S5 ICT Practice Paper | Data representation and file size, subnetting, database queries, program trace, multimedia compression, information security

S5 ICT | Time allowed: 75 minutes | Total: 100 marks | 24 questions

Question 1: Data representation and multimedia file size (18 marks)

Data representation

1. (a) Convert the binary number 1101 0110 to denary and to hexadecimal, and state how many bytes it occupies (8 bits = 1 byte). (4 marks)

2. (b) A 1920 × 1080 bitmap uses 24-bit true colour. Find its uncompressed size in bytes and in MiB (1 MiB = 1 048 576 bytes), correct to 2 decimal places. (5 marks)

3. (c) A stereo sound clip is sampled at 44.1 kHz with 16-bit depth and lasts 180 seconds. Find its uncompressed size in bytes and in MiB, correct to 2 decimal places. (5 marks)

4. (d) If both the width and the height of that bitmap are halved, what fraction of the original uncompressed size remains? Give the answer as a percentage. (4 marks)

Question 2: Subnetting and transmission time (17 marks)

Networking

5. (a) A network uses the subnet mask 255.255.255.192 (/26). How many usable host addresses does each subnet provide, and how many addresses are in each subnet block? (5 marks)

6. (b) The subnets of 192.168.10.0/26 start at .0, .64, .128 and .192. State the broadcast address of the third subnet and explain why. (4 marks)

7. (c) A 24 MB file is sent over a 12 Mbps link at 80% efficiency. How many seconds does the transfer take? (1 MB = 8 Mb) (4 marks)

8. (d) Another 60 Mbps leased line uploads a 480 MB backup with no overhead. How many seconds does it take? (4 marks)

Question 3: Database keys, SQL and normalisation (16 marks)

Databases

9. (a) A student table has the fields StudentID, Name, Class and Score. Which field is the best primary key? State two requirements that a primary key must satisfy. (4 marks)

10. (b) The 6 records are (4A,72) (4B,55) (4A,58) (4A,91) (4B,67) (4C,48). What does SELECT COUNT(*) FROM Students WHERE Class = '4A' AND Score >= 60; return? (4 marks)

11. (c) The original table stores Activity1 and Activity2 in one record. To reach first normal form (1NF), how many tables are needed and how many records does each hold? (4 marks)

12. (d) If a DateOfBirth field is added, which data type is suitable? Give one validation method suitable for the Score field. (4 marks)

Question 4: Program trace and loop counts (18 marks)

Programming

13. (a) Trace the program and write the value of total after each iteration (6 values) and the final output.

```
total <- 0
FOR i <- 1 TO 6
IF i MOD 3 = 0 THEN total <- total + i * 2 ELSE total <- total + i
NEXT i
OUTPUT total
```

(6 marks)

14. (b) How many times is the THEN branch (the multiplication) executed, and at which values of i? (4 marks)

15. (c) Another program: n <- 100; count <- 0; WHILE n > 1 DO n <- n DIV 2; count <- count + 1; END WHILE. List the successive values of n and the final value of count. (4 marks)

16. (d) For the nested loops FOR i <- 1 TO 4; FOR j <- 1 TO i; OUTPUT i * j; NEXT j; NEXT i, how many times does the inner body run in total? (4 marks)

Question 5: Multimedia compression and video files (16 marks)

Multimedia

17. (a) An 800 × 600 8-bit greyscale image is uncompressed. Find its size in bytes and in KiB. (4 marks)

18. (b) With lossless compression at a 4:1 ratio, what is the compressed size in bytes and in KiB, correct to 2 decimal places? (4 marks)

19. (c) A 1280 × 720, 24-bit, 25 fps video lasting 120 s is compressed to 8% of its raw size. Find the compressed size in bytes and in GiB, correct to 2 decimal places. (5 marks)

20. (d) Of MP3, PNG and FLAC, which uses lossy compression? Give one reason. (3 marks)

Question 6: Cipher, hashing and backup (15 marks)

Information security

21. (a) A Caesar cipher shifts every letter forward by 5 (A to F, Z to E). What plaintext gives the ciphertext XJHWJY? (4 marks)

22. (b) A system stores only the hash of each password. State two properties of a hash function and explain why this is safer. (4 marks)

23. (c) Backing up 400 GB at 80 MB/s takes how many seconds, and how many minutes to 1 decimal place? (4 marks)

24. (d) Online banking requires a password plus an SMS code. Which type of authentication is this, and which attack does it reduce? (3 marks)