MEGABYTE • IT & ICT

MegaByte IT

Chapter-wise Written

Job Solution

CSE • EEE • ECE • ICT



- 1500 Written Questions
- 18 Chapters

WRITER

AL MaMun

Assistant Programmer, DoICT
Former Assistant General Manager (IT)
Bangladesh Rural Electrification Board
Email: doictmamun@gmail.com

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Chapter 01

Computer Fundamentals & Number Systems

Total questions in this chapter: 22

Chapter Questions (22 questions)

1. Differentiate between system software and application software. Give suitable examples of each.
2. Discuss how floating point representation contributes to rounding errors.
3. What factors should be considered when selecting a monitor for a computer?
4. Distinguish between OMR and MICR.
5. Describe the generations of computers.
6. Differentiate OCR, OMR and MICR.
7. Summarize high-yield differences frequently asked in technical interviews.
8. A bank needs to store 250,000 customer identification numbers, each containing exactly 12 ASCII digits. Calculate the raw storage requirement in bytes, KiB and MiB, assuming one byte per digit and no record overhead. Distinguish MB from MiB.
9. Compare ASCII, Unicode code points, UTF-8 and UTF-16. Explain why the number of characters in a multilingual customer name does not necessarily equal the number of bytes required to store it.
10. An uncompressed true-colour image has resolution 1600 × 1200 pixels and uses 24 bits per pixel. Calculate its size in bytes and MiB, excluding file headers and padding. Explain why a compressed JPEG can occupy much less space.
11. For a signed 8-bit integer, determine the representable range using two's-complement encoding. Represent -45 in binary and show what happens when 100 + 60 is evaluated using signed 8-bit arithmetic. Identify the overflow condition.
12. Distinguish input validation, data verification and error detection in data entry. Design a practical procedure for minimizing transcription errors when a bank operator inputs a customer account number.
13. A computer laboratory must choose between upgrading 8 GiB RAM to 16 GiB, replacing a hard disk with an SSD, and increasing the processor clock rate. For boot-time, swapping and CPU-bound workloads, identify the most relevant upgrade and justify each choice.
14. Explain the roles of device drivers, utility software, system calls and application programs with an example of printing a bank transaction receipt. Identify the software boundary that interacts directly with the hardware.
15. How are throughput, response time, latency and availability measured in an ICT service? A system processes 1,800 requests in 3 minutes; calculate its average throughput in requests per second and explain why this does not reveal the worst-case response time.
16. Convert each of the following numbers into the other three bases among binary, octal, decimal and hexadecimal. Show the conversion steps for both integer and fractional parts, and verify each result by converting it back to decimal:
(a) $(110101.101)_2$;
(b) $(735.4)_8$;
(c) $(345.625)_{10}$;
(d) $(2AF.8)_{16}$. State whether any result requires rounding.

Source number	Original base	Required conversions
110101.101	Binary	Octal, decimal and hexadecimal
735.4	Octal	Binary, decimal and hexadecimal
345.625	Decimal	Binary, octal and hexadecimal
2AF.8	Hexadecimal	Binary, octal and decimal

17. Convert the numbers $(545)_6$ and $(342)_8$ into binary format and show their sum in hexadecimal format.
18. Convert $(16A.6)_{16}$ and $(72.3)_8$ into binary format and show their sum in hexadecimal format.
19. (a) Write the decimal, octal and binary forms of the hexadecimal number $(E)_{16}$.
(b) Write the next four numbers in the hexadecimal sequence: 6FC, 6FE, ____, ____, ____, ____.

Additional Important Questions

20. Represent the decimal number −13.625 in IEEE 754 single-precision (32-bit) floating-point format. Show the sign, biased exponent and mantissa fields, and write the final result in hexadecimal.
21. Convert the decimal number 59 into (a) binary, (b) BCD (8421), (c) Excess-3 code and (d) Gray code. Show every step.
22. Calculate the storage required for: (a) an uncompressed 1920 × 1080 colour image with 24-bit colour depth; (b) a 3-minute uncompressed stereo audio clip sampled at 44.1 kHz with 16-bit samples; (c) a 1-minute uncompressed video of the same frame size at 30 frames per second. Express each result in MB (1 MB = 2^{20} bytes).

