GCSE
COMPUTER SCIENCE

Paper 2 Supplementary questions

These supplementary questions are taken from the 2014/5/6 GCSE Computer Science (4512) assessments. The table on page 2 shows the content in our new GCSE Computer Science (8520) specification to which these questions relate. These supplementary questions should not be treated as a complete paper, they do not provide a balanced coverage of the specification or the assessment objectives in the same way that a fully live paper would do.

It is hoped that teachers will find these questions to be a useful resource to enable them to understand the nature of questions that could be assessed as part of the specification.

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8520 Specification Reference	Question from 4512 – June 2014	Question from 4512 – June 2015	Question from 4512 – June 2016
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Answer **all** questions in the spaces provided.

Topic: 3.3 Fundamentals of data representation
3.3.1 Number bases

Question and Mark Scheme from 4512 – June 2014

1 (c) Give **one** reason why programmers often use hexadecimal, instead of binary, to represent numbers.

[1 mark]

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1	**c**		1 mark each for any correct answer. Examples include: Hexadecimal is easier (for humans) to read (than binary); Hexadecimal is easier to convert (to binary) than denary; Numbers are displayed in a more compact way (in hexadecimal than in binary); It is quicker to type in (hexadecimal numbers than binary numbers); It is more accurate to type in (hexadecimal numbers than binary numbers); **R.** anything that implies less memory is used.	**1**

Topic: 3.3.2 Converting between number bases

Question and Mark Scheme from 4512 – June 2014

1 (a) State the denary representation of the binary number 10010111

[1 mark]

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1 (b) State the hexadecimal representation of the denary number 125. You must show your working.

[2 marks]

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1 (d) The ASCII character set uses seven bits to encode every character.

What is the total number of characters that can be encoded in ASCII?

[1 mark]

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1	a		151;	1
1	b		7D; **If there is no hexadecimal answer then** do not reward any working; **If the answer given is 7D then** reward any attempt at working; **If the hexadecimal answer given is not 7D then** a maximum of 1 mark can be awarded for any of the following working out stages: • convert to binary 0111 1101 • convert each of their nibbles to hex **A**. If incorrect bit pattern is converted to its corresponding hex value • show division of 125 by 16 giving the quotient and remainder;	2
1	d		128 (characters) // 2^7 (characters);	1

Question and Mark Scheme from 4512 – June 2015

1 (a) State the **denary** representation of the binary number 10111010.

[1 mark]

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1 (b) State the **hexadecimal** representation of the binary number 1110.

[1 mark]

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1 (c) State the **denary** representation of the hexadecimal number 4C. You **must** show your working.

[2 marks]

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1	**a**		186;	**1**
1	**b**		E;	**1**
1	**c**		76; If the answer given is 76 then reward any attempt at working; If the answer given is not 76 then a maximum of 1 mark can be awarded for any of the following working out stages: • Show multiplication of 4 by 16 and another number between 0 and 16 by 1 (i.e. allow C to be incorrectly converted to decimal). • Convert to binary 1001100 but then incorrectly converted to denary // convert to binary 01001100 but then incorrectly converted to denary. • Convert to a binary number other than 1001100, which must consist of more than 4 bits, but then convert this binary number to its correct decimal representation.	**2**

Question and Mark Scheme from 4512 – June 2016

1 (a) State the **binary** representation of the denary number `87`.

[1 mark]

1 (b) State the **binary** representation of the hexadecimal number `CE`. You must show your working.

[2 marks]

1 (c) Place these **three** numbers into order of size (**1–3** where **1** is the largest and **3** is the smallest).

Number	Order (1–3)
The denary number `12`	
The binary number `1110`	
The hexadecimal number `D`	

[2 marks]

1 (d) What is the minimum number of bits needed to be able to represent any character from a character set that contains only the 26 lower-case letters of the alphabet?

