S5 ICT Practice Paper 1 with Answers

ICT · S5 · Data-response

S5 ICT paper on hex conversion, file sizes, network transfer time, spreadsheets, databases, algorithm steps and password strength; 6 questions, 100 marks, with answers.

1. Number systems and file size (16 marks)

A student uploads a 90-second music clip and a photo to the school server. The audio is sampled at 44.1 kHz with a 16-bit sample size, mono; the photo is 1920 x 1080 pixels with a 24-bit colour depth.

#	Question	Answer and marking notes
1	Convert the hexadecimal value 2F5A to decimal.	Answer: 2 x 4096 + 15 x 256 + 5 x 16 + 10 = 12122.
2	Find the raw size of the WAV file in bytes and in MiB (1 MiB = 1048576 bytes).	Answer: bit rate = 44100 x 16 x 1 = 705600 bps; size = 44100 x 2 x 90 = 7938000 bytes = 7.57 MiB.
3	Find the uncompressed size of the photo in MiB.	Answer: 1920 x 1080 x 3 = 6220800 bytes = 5.93 MiB.
4	The same audio is stored as a 128 kbps MP3. Find the MP3 size, the compression ratio and the percentage of the original size.	Answer: 128000 / 8 x 90 = 1440000 bytes; ratio 5.51:1; it keeps 18.1% of the original size.

2. Network transfer and bandwidth (18 marks)

The school link is 100 Mbps. A 400 MB file took 40 seconds to upload. A mobile plan allows 200 GB per month; extra data costs $12 per GB.

#	Question	Answer and marking notes
5	Ignoring overhead, what is the theoretical upload time in seconds?	Answer: 400 x 8 = 3200 Mb; t = 3200 / 100 = 32 s.
6	Find the actual throughput in Mbps and the transmission efficiency in per cent.	Answer: throughput = 3200 / 40 = 80 Mbps; efficiency = 80 / 100 x 100% = 80%.
7	Each day the user uploads 1.5 GB and downloads 6 GB, for 30 days. Find the total usage and the excess charge.	Answer: 7.5 GB x 30 = 225 GB; excess = 225 - 200 = 25 GB; charge = 25 x $12 = $300.
8	A 4 GB video is downloaded over a 1000 Mbps fibre link and a 200 Mbps 5G link. How long does each take, and what is the difference?	Answer: 4 x 8 x 1024 = 32768 Mb; fibre 32768 / 1000 = 32.8 s, 5G 32768 / 200 = 163.8 s, difference 131.1 s.

3. Spreadsheet formulas and weighted average (16 marks)

Cells B2:B6 hold five quiz scores: 45, 52, 61, 38 and 74. A second sheet compares last year (240) with this year (270), and totals weighted marks of 30%, 30% and 40%.

#	Question	Answer and marking notes
9	Write the formulas for the total and the mean, and give both values.	Answer: =SUM(B2:B6) = 270; =AVERAGE(B2:B6) = 54.
10	Fill =IF(B2>=50,"Pass","Fail") down the column; find how many pass and list their scores.	Answer: 3 pass, with scores 52, 61 and 74.
11	Find the percentage increase from 240 to 270.	Answer: (270 - 240) / 240 x 100% = 12.5%.
12	Three papers score 62, 58 and 70 with weights 30%, 30% and 40%. Find the weighted mean.	Answer: 62 x 0.3 + 58 x 0.3 + 70 x 0.4 = 18.6 + 17.4 + 28 = 64.0 marks.

4. Database queries and relations (16 marks)

The score column of the student table holds 55, 62, 78, 90, 48 and 66 in 6 records; a further 240 student records must store a class name.

#	Question	Answer and marking notes
13	Explain why a student ID is a better primary key than a name.	Answer: a student ID is unique in every record and never null, while two students may share a name, which breaks uniqueness; an ID also survives a change of name.
14	Run SELECT COUNT(*) FROM student WHERE score >= 60. What is the result?	Answer: 62, 78, 90 and 66 give 4 records.
15	Run SELECT * FROM student ORDER BY score DESC LIMIT 2. Give the two scores and their mean.	Answer: 90 and 78; mean = (90 + 78) / 2 = 84.
16	If a class name takes 12 bytes, how many bytes are saved on 240 records by using a 4-byte foreign key instead?	Answer: each record saves 12 - 4 = 8 bytes; 240 x 8 = 1920 bytes.

5. Algorithms and program tracing (18 marks)

*A program runs total = 0, then for i in range(1,6): total = total + i*i. Another program halves n by integer division until n = 1.*

#	Question	Answer and marking notes
17	Trace the first program and give the final value of total.	Answer: 1 + 4 + 9 + 16 + 25 = 55.
18	With n = 1000, how many divisions does the second program perform?	Answer: 1000-500-250-125-62-31-15-7-3-1, that is 10 divisions.
19	For 1024 sorted items, what are the worst-case comparisons of linear search and binary search, and what is the ratio?	Answer: linear 1024; binary ceil(log2 1024) = 10; that is 1014 fewer, a factor of 102.4.

#	Question	Answer and marking notes
20	A doubly nested loop runs n times at each level. With n = 50, what is the total number of operations, and how many times more than a single loop?	Answer: 50 x 50 = 2500; a single loop runs 50 times; (2500) / 50 = 50 times more.

6. Information security and backup (16 marks)

A site requires 8-character passwords drawn from upper case, lower case and digits (62 characters). The server changes 3 GB of data each day, and backup compression is 4:1.

#	Question	Answer and marking notes
21	Compute the entropy of such a password in bits, to one decimal place.	Answer: 8 x log2 62 = 8 x 5.954 = 47.6 bits.
22	How many 4-digit PINs are there? At 100 tries per second, how long to try them all, and on average?	Answer: 10^4 = 10000; all of them take 10000 / 100 = 100 s; on average 50 s.
23	Explain why a site stores password hashes instead of plain text, and how two-factor authentication limits a leaked password.	Answer: a hash is a one-way function, so a leaked database exposes only hashes that are hard to reverse; two-factor authentication also demands a second factor such as a one-time code, so a leaked password alone cannot log in.
24	Find the compressed size of 30 daily backups; if two off-site copies are kept, what is the total storage?	Answer: 3 x 30 = 90 GB; compressed 90 / 4 = 22.5 GB; two copies need 45.0 GB.