Questions with Answers

1. Differentiate between system software and application software. Give suitable examples of each.

Answer:

Point	System software	Application software
Purpose	Controls and manages hardware and provides a platform for other programs	Performs a specific task for the user

Point	System software	Application software
Dependence	Runs independently; the computer cannot work without it	Needs system software to run
Interaction	Works close to the hardware, mostly in the background	Interacts directly with the user
Language	Usually low-level/system languages (C, assembly)	Usually high-level languages
Examples	Windows, Linux, device drivers, compilers, utilities	MS Word, Excel, browsers, banking software

2. Discuss how floating point representation contributes to rounding errors.

Answer: Floating-point numbers (IEEE 754) store a value as sign × mantissa × $2^{exponent}$ using a fixed number of bits (24 bits of mantissa in single, 53 in double precision). Rounding errors arise because:

- **Finite precision:** only a limited number of significant bits is kept, so the exact result is rounded to the nearest representable number.
- **Binary base:** many decimal fractions (0.1, 0.2, 0.7) are infinite recurring fractions in binary, so they can never be stored exactly; hence 0.1 + 0.2 ≠ 0.3 exactly.
- **Uneven spacing:** the gap between neighbouring numbers grows with magnitude, so adding a very small number to a very large one loses the small one (absorption).
- **Accumulation and cancellation:** errors add up over many operations, and subtracting two nearly equal numbers loses significant digits.

For this reason money is stored with integer or decimal (BCD) types, and floats are compared using a tolerance instead of ==.

3. What factors should be considered when selecting a monitor for a computer?

Answer:
- **Screen size and aspect ratio:** according to the work (e.g. 22–27 inch, 16:9).
- **Resolution and pixel density:** Full HD, QHD or 4K; higher resolution gives a sharper image.
- **Panel type:** IPS (best colour and viewing angle), VA (high contrast), TN (fast but poor colour).
- **Refresh rate and response time:** 60 Hz is enough for office work; 120–144 Hz and 1–5 ms for gaming.
- **Colour accuracy, brightness and contrast:** important for graphics and video work.
- **Connectivity:** HDMI, DisplayPort, USB-C, VGA compatibility with the PC.
- **Ergonomics and eye care:** height/tilt adjustment, flicker-free, low blue light.
- **Power consumption, warranty and price.**

4. Distinguish between OMR and MICR.

Answer:

Point	OMR	MICR
Full form	Optical Mark Recognition/Reader	Magnetic Ink Character Recognition/Reader
Reads	Presence or absence of pencil/pen marks at fixed positions	Special characters printed with magnetic (iron-oxide) ink
Technology	Reflected light (optical)	Magnetisation of the ink (magnetic)
Use	MCQ answer sheets, surveys, lottery forms	Bank cheques (cheque no., bank/branch code, account no.)
Security	Low; marks can be altered easily	High; difficult to forge, readable even if overwritten
Cost	Cheap	Expensive reader and ink

5. Describe the generations of computers.

Answer:

Generation	Period	Technology	Features / examples
First	1940–1956	Vacuum tubes	Huge, hot, machine language, punched cards; ENIAC, UNIVAC
Second	1956–1963	Transistors	Smaller, faster, assembly and early high-level languages (FORTRAN, COBOL); IBM 1401
Third	1964–1971	Integrated circuits (IC)	Keyboard/monitor, operating systems, multiprogramming; IBM 360
Fourth	1971–present	Microprocessor (LSI/VLSI)	Personal computers, GUI, networks; Intel 4004, IBM PC
Fifth	Present and beyond	ULSI, AI, parallel processing	Artificial intelligence, natural-language processing, quantum computing

6. Differentiate OCR, OMR and MICR.

Answer:

Point	OCR	OMR	MICR
Full form	Optical Character Recognition	Optical Mark Recognition	Magnetic Ink Character Recognition
Reads	Printed or handwritten characters	