[1 mark]

<table>
<tr><th>Qu</th><th>Part</th><th>Sub-part</th><th>Marking Guidance</th><th>Marks</th></tr>
<tr><td>1</td><td>a</td><td></td><td>101 0111;

I. Leading zeros</td><td>1</td></tr>
<tr><td>1</td><td>b</td><td></td><td>1100 1110;

If answer given is 11001110 then reward any attempt at working;
If the answer given is not 11001110 then a maximum of 1 mark can be awarded for any of the following working out stages:

• C or E (but not both) are converted to an incorrect binary representation but are then combined with the other correct representation. For example C is converted incorrectly to 1001 but E is converted correctly to 1110 and the answer given is 10011110;
• C is converted to a denary number other than 12 and/or E is converted to a denary number other than 14 but both of the denary numbers are correctly converted to binary.
• The candidate has attempted to multiply 16 by 12 and 1 by 14 but has then incorrectly converted the result into binary (through either an initial multiplication error or binary conversion error but not both).</td><td>2</td></tr>
<tr><td>1</td><td>c</td><td></td><td>1 mark for one correct row;
Both marks for all three correct rows;

<table><tr><th>Number</th><th>Order (1 – 3)</th></tr><tr><td>The denary number 12</td><td>3</td></tr><tr><td>The binary number 1110</td><td>1</td></tr><tr><td>The hexadecimal number D</td><td>2</td></tr></table>
R. if duplicate numbers have been used</td><td>2</td></tr>
<tr><td>1</td><td>d</td><td></td><td>5;</td><td>1</td></tr>
</table>

Topic: 3.3.3 Units of information

Question and Mark Scheme from 4512 – June 2015

1 (d) Place the following quantities in order of size (1 – 4, where 1 is the smallest and 4 is the largest).

Quantity	Order (1 – 4)
15 bits	
3 nibbles	
2 bytes	
1 kilobyte	

[3 marks]

1	**d**		1 mark if 1 number correct; 2 marks if 2 numbers correct; 3 marks if all 4 numbers correct; The correct order is: 2, 1, 3, 4 **Quantity** / **Order (1-4)** 15 bits – 2 3 nibbles – 1 2 bytes – 3 1 kilobyte – 4	**3**

Topic: 3.3.5 Character encoding

Question and Mark Scheme from 4512 – June 2015

1 (e) ASCII is a character-encoding system that uses seven bits to represent each character. Complete the table stating the binary representation of the character g.

Character	Binary Representation
f	110 0110
g	

[1 mark]

1	**e**		110 0111; **R.** if more than 7 bits used (eg 0110 0111)	**1**

Question and Mark Scheme from 4512 – June 2016

2 (d) How many bits does ASCII use to represent a single character?

[1 mark]

2	**d**		7; **A.** 8-bits; (extended ASCII)	**1**

Topic: 3.3.6 Representing images

Question and Mark Scheme from 4512 – June 2014

1 (f) Describe how a black and white image could be represented as a bitmap in binary.

[3 marks]

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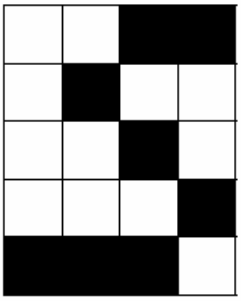
1	f		The image is represented as a series/grid/sequence of pixels; Each pixel/dot is represented by one bit; White is represented by a 0; Black is represented by a 1; **A.** White=1; Black=0; **A.** White and black are represented using different bit patterns (1 mark); **R.** Same bit pattern used for black and white Metadata about the image is also stored; A. examples of metadata **MAX 3**	3

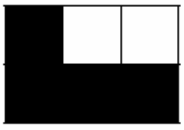
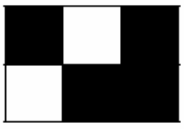
Question and Mark Scheme from 4512 – June 2015

1 (f) The following grid represents a bitmap image where a black pixel is represented using the bit pattern `00` and a white pixel is represented using the bit pattern `01`. The binary encoding of each row is shown next to the image.



```
01010000
01000101
01010001
01010100
00000001
```

1 (f) (i) Which **one** of the following images has the correct encoding?

	Image	Encoding	Tick one box
A		`010100` `000101`	
B		`00010100` `00000000`	
C		`000100` `010000`	

[1 mark]

1 (f) (ii) State the maximum number of different colours that can be encoded when using two bits for each pixel.

[1 mark]

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1 (f) (iii) State the minimum number of bits needed to encode 32 different colours.

[1 mark]

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1 (f) (iv) State **one** factor, other than the number of bits used to represent individual colours, that can affect the quality of a bitmap image.

[1 mark]

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1	**f**	**i**	C; (correct answer only, do not award if more than one box is ticked)	**1**
1	**f**	**ii**	$4//2^2$;	**1**
1	**f**	**iii**	5;	**1**
1	**f**	**iv**	the resolution // number of pixels used // size of the grid // ppi (or equivalent) // compression;	**1**

Topic: 3.3.7 Representing sound

Question and Mark Scheme from 4512 – June 2014

1 (e) **Table 1** shows four stages in converting sound into a digital form.

