S5 ICT Practice Paper | binary and colour depth, image compression, audio sampling, subnetting, algorithm efficiency and backup security

Senior Secondary Information and Communication Technology

S5 ICT practice paper with answers: number bases, colour depth, image compression, audio sampling, subnetting, algorithm efficiency and backup security. Free PDF.

Question 1 Number bases and colour depth

One colour channel value of a pixel is 10110110 in binary. A monitor uses 24 bits per pixel (8 bits each for red, green and blue) at a resolution of 3,840 by 2,160. A cheaper panel uses RGB565, with 5 bits for red and blue and 6 bits for green.

#	Question
1	(a) Convert 10110110 in binary to decimal and hexadecimal.
2	(b) Find the size of one uncompressed bitmap at that resolution in MiB.
3	(c) Moving from 24-bit to 16-bit colour, by what percentage does memory use fall?
4	(d) Find the number of colours available in 24-bit and in RGB565, and state the difference.

Question 2 Image compression and card capacity

A photographer shoots 4,000 photos of 12 megapixels each, using 3 bytes per pixel; after JPEG compression each file averages 3.2 MB. All photos go onto one 64 GB card of which 90 per cent is usable, then are backed up to the cloud over a 25 Mbps link.

#	Question
5	(a) Find the raw size of one photo and the compression ratio.
6	(b) What is the total size of the photos in GB?
7	(c) How many photos fit on the card, and how much space is left?
8	(d) If the real throughput is only 80 per cent of the link speed, how many minutes does the upload take?

Question 3 Audio sampling and streaming data

A 200 second stereo track is recorded at 44,100 Hz with 16 bit samples, then encoded as a 128 kbps MP3. A streaming service delivers the same song at 320 kbps.

#	Question
9	(a) Find the size of the uncompressed file in MiB.
10	(b) Find the MP3 size and the compression ratio against the uncompressed file.
11	(c) With 96,000 Hz sampling and all else unchanged, what is the new size and the percentage increase?
12	(d) How many MB of data does one hour of 320 kbps streaming use?

Question 4 Subnetting and download time

A network is 192.168.10.0/24; one of its subnets uses a /26 mask (255.255.255.192), and host 192.168.10.130 sits in one of them. Separately, a computer downloads a 750 MB installer over a 100 Mbps leased line at 85 per cent efficiency.

#	Question
13	(a) How many addresses does the subnet contain, and how many are usable host addresses?
14	(b) Find the network address and broadcast address of the subnet holding 192.168.10.130.
15	(c) Find the download time in seconds.
16	(d) To split 192.168.10.0/24 into 5 subnets of at least 25 hosts each, which prefix works, and how many subnets and hosts per subnet does it give?

Question 5 Comparison counts in searching and sorting

A sorted table holds 1,000,000 records and each key comparison takes 0.5 microseconds. Another program bubble sorts 500 items and could use merge sort instead.

#	Question
17	(a) In the worst case, how many comparisons does a linear search need, and how long does it take?
18	(b) In the worst case, how many comparisons does a binary search need, and how long?
19	(c) How many comparisons does bubble sort need in the worst case for 500 items?
20	(d) Merge sort needs about n log2 n comparisons; find that count and the speed-up over bubble sort.

Question 6 Backup capacity and password combinations

A company holds 2.4 TB of primary data, keeps 3 full copies under the 3-2-1 rule, changes about 40 GB a day and retains 30 days of incremental backups. Passwords are 8 characters long, each an uppercase letter, a lowercase letter or a digit, and an attacker can try one billion guesses per second. The nightly window is 4 hours at 90 MB/s.

#	Question
21	(a) Under the 3-2-1 rule, how much storage do all full copies need?
22	(b) Find the total size of 30 days of incremental backups and compare with the full copies.
23	(c) Find the total number of 8-character passwords and the days needed to try them all.
24	(d) Find the password entropy in bits, and decide whether a 4 hour window can complete one full 2.4 TB backup.