INFORMATION REPRESENTATION

COMPUTER SCIENCE

Topic: Information Representation
Duration: 2 hours

INSTRUCTIONS

- Carry out every instruction in each task.
- Answer **all** questions.
- Use a black or dark blue pen.
- You may use an HB pencil for any diagram, graphs or rough working.
- **Calculator Not Allowed**.
- Show your workings if relevant.

INFORMATION

- The total marks for this paper is **113 marks**.
- The number of marks for each question or part question is shown in brackets [ ].

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1. The following bytes represent binary integers using the two's complement form. State the equivalent denary values.

(a) 0101 1010 [2]

(b) 1111 1111 [2]

(c) Write the integer -53 in two's complement form. [2]

(d) What is the largest positive integer that can be represented using 8 bits in two's complement form? Give your answers in denary. [2]

2. Write the denary integer 798 in binary-coded decimal (BCD) form in:

(a) Packed BCD [1]

(b) Unpacked BCD [1]

(c) Write one use of BCD. [2]

3. Write the difference between ASCII codes and Unicode. [2]

4. A software developer is developing a new software which will include images.

(a) Explain the difference between bitmap and vector images. [2]

(b) Explain any one way to losslessly compress an image. [2]

(c) Explain any one way to lossily compress an image. [2]

5. Compression is a technique used to reduce the size of data.

(a) Explain the difference between lossless and lossy compression. [2]

Manip decides to compress a file before sending it to his friend.

(b) Explain one advantage and one disadvantage of compressing the file. [2]

Explain one lossy (if suitable) and one lossless compression method for following:

(c) Text [2]

(d) Image [2]

(e) Audio [2]

(f) Video [2]

6. A video recording application stores videos in 60 frames per second. Each frame is a 1920x1080 pixel image.

(a) Calculate the size of 5 minutes of video in MegaBytes if bit depth is 24 bits. [4]

For thumbnail for the video, a user extracts image that is 16384 pixels wide and 512 pixels high.

(b) Calculate the size of image file in gibibytes. [3]

(c) The actual size of image is usually different than the calculated size. Explain why. [2]

7. A singer uses microphone and a audio recording software to record a song.
The software allows user to select sampling rate and sampling resolution.

(a) Explain what is meant by sampling rate and sampling resolution. [2]

(b) Describe how changing sampling rate will affect the recorded audio. [2]

(c) Describe how changing sampling resolution will affect the recorded audio. [2]

8. A computer program needs to store Roll Number, Name, and Marks of students.

(a) What data type would be suitable for storing detail of each student, and why? [2]

(b) Write type definition for the data type you have chosen. [2]

(c) If the program needs to store data of 100 students, how would you store the data? Give proper reason. [2]

9. Explain what is meant by Enumerated data type and pointer data type with example of type declaration and use. [6]

10. File handling is an important concept in programming.

(a) Explain what is meant by file handling. Why is it important? [2]

(b) Explain how sequential file organization is different from serial file organization. [2]

(c) Explain how you would use random file organization and access. [2]

11. Convert these binary floating-point numbers into denary numbers. Both mantissa and exponent are in two's complement form.

(a) [2]

Mantissa								Exponent							
0	1	0	0	1	1	1	0	0	0	0	0	0	1	0	1

(b) [2]

Mantissa								Exponent							
0	1	1	1	0	0	0	0	1	1	1	1	1	1	0	1

(c) [2]

Mantissa								Exponent							
1	0	1	0	0	0	0	0	1	1	1	1	1	1	1	1

(d) [2]

Mantissa								Exponent							
1	0	1	1	1	1	1	1	0	0	0	0	0	0	1	0

12. Convert these denary numbers into binary floating-point numbers.

(a) +3.5 [3]

Mantissa								Exponent							

(b) -7.25 [3]

Mantissa												Exponent			

(c) +0.75

Mantissa Exponent [3]

(d) -0.125

Mantissa Exponent [3]

(e) -0.75

Mantissa Exponent [3]

13. Normalize the following floating-point numbers.

(a) Mantissa Exponent [2]

0	0	0	1	0	1	1	0	0	0	0	0	0	0	1	1

(b) Mantissa Exponent [2]

1	1	1	0	1	1	0	0	0	0	0	0	1	0	1	0

(c) Mantissa Exponent [2]

0	0	1	0	1	1	1	0	0	0	0	0	0	1	0	1

(d) Why is normalization of floating-point numbers important? [2]

(e) A programming language print 0.30000000001 as a result of 0.1 + 0.2. Explain why this happens. [2]

14. A computer system uses 8 bits for mantissa, and 4 bits for exponent.

(a) What are the range of values that can be represented using this system? [6]

(b) What is the effect of increasing the number of bits in mantissa? [2]

(c) What is the effect of increasing the number of bits in exponent? [2]