Chhetri Academy

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GCSE COMPUTER SCIENCE

2.2

Edexcel 1CP2 | Specification point 2.2.2

How bitmap images are represented in binary (pixels, resolution, colour depth)

Untiered

Past paper question booklet

6	2015-2025	Untiered
question groups	available papers	tier

Before you begin

1. Show working and use units where appropriate.
2. Use extra paper if you need more space.
3. Print at actual size (100%) for measurement questions.

Name _____ **Date** _____

Whole questions are retained for context; some parts cover other points. Legacy sources are labelled.

3 John has decided to set up a website to promote the local youth football club.

(a) Bit-mapped images of the club uniform are taken with a digital camera and put on the website.

Complete these statements.

(i) ..... are the smallest elements of a bit-mapped image and the smallest element that can be displayed on a screen.

(1)

(ii) The ..... of an image is based on the number of elements used to represent the full image. The higher the number of elements for a given size, the better the quality of the image.

(1)

(iii) ..... indicates the number of bits used to represent the colour of a picture element. The higher the number of bits used, the greater the range of colours.

(1)

(b) Files for the website are stored on secondary storage media.

Complete this table with the name of the category of secondary storage described in each row.

(3)

Category of secondary storage	Description
	Uses metal platters coated in iron oxide. The platters rotate at high speeds.
	Small pits are burned in patterns onto a flat surface. A laser can be used to interpret light reflected from the flat or pitted surface.
	No moving parts; data is stored as an electrical charge.

(c) Network protocols break the files into packets before transmission.
Three fields in a network packet are source, destination, and check sum.

Give **two** additional fields found in a network packet.

(2)

1 .....

2 .....

(d) State the purpose of a check sum.

(1)

.....

.....

(e) John needs to convert the file sizes from megabytes (MB) to gigabytes (GB).

State how John could convert 4096MB to GB.

(1)

.....

.....

(f) The end user will use a browser to view the club's website.

Describe **one** difference between the Internet and the World Wide Web.

(2)

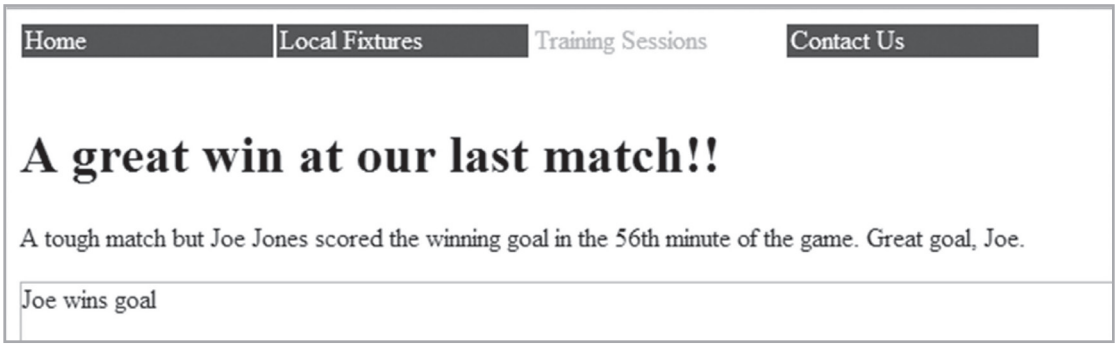
.....

.....

.....

.....

(g) John has created a sample page for the website. Here is the page displayed in a browser together with the code for the page.




```
1  <html>
2  <head>
3  <title>Local Football Club</title>
4  <style>
5      ul { list-style-type:none; margin:0; padding:0;}
6      a { display:block; width:150px; background-color:blue;
7          color:white; text-decoration: none; padding-left:2px;
8          border:2px; border-color:black; cursor:pointer; }
9      a:hover { color: orange;  background-color: white; }
10     li { display:inline; float:left; margin:1px;}
11 </style>
12 </head>
13 <body>
14     <ul>
15         <li><a href="home.html">Home</a></li>
16         <li><a href="local_fix.html">Local Fixtures</a></li>
17         <li><a href="training.html">Training Sessions</a></li>
18         <li><a href="contact.html">Contact Us</a></li>
19     </ul>
20 <br/><br/>
21 <h1>A great win at our last match!!</h1>
22 <p>A tough match but Joe Jones scored the winning goal in
23     the 56th minute of the game.  Great goal, Joe.</p>
24 <img src="thegoal.jpg" width="700" height="500" alt="Joe wins goal">
25 </body>
26 </html>
27
```

(i) State the **line numbers** that show Cascading Style Sheet information.

