AQA
Realising potential

LANGLEY PARK SCHOOL FOR BOYS

MORES ET STUDIA

GCSE COMPUTER SCIENCE

GCSE (8520)

UNIT 3.6

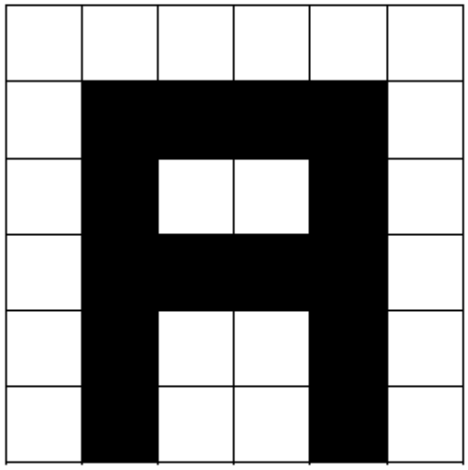
3.6 Representing images

Content	Additional information
Understand what a pixel is and be able to describe how pixels relate to an image and the way images are displayed.	Students should know that the term pixel is short for Picture Element. A pixel is a single point in a graphical image. VDUs display pictures by dividing the display screen into thousands (or millions) of pixels, arranged into rows and columns.
Describe the following for bitmaps: • size in pixels • colour depth. Know that the size of a bitmap image in pixels (width x height) is known as the image resolution.	The size of an image is expressed directly as width of image in pixels by height of image in pixels using the notation width x height. Colour depth is the number of bits used to represent each pixel.
Describe how a bitmap represents an image using pixels and colour depth.	Students should be able to explain how bitmaps are made from pixels.
Describe using examples how the number of pixels and colour depth can affect the file size of a bitmap image.	Students should be able to describe how higher numbers of pixels and higher colour depths can affect file size and should also be able to use examples.
Calculate bitmap image file sizes based on the number of pixels and colour depth.	Students only need to use colour depth and number of pixels within their calculations. Size (bits) = W x H x D Size (bytes) = (W x H x D)/8 W = image width H = image height D = colour depth in bits.
Convert binary data into a black and white image.	Given a binary pattern that represents a black and white bitmap, students should be able to draw the resulting image as a series of pixels.
Convert a black and white image into binary data.	Given a black and white bitmap, students should be able to write down a bit pattern that represents the image.

SPECIMEN MATERIAL 2015

0 4 **Figure 4** contains a black and white image consisting of 36 pixels.

Figure 4



0 4 . 1 Explain why 36 bits are needed to represent the pixels in the image shown in **Figure 4**.

[2 marks]

0 4 . 2 How many bits per pixel would need to be used if the image shown in **Figure 4** used 4 colours instead of 2?

[1 mark]

0 4 . 3 Define the term **pixel**.

[1 mark]

SPECIMEN PAPER 2 ADDITIONAL MATERIAL 2015

0 1 Images can be represented in a computer's memory as a bitmap.

0 1 . 1 Explain how an image can be represented as a bitmap.

[3 marks]

0 1 . 2 A bitmapped image with a colour depth of one can represent images that use two colours.

How many **more** colours can be represented in an image if the colour depth is increased from one to four?

[1 mark]

SPECIMEN PAPER 1 SUPPLEMENTAL MATERIAL 2015

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

[3 marks]

.....

.....

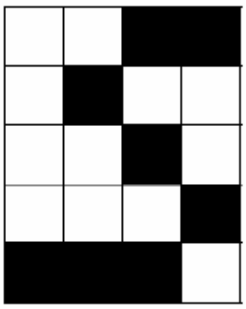
.....

.....

.....

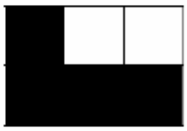
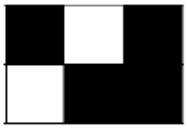
.....

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]

.....

.....

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

[1 mark]

.....

.....

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]

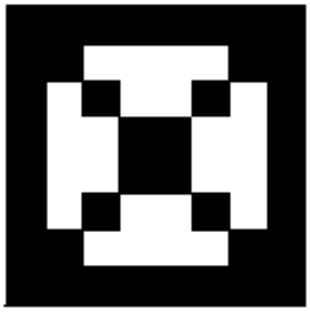
.....

.....

0 4 **Figure 2** shows an 8 x 8 black and white bitmap image. The image has been represented as a bit pattern with each bit representing a pixel. Row 3 has been represented as 01011010.

Figure 2

Row 1
Row 2
Row 3
Row 4
Row 5
Row 6
Row 7
Row 8



0 4 . 1 What is the binary representation of Row 4 in **Figure 2**?

[1 mark]

Row 4: _____

0 4 . 2 The image in **Figure 2** is going to be changed so that each pixel can be any one of 16 different colours.

What is the **minimum** number of bits that would be needed to represent the entire 16-colour image?

You should show your working.

[2 marks]

_____

_____

_____

_____

2020 PAPER 1

0 1 . 1 A bitmap image is represented as a grid of pixels.

State what is meant by the term pixel.

[1 mark]

0 1 . 2 State the maximum number of different colours that can be used if a bitmap image has a colour depth of six bits.

[1 mark]

0 1 . 3 What is the minimum file size for an 800 pixel by 1000 pixel bitmap image that uses 20 different colours? You should give your answer in **kilobytes**.

You should show your working.

[3 marks]

Answer _____ kB

0 1 . 4 The algorithm shown in **Figure 1** converts binary data entered as a string by the user into a representation of a black and white image.

The algorithm uses the + operator to concatenate two strings.

Characters in the string are indexed starting at zero. For example `bdata[2]` would access the third character of the string stored in the variable `bdata`

The `MOD` operator calculates the remainder after integer division, for example `17 MOD 5 = 2`

Figure 1

```
bdata ← USERINPUT
image ← ''
FOR i ← 0 TO LEN(bdata) - 1
   IF bdata[i] = '0' THEN
      image ← image + '*'
   ELSE
      image ← image + '/'
   ENDIF
   IF i MOD 3 = 2 THEN
      OUTPUT image
      image ← ''
   ENDIF
ENDFOR
```

Complete the trace table for the algorithm shown in **Figure 1** when the variable `bdata` is given the following value from the user:

`110101`

You may not need to use every row in the table. The algorithm output is not required.

[3 marks]

i	image