Show the correct order for the stages by labelling them with the numbers 1 – 4 (1 being the first stage).

[3 marks]

Table 1

Stage	**Order (1 – 4)**
binary representation of level stored	
microphone picks up sound waves	
value read at specific point and rounded to a level	
converted to an electrical analogue signal	

1	**e**		1 mark if **1** stage correct 2 marks if **2** stages correct 3 marks if **all 4** stages correct The correct stages are: 4, 1, 3, 2	**3**

Topic: 3.3.8 Data compression

Question and Mark Scheme from 4512 – June 2014

1 (d) The ASCII character set uses seven bits to encode every character.

What is the total number of characters that can be encoded in ASCII?

[1 mark]

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.....

1	**d**		128 (characters) // 2^7 (characters);	**1**

Topic: 3.4 Computer systems
3.4.4 Systems architecture

Question and Mark Scheme from 4512 – June 2014

2 A typical computer's main memory consists of both volatile memory and non-volatile memory.

2 (a) (i) Explain what is meant by the term **volatile memory**.

[1 mark]

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2 (a) (ii) What is normally stored in the non-volatile part of a computer's main memory?

[1 mark]

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2 (b) Explain why having cache memory can improve the performance of the Central Processing Unit (CPU).

[2 marks]

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2 (c) State **two** characteristics, other than the size of cache memory, that can improve the performance of CPUs.

[2 marks]

Characteristic 1 .....

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Characteristic 2 .....

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2	**a**	**i**	Memory content is lost when power is turned off; A. Any statement that implies temporary	**1**
2	**a**	**ii**	The computer's BIOS//initial instructions//bootstrapping instructions; **A.** Qualified answers about embedded systems eg washing machines. **A.** Operating system	**1**
2	**b**		Frequently used data/instructions are stored in the cache; Meaning they don't have to be fetched from main memory; Data/instructions stored in the cache memory can be accessed faster (than data/instructions stored in the main memory); **MAX 2**	**2**
2	**c**		1 mark each for any correct answer. Examples include: the number of cores/processors; the processing speed/clock speed/number of cycles (per second) of the processor; the bus width; the word size; the architecture of the processor/CPU; the type of cache memory; **R.** amount of cache memory **MAX 2**	**2**

5 **Figure 2** shows an example of a tablet computer.

Figure 2

© Thinkstock

5 (b) Tablet computers normally use solid state storage media instead of magnetic storage media.

State and explain **two** differences, other than cost and storage capacity, that make solid state media a better choice than magnetic media for tablet computers.

[4 marks]

Difference 1 .....

Explanation 1 .....

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Difference 2 .....

Explanation 2 .....

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5	**b**		Examples include: Difference: No mechanical parts in solid state media//Magnetic media has mechanical parts. Explanation: Magnetic media are often unsuitable for mobile use because the mechanical parts cannot function during movement // mechanical parts are less robust during movement. Difference: Speed of read access higher in solid state drives. Explanation: Data can often be read more quickly from solid state media than magnetic media. Difference: Solid state media can be more compact than magnetic media. Explanation: The smaller size enables better mobility; Reason: The battery will last longer Explanation: Solid state media uses less power Difference: Less heat generated when using solid state Explanation: Utilising the power more efficiently//allows for more miniaturisation. Difference: Solid state is silent Explanation: Makes it more attractive to use.	**4**

6 Explain how data is read from optical media such as a CD.

[5 marks]

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6			1 mark for every correct point that explains the functionality of reading data from an optical medium such as a CD up to a maximum of 5 marks. Examples include: The tracking mechanism moves the laser into the correct position over the CD; The CD is spun to ensure all data can be read; The CD spins slower when the laser/read-head is above the outer tracks; The laser is shone on to the disk; The laser is reflected; Bumps/pits are raised parts of the disk; Bumps/pits form a spiral from the centre to the outside of the disk; A (opto-electric) sensor detects changes in reflectivity; Bumps/pits and lands represent the two possible bit values	**5**

Question and Mark Scheme from 4512 – June 2015

6 (a) What is a **computer system**?

[1 mark]

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6 (b) Memory and the processor are two essential pieces of hardware. Explain, with reference to both memory and the processor, how a computer processes instructions.

[4 marks]

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6 (c) Give **one** reason why a CPU with two cores might perform faster than an equivalent CPU with only one core.