(1)

.....

(ii) Here is line 18 of the code.

Contact Us

Explain how it is connected to the Cascading Style Sheet information.

(1)

.....

.....

(h) Audio interviews with the club's coach are converted to a digital format.

(i) State the aspect of the analogue signal that must be sampled and stored as binary data during the analogue to digital conversion.

(1)

.....

(ii) State how increasing the **sampling frequency** affects the digital representation of the original audio.

(1)

.....

.....

(i) The club has a simple black and white logo. The image is compressed using a lossless, run-length encoding (RLE) algorithm.

Explain how a run-length encoding algorithm works.

(2)

.....

.....

.....

.....

(Total for Question 3 = 18 marks)

1 An online quiz asks students questions about computer science topics.

(a) Images are used in some of the questions.

(i) An image is 300 pixels high and 200 pixels wide.

Construct an expression to calculate how many pixels are needed to represent this image.

(1)

(ii) An image file uses 24-bit colour depth.

Describe how 24-bits are used to represent the colour in the file.

(3)

(b) One of the colours used in an image is 'cadet blue'.

'Cadet blue' in binary is 0101 1111 1001 1110 1010 0000

Convert 0101 1111 1001 1110 1010 0000 to hexadecimal.

(3)

(c) A player earns a badge for every 100 questions they answer correctly, providing this includes at least 10 hard questions or 30 medium questions.

This can be expressed as (NQ >= 100) and (HQ >= 10 or MQ >= 30).

Complete the truth table.

(6)

NQ >= 100	HQ >= 10	MQ >= 30	HQ or MQ	NQ and (HQ or MQ)
0	0	0	0	
0	1	0		0
0	0	1	1	
0	1	1	1	0
1	0	0		0
1	1	0	1	
1	0	1	1	
1	1	1	1	1

(Total for Question 1 = 13 marks)

1 A computer game designer is creating a new game.

(a) Colours in the game are represented in hexadecimal.

Convert the binary numbers in this table to hexadecimal.

(3)

	Hexadecimal
1101 1110	
1010 1111	
1100 0100	

(b) Convert the hexadecimal number 12 to binary and the result from binary to denary.

(2)

Binary

.....

.....

Denary

.....

.....

(c) State what is meant by the term 'image resolution'.

(1)

(d) Computers use binary to represent colour.

Compare the use of 8 bits and 24 bits to represent colour.

(3)

(e) The game uses black and white as well as colour images.

Explain the effects of using a run-length encoding (RLE) algorithm on the black and white images used in the game.

(3)

(Total for Question 1 = 12 marks)

5 The principles of computer science are used in computer game design.

(a) State the reason why console games are provided on ROM rather than RAM.

(1)

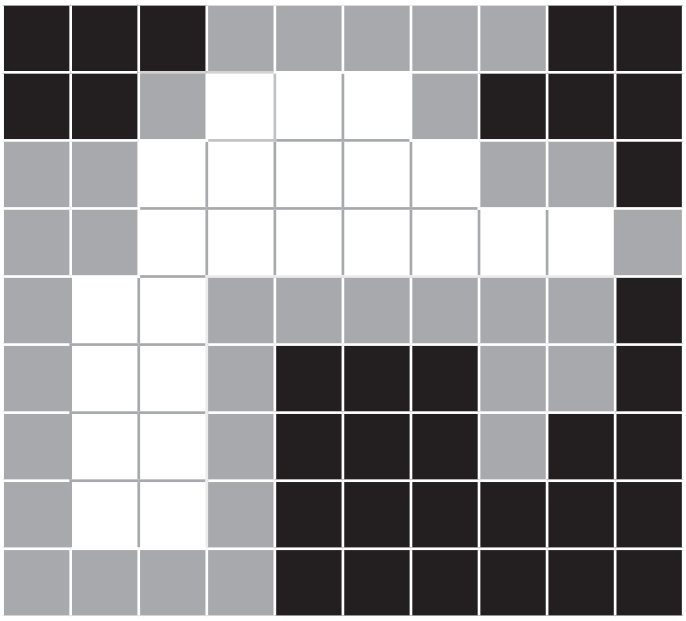
(b) Explain why a game console requires RAM.

