Chapter 26 – Coding systems

TASK QUESTIONS (WITH ANSWERS)

1 The number 5 could be represented in binary as 00000101. Using ASCII, the binary code for 5 is 00110101. Explain why there are two different binary codes for the same number.
The same bit string can have several different meanings or representations. It is critical, therefore, that the processor knows how to handle the strings of 0s and 1s.

2 Describe how the following methods work and explain why none of them are guaranteed to spot all errors in data.

a) parity bit
Counts the number of zeros or ones and then adds a further bit on the end to indicate whether there is an even or odd number (depending on the method used). At the end, the parity bit can be generated again to see if the number of 0s or 1s is still odd or even. If not, an error has occurred.

b) majority voting
Each bit is sent multiple times. If each bit is sent three times you would expect to see patterns 000111000111111 etc. If this was not the case, you could assume that 110 was supposed to be 111 and therefore the bit is supposed to be a 1.
The same principle can be applied on a larger scale, e.g. you can have multiple systems working on the same process, particularly on critical applications.

c) check digits
Check digits are created by calculating a number based on the data being sent and adding it to the end of the bit string. The number is recalculated at the end and if it is different an error has occurred.

None of these systems are 100% reliable as the bits being used to detect errors could be corrupted themselves. Similarly, several bits may be corrupted and they just happen to produce the same parity or check digit as the original.

3 What is a bit-mapped graphic?
A bit-mapped graphic is an image that is made up of dots or pixels. Each pixel is individually controlled in terms of colour and shade. Combining many pixels together forms the overall image.

4 If eight bits of memory are allocated to each colour (red, green, blue) in a pixel, how many megabytes of memory are needed to store a 1024 x 768 display?
8 bits is 1 byte so the total amount of memory needed to store an image 1024 x 768 is:
1024 x 768 x 3 = 2359296 bytes
equivalent to 2.36Mb

5 What is a vector graphic?
A vector graphic is an image made up of lines and coordinates. Vector graphics files store the mathematical codes required to create the image rather than the image itself.

6 Give two examples where analogue data needs to be converted to digital data.

to convert data received across the Internet via telephone cables

to convert recorded sound into digital format for processing on a computer

7 Give two examples where digital data needs to be converted to analogue data.

Digital to analogue conversion would be needed:

to convert computer data into analogue in order to be transmitted over telephone lines

to send data to external control devices.

8 'Analogue produces a purer sound than digital'. Give one reason why this statement could be true.

Analogue sound could be said to be purer because every minor change in the amplitude of the wave will be recorded, whereas digital sound only takes samples of the sound. As a consequence, digital sound may miss some of the subtle changes that analogue sound would not.

9 Explain why the storage of video with sound requires a large amount of disk space.

Video requires a large amount of disk space as it is made up of a series of still video images. Each image is made up of thousands of pixels, each of which may be allocated 24 bits.

The sound is synthesised by taking samples of the original sound. To re-create the sound faithfully, multiple samples must be taken every second. Therefore, thousands of samples have to be taken and stored.

10 Explain two situations where you might use:

a) lossy compression

video streaming, sound streaming,

b) lossless compression.

image compression, zipping files for storage

11 Explain the difference between odd and even parity giving an example of each.

Odd parity ensures the number of 1s in a bit string is odd and even parity ensures the number of 1s in a bit string is even.

Odd parity for an 8-bit string with the parity bit shown on the end 01100010(0)

Even parity for an 8-bit string with parity bit shown on the end 01100010(1)