# Revision Answers

1. The symbol is used to describe a set of integer numbers.  
   1. Complete the table below to identify which numbers are integers and which are not.

|  |  |  |
| --- | --- | --- |
| **Value** | **Is not an integer** | **Is an integer** |
| 3 |  | x |
| 1.2 | x |  |
| π | x |  |
| -7 |  | x |
| 3/2 | x |  |

[5]

* 1. is used to describe a set of **real numbers**. A real number is any number that also belongs to at least one of three other sets of numbers.   
       
     Name the three sets of numbers.

Set 1: Rational

Set 2: Irrational

Set 3: Integer

[3]

1. Binary values are extensively used within computer systems.
   1. What is the binary equivalent of the decimal number 23110? Show your working.

1 mark for each point:

* Shows place values in correct order 128,64,32,16,8,4,2,1
* Correct answer: 11100111

[2]

* 1. Hexadecimal values provide a summary of groups of binary digits. Convert the binary value 101011002 into hexadecimal. Show your working.

1 mark for each nibble:

* 1010 = A, 1100 = C

[2]

* 1. Represent the decimal value 2.7510 as an unsigned binary fixed point number, with   
     the most significant 4 bits as the whole number part and the remaining 4 bits as the fractional part after the binary point.

0010.1100  
 1 mark for each point:

* Left-most 4 bits: 0010
* Right-most 4 bits: 1100

[2]

* 1. Two’s complement binary is used to represent negative values.  
       
     Represent -12110 as an 8-bit two’s complement binary value:

10000111

1 mark for each point:

* Left-most 4 bits: 1000
* Right-most 4 bits: 0111

[2]

* 1. Use two’s complement 8-bit binary to calculate the answer to 9810 – 2210. Show how you worked your answer.

1 mark for each point:

* 98 converted to 01100010
* 22 converted to 00010110
* -22 converted to 11101010
* the two binary numbers added to give 01001100

[4]

* 1. Binary multiplication is a common operation in computer systems.   
       
     Calculate 1012 x 10102. Show your working:

1 mark for each point:

* Multiplication produces sub-totals of 1010…
* …and 101000
* Answer: 110010 (check: 5 x 10 = 50)

[3]

1. The unit **byte** is used to represent 8 bits of data. Number prefixes can be used to summarise large amount of bytes. e.g. 1KB = 1000 bytes.
   1. How many bits are are represented by the value 65 MB? Show your working.

1 mark for each point:

* 65,000,000 x 8
* 520,000,000 bits

[2]

* 1. How many gigabytes does this value represent?
* 0.065 GB

[1]

* 1. A KiB is a alternative byte prefix. How many bytes are in a KiB?
* 1024 bytes / KiB

[1]

1. ASCII is a system used to represent characters in a computer system using a predetermined character set.
   1. What is meant by a character set?

* The set of binary codes which map to each character used, *OR*
* a set of characters along with the binary codes which represent each one

[1]

* 1. The ASCII code for the letter b is 11000102. How would the word “at” be represented in ASCII:

a: 1100001

t: 1110100

(a is the first letter of the alphabet, t is the 20th.)

Answer 1100001 1110100

[2]

* 1. **Unicode** character encoding is used as an alternative coding system due to its larger character set. Explain why the ASCII character set is unsuitable in the modern world.

1 mark for each point:

* ASCII only uses a maximum of 8 bits giving 256 combinations
* Used by western alphabets only so no spare capacity for other alphabets

[2]

1. A digital picture frame is a low-powered computer that is able to display photos and play music. The image and sound files are stored on a 2 GB memory card plugged into the back of the frame.



* 1. Photos are taken on an 8 Megapixel digital camera with a 24-bit colour depth. How many photos can be stored on the memory card? Show your working.

1 mark for each point:

* 1 picture is: 8,000,000 x 24 = 192,000,000 bits
* …which is 24 MB
* 2000 MB card / 24 MB picture = 83 pictures (has to be rounded down to nearest whole number – can’t have half a picture)

[3]

* 1. All these photos do not fit on the memory card even though the full 2 GB is available, because **metadata** is stored with each image file. Give **two** examples of metadata. [2]

1 mark for each point. Answers include:

* Date created or modified
* Resolution or size in pixels
* Colour depth
* Camera type
* Lens type
* Any other sensible answer

[2]

* 1. Photos are transferred onto the memory card leaving 72 MB of storage. A user wants to store 3600 seconds of audio to play on the frame. The device needs the audio to have a sampling resolution set to 16 bits.  
       
     What sampling rate should they set the sound files to so that they can get this amount of audio on the device? Show your working.

1 mark for each point:

* Maximum data in one second: 72,000,000 / 3600 = 20,000 bytes / second
* As bits: 20,000 x 8 = 160,000 bits
* 160,000 bits per second / 16 bit per sample…
* …= 10,000 Hz

[2]

* 1. The instruction manual for the frame suggests that the sampling rate of audio files be no lower than 44,000 Hz.  
       
     What happens to the quality of audio as the sampling rate is reduced? Explain how the Nyquist theorem has been used to determine this lowest recommended sample rate.  
     1 mark for each point:
* Quality of audio redcuces as sampling rate decreases
* Nyquist states that in order to get accurate reproduction of audio, must sample at twice the highest frequency or more
* Humans can only hear up to 22,000 Hz hence 44,000 Hz gives accurate sound recreation

[2]

1. A photographer is uploading images across the Internet to his newspaper’s file repository in preparation for an exclusive front page story. There are several hundred high quality images that need to be uploaded.  
     
   The editor needs the photos urgently and needs them to be of a high quality. She suggests you compress the files before sending.
   1. Explain the differences between lossy and lossless compression and the effect that this might have on file transfer time.

1 mark for each point:

* Lossy compression removes unneeded data…
* …so that the file size can be significantly reduced at expense of less accuracy
* Lossless compression summarises patterns of the same data…
* …so that complete file detail is maintained but at a cost of less compression applied
* Lossless files will be higher quality, larger and take longer to transmit…
* … lossy compression will reduce the quality of the images and transfer time

[5]

* 1. You feel that the files need to be encrypted when being sent across the Internet. Explain why this would be a good idea.

1 mark for each point:

* Internet is a public network and data can be intercepted by anyone
* Encryption ensures the contents of each message cannot be understood without a decryption method

[2]  
The newspaper uses a Vernam cipher to allow all its employees to upload secure data to its servers. To do this they provide employees with a **one-time pad**.  
  
Explain what the one-time pad is and how it should be used by employees.  
  
1 mark for each point:

* Method of encrypting messages so that they are unbreakable
* Employees should use pad to encrypt the data being sent
* Pad should be destroyed after message has been sent

[2]  
 Total 50 marks