style="list-style-type: none"> • A form of entertainment. • Many of the criticisms of which could equally be levelled against Films or TV. • Only a small percentage of games are violent. • Online gaming can allow people to socialize. • Encourages teamwork. • Allows people to ‘experience’ things they otherwise couldn’t. • Some video games can have an educational element. • Can be used for therapeutic reasons.

Question	Answer	Marks	Guidance
	<p>The candidate makes a reasonable attempt to come to a conclusion showing some recognition of influencing factors that would determine whether video games have a negative effect on those who play them. <i>There is a line of reasoning presented with some structure.</i></p> <p><i>The information presented is in the most part relevant and supported by some evidence.</i></p> <p>Mark Band 1-Low Level (1-3 marks) The candidate demonstrates a basic knowledge of considerations with limited understanding shown; the material is basic and contains some inaccuracies. The candidate makes a limited attempt to apply acquired knowledge and understanding to the context provided.</p> <p>The candidate provides nothing more than an unsupported assertion.</p> <p><i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i></p> <p>0 marks No attempt to answer the question or response is not worthy of credit.</p>		<p>AO2.1: Application The selected knowledge/examples should be directly related to the specific question. The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive:</p> <ul style="list-style-type: none"> • Discussions around how situations are modelled using A01 and how these are currently limited • Discussions around how evidence is gathered to support either side of the argument • Discussions of cutting edge VR technology and its impacts • Discussion of the more extreme physical side effects of prolonged gaming and measures that developers have put into place to combat these effects • Discussions around how games are designed to entertain interactively • Comparison of entertainment paradigms and the desired effects of each <p>AO3.3: Evaluation Having considered the different sides to the argument candidates will need to reach a supported judgment based on the evidence included in their response.</p> <p>There should be no bias in marks as to the degree to which the candidate agrees with the statement but especially in the top mark band there must be a clear link between the points candidates have made and justification.</p>

Question			Answer	Marks	Guidance
					<p>The following is indicative of possible factors/evidence that candidates may refer to but is not prescriptive or exhaustive:</p> <ul style="list-style-type: none"> • Discussions around using emotive examples and cherry picking sensationalised examples • Discussions of how the scale of the games industry will affect the incidence rate of extreme cases • Discussion around how “negative effect ” is quantified <p>Comparison of cultural shift towards gaming compared to shift away from more traditional media</p>
9	(a)		<ul style="list-style-type: none"> • A group of computers/devices (1 – AO1.2) connected over a small geographical area (1 – AO1.2). The infrastructure is usually owned by the network owner (1 – AO1.2). 	<p>2</p> <p>AO1.2 (2)</p>	Up to 2 marks for a valid description.
	(b)		<ul style="list-style-type: none"> • Data is split into chunks called packets (1 – AO1.1) which have labels (1 – AO1.1) including address being sent to (1 – AO1.1) and order (1 – AO1.1). Each packet is sent on the most convenient/avoidable route (1- AO1.2) meaning they may arrive in a different order to which they were sent (1 – AO1.2). Once packets arrive at receiver they are reordered (1 – AO1.2). 	<p>4</p> <p>AO1.1 (2)</p> <p>AO1.2 (2)</p>	<p>Up to 2 marks for demonstrating knowledge (AO1.1).</p> <p>Up to 2 marks for demonstrating understanding (AO1.2).</p>
10	(a)	(i)	<ul style="list-style-type: none"> • $S=A \text{ XOR } B$ 	<p>1</p> <p>AO2.2 (1)</p>	For 1 mark.
		(ii)	<ul style="list-style-type: none"> • $C=A \text{ AND } B$ 	<p>1</p> <p>AO2.2 (1)</p>	For 1 mark.

Question		Answer	Marks	Guidance
	(iii)		<p>2</p> <p>AO2.2 (2)</p>	<p>For 2 marks – two gates with correct inputs.</p>
(b)		<ul style="list-style-type: none"> • $A \wedge B \vee A \wedge (B \vee C) \vee B \wedge (B \vee C)$ • $A \wedge B \vee A \wedge B \vee A \wedge C \vee B \wedge B \vee B \wedge C$ • $A \wedge B \vee A \wedge C \vee B \vee B \wedge C$ • $A \wedge B \vee A \wedge C \vee B$ <p>$B \vee A \wedge C$</p>	<p>4</p> <p>AO2.2 (4)</p>	<p>For 4 marks - 1 mark for each bullet completed correctly.</p>

Assessment Objectives (AO) Grid

Question	Assessment Objectives							Total
	AO1.1	AO1.2	AO2.1	AO2.2	AO3.1	AO3.2	AO3.3	
1a	2	0	0	0	0	0	0	2
1b	0	0	3	0	0	0	0	3
1ci	0	2	2	0	0	0	0	4
1cii	0	0	2	0	0	0	0	2
1d*	2	2	3	0	0	0	5	12
2a	1	0	0	0	0	0	0	1
2bi	0	0	0	0	0	5	0	5
2bii	0	2	0	0	0	0	0	2
2c	0	0	0	0	0	6	0	6
3a	0	3	0	0	0	0	0	3
3b	0	3	0	0	0	0	0	3
3ci	0	1	0	0	0	0	0	1
3cii	0	0	0	0	3	0	0	3
3di	2	0	0	0	0	0	0	2
3dii	0	0	0	0	0	4	0	4
4a	2	0	0	0	0	0	0	2
4b	1	0	0	0	0	0	0	1
4ci	3	0	0	0	0	0	0	3
4cii	0	1	2	0	0	0	0	3
4d	0	3	0	0	0	0	0	3
5a	0	1	0	0	0	0	0	1
5b	0	0	2	0	0	0	0	2
5c	0	0	2	0	0	0	0	2
5d	0	0	0	0	0	4	0	4
5ei	0	0	1	0	0	0	0	1
5eii	0	0	1	0	0	0	0	1
6a	0	1	1	0	0	0	0	2
6b	0	1	0	0	0	0	2	3
6c*	2	2	2	0	0	0	3	9
7am	0	2	0	0	0	0	0	2
7bm	0	1	0	0	0	0	0	1
7cm	0	2	0	0	0	0	0	2
7dm	0	2	0	0	0	0	0	2
7em	0	3	0	0	0	0	0	3
7fm	0	4	0	0	0	0	0	4
8a	2	2	0	0	0	0	0	4
8b	0	2	0	0	0	0	0	2
8c	0	3	0	0	0	0	0	3
8d	0	2	2	0	0	0	0	4
8e*	2	2	2	0	0	0	3	9
9a	0	2	0	0	0	0	0	2
9b	2	2	0	0	0	0	0	4
10aim	0	0	0	1	0	0	0	1
10aiim	0	0	0	1	0	0	0	1
10aiiim	0	0	0	2	0	0	0	2
10bm	0	0	0	4	0	0	0	4
Totals	21	51	25	8	3	19	13	140

* = extended response

m = mathematical content

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