[1 mark]

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6 (d) The following are types of memory and storage (labelled A – F):

A. Cache memory
B. Magnetic media
C. Non-volatile memory
D. Optical media
E. ROM
F. Solid state media

For each of the descriptions in the table, write the label of the type of memory or storage it best describes.

Description	**Label (A – F)**
Uses a laser to read the data	
Contents cannot be edited	
Small and very fast storage found close to the processor	

[3 marks]

<table>
<tr><td>6</td><td>a</td><td></td><td>(A combination of) hardware and software;</td><td>1</td></tr>
<tr><td>6</td><td>b</td><td></td><td>One mark for each valid point below (maximum 4). If only one of memory or processor is referenced then maximum 3 marks.
The instructions are held in memory;
Loads instructions from secondary storage to memory;
Instructions are stored in a contiguous format;
The processor fetches an instruction from memory;
The processor decodes the instruction;
The processor executes the instruction;
The result may be stored back into memory;
The process is repeated continuously//cycles;

A. Any other correct answer</td><td>4</td></tr>
<tr><td>6</td><td>c</td><td></td><td>(Because the processor with two cores may be able to process) two instructions in parallel/at the same time/simultaneously;

A. Processing is shared.</td><td>1</td></tr>
<tr><td>6</td><td>d</td><td></td><td>The completed table is:
<table>
<tr><th>Description</th><th>Term</th></tr>
<tr><td>Uses a laser to read the data.</td><td>D (Optical media)</td></tr>
<tr><td>Contents cannot be edited.</td><td>E (ROM)</td></tr>
<tr><td>Small and very fast storage found close to the processor</td><td>A (Cache memory)</td></tr>
</table>
1 mark for each correct label.

A. The terms written out in full instead of the labels (do not penalise spelling errors)</td><td>3</td></tr>
</table>

Question and Mark Scheme from 4512 – June 2016

1 (f) Two typical secondary storage devices, with the same cost, are advertised as follows.

Device A	Device B
Solid state drive, capacity 128GB	Magnetic hard drive, capacity 1TB

1 (f) (i) State **one** reason why **Device B** could be considered a better choice than **Device A**.
[1 mark]

1 (f) (ii) State **two** reasons why **Device A** could be considered a better choice than **Device B**.
[2 marks]

1	**f**	**i**	It has a larger storage capacity / it can hold more data;	**1**
1	**f**	**ii**	Any creditworthy point to a **maximum of two**. Examples of typical advantages of solid state over magnetic storage include: It has a higher read/write speed; It is smaller; It is more robust; It generates less heat; It has a lower power consumption; It is lighter; It is quieter;	**2**

8 There are several CPU characteristics that can affect its performance. One of these is clock speed.

Explain how clock speed and **one** other CPU characteristic can affect CPU performance.

In this question you will be marked on your ability to use good English, to organise information clearly and to use specialist vocabulary where appropriate.

[6 marks]

8			No creditworthy material	0		**6**
			Lower mark range Vague statements are made about how clock speed and/or one other characteristic can affect CPU performance // Clock speed not mentioned but another CPU characteristic is described Quality of written communication: The candidate has used a form and style of writing which has many deficiencies. Ideas are not often clearly expressed. Sentences and paragraphs are often not well-connected or at times bullet points may have been used. Specialist vocabulary has been used inappropriately or not at all. Much of the text is	1-2 marks		

			legible and some of the meaning is clear. There are many errors of spelling, punctuation and grammar but it should still be possible to understand much of the response.			
			Mid mark range Clear descriptions are made about how clock speed affects performance. One other CPU characteristic is described. Quality of written communication: The candidate has mostly used a form and style of writing appropriate to purpose and has expressed some complex ideas reasonably clearly and fluently. The candidate has usually used well linked sentences and paragraphs. Specialist vocabulary has been used on a number of occasions but not always appropriately. Text is legible and most of the meaning is clear. There are occasional errors of spelling, punctuation and grammar.	3-4 marks		
			High mark range A correct and detailed explanation of how clock speed affects CPU performance is given, along with a correct and detailed description of one other CPU characteristic and its effect on performance. Quality of written communication: The candidate has selected and used a form and style of writing appropriate to purpose and has expressed complex ideas clearly and fluently. Sentences and paragraphs follow on from one another clearly and coherently. Specialist vocabulary has been used appropriately throughout. Text is legible and the meaning is clear. There are few if any errors of spelling, punctuation and grammar.	5-6 marks		
			Quality of written communication skills The candidate's quality of written communication skills will be one of the factors influencing the actual mark an examiner will give within a level of response. The quality of written communication skills associated with each level is indicated above.			