(2)

(c) Describe how logic is used in computer games to produce more realistic simulations of the real world.

(2)

(d) Data representing this image must be compressed using run-length encoding (RLE).



Palette:

	000
	010
	111

(i) The first 3 bits are used for the colour and the next 4 bits are used for the run length of pixels.

Encoding starts from the top left pixel and is continuous between rows.

Convert the first two rows of pixels to binary data using RLE.

(3)

(ii) Construct an expression to show the maximum saving in bits that could be made by using an RLE algorithm to compress an image with this resolution.

(4)

(Total for Question 5 = 12 marks)

3 Data

(a) Computers manipulate binary patterns. Patterns can represent signed or unsigned integers.

(i) Convert the denary number 57 to 8-bit binary.

(2)

(ii) Convert the binary number 0010 1101 to hexadecimal.

(2)

(iii) Describe the process of converting a binary number to two's complement.

(2)

(iv) Explain what has happened as a result of adding these two 8-bit binary numbers.

	1	0	1	1	0	0	0	1
	1	0	1	0	1	1	0	0 +
1	0	1	0	1	1	1	0	1

(2)

(b) After applying compression to a file, the original contents cannot be reconstructed fully.

State the type of compression used on the file.

(1)

(c) Data can be encoded using ASCII.

Describe ASCII.

(2)

(d) A pixel is the smallest element in a bitmap image.

(i) Two images are displayed on the same screen.

One image is 1280 × 720 pixels. The second image is 1920 × 1080 pixels. The second image has a higher resolution.

State **one** reason why the second image will be displayed in more detail.

(1)

.....

.....

(ii) A 10-colour bitmap image uses 15-bit colour depth. The image is 1028 pixels wide and 640 pixels high.

Complete the expression to show the minimum file size for the image in MiB.

You do not have to do the calculation.

(4)

$$\frac{\square \times \square \times \square}{1024 \times \square \times \square}$$

(Total for Question 3 = 16 marks)

1 Data

(a) Binary patterns consist of groups of bits.

(i) Identify the largest unit of measurement.

(1)

- ☒ **A** Gibibyte
- ☒ **B** Kibibyte
- ☒ **C** Mebibyte
- ☒ **D** Nibble

(ii) State the number of unique values that can be represented with 7 bits.

(1)

.....

.....

.....

(iii) The denary ASCII code for **D** is 68.

Give the denary ASCII code for **G**.

(1)

.....

.....

(b) Hexadecimal is used to represent memory addresses.

(i) Give **two** characteristics of hexadecimal notation.

(2)

1 .....

.....

2 .....

.....

(ii) Explain **one** reason why programmers use hexadecimal to specify memory addresses.

(2)

(c) Audio and image files store data in binary.

(i) Explain **one** reason why lossy compression is used to reduce the size of an audio file.

(2)

(ii) An image is 315 pixels wide, 923 pixels high and has a colour depth of 7 bits.

Complete the expression to show the minimum file size in bytes.

You do not have to do the calculation.

(3)

$$\frac{\square \times \square \times \square}{\square}$$

(d) Computer systems manipulate bit patterns.

(i) Identify the result of applying an arithmetic shift right by two to the binary pattern 0110 1100

(1)

- ☒ **A** 0001 1100
- ☒ **B** 1101 1000
- ☒ **C** 0001 1011
- ☒ **D** 1011 0000

(ii) Convert the denary number 25 to 8-bit binary.

(2)

(iii) Convert the denary number –13 to 8-bit binary using two's complement.

(2)

(Total for Question 1 = 17 marks)