			Explanation of clock speed Instructions are fetched from memory; Decoded//Executed by the processor; The speed at which this cycle happens; Is directly related to the clock speed; So a higher clock speed means more instructions can be executed (per unit time). **Description of other characteristics may include:** **Cache memory** Frequently used instructions/data; Instructions/data which is predicted to be used; Are pre-loaded into cache; Which is faster to access than RAM/main memory; Is located on or close to the processor; Reduces the time to fetch data/instructions; **Number of cores** One processor/CPU has multiple cores; Each core can process instructions independently of the other; Allow more than one instruction/process to be processed in parallel;			

Topic: 3.5 Fundamentals of computer networks

Question and Mark Scheme from 4512 – June 2014

4 (a) What is a computer network?

[2 marks]

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4	**a**		Two or more computers//a group of computers; That have been connected together//That can communicate with/send messages to one another;	**2**

Question and Mark Scheme from 4512 – June 2015

8 Discuss the advantages **and** disadvantages of connecting a computer to a network.

In this question you will be marked on your ability to use good English, to organise information clearly and to use specialist vocabulary where appropriate.

[6 marks]

8			**No creditworthy material**	0	6
			Lower mark range One or two (dis) advantages are stated. // One (dis)advantage is explained. Quality of written communication: The candidate has used a form and style of writing which has many deficiencies. Ideas are not often clearly expressed. Sentences and paragraphs are often not well-connected or at times bullet points may have been used. Specialist vocabulary has been used inappropriately or not at all. Much of the text is legible and some of the meaning is clear. There are many errors of spelling, punctuation and	1-2 marks	

			grammar but it should still be possible to understand much of the response.				
			Mid mark range Two or more (dis) advantages are explained Quality of written communication: The candidate has mostly used a form and style of writing appropriate to purpose and has expressed some complex ideas reasonably clearly and fluently. The candidate has usually used well linked sentences and paragraphs. Specialist vocabulary has been used on a number of occasions but not always appropriately. Text is legible and most of the meaning is clear. There are occasional errors of spelling, punctuation and grammar.	3-4 marks			
			High mark range Two or more (dis) advantages are discussed (including at least one advantage **and** one disadvantage). Quality of written communication: The candidate has selected and used a form and style of writing appropriate to purpose and has expressed complex ideas clearly and fluently. Sentences and paragraphs follow on from one another clearly and coherently. Specialist vocabulary has been used appropriately throughout. Text is legible and the meaning is clear. There are few if any errors of spelling, punctuation and grammar.	5-6 marks			
			Quality of written communication skills The candidate's quality of written communication skills will be one of the factors influencing the actual mark an examiner will give within a level of response. The quality of written communication skills associated with each level is indicated above.				

			Examples of advantages of connecting to a network (give credit to any other correct example): • Enables users to work from multiple physical locations. • Enables hardware resources to be shared between computers. • Enables computers to communicate with one another. • Creates more resilient systems (than when you are reliant on just one computer). • Enables processing to be distributed. • May enable access to web services. • Easier monitoring of all users. • Centralised back-up is possible. • Easier to maintain multiple devices. **Examples of disadvantages of connecting to a network (give credit to any other correct example):** • Additional hardware is required. • Introduces potential security risks. [allow a maximum of two points for viruses, hacking and so on] • Additional support costs • Certain hardware failures (e.g. main server or switch/router) could impact other devices • Performance potentially limited by network traffic.		

Question and Mark Scheme from 4512 – June 2016

4 (a) (i) What network topology is shown in **Figure 2**?

[1 mark]

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4	**a**	**i**	Star; **A.** Switched Ethernet	**1**

4 (b) A dynamically-created web page is being viewed on one of the client machines.

The following four actions would have had to take place to allow this to happen.
Put the actions in the correct order (**1–4**, where **1** is the first action to happen and **4** is the last action to happen).

Action	**Order (1–4)**
The client receives the web page.	
The client requests the web page.	
The server delivers the web page.	
The server connects to a database to complete the web page.	

[3 marks]

4	**b**		1 mark if 1 action correct; 2 marks if 2 actions correct; 3 marks if all 4 actions correct; The correct table is:	**3**

Action	**Order (1 – 4)**
The client receives the webpage	**4**
The client requests the webpage	**1**
The server delivers the webpage	**3**
The server connects to a database to complete the webpage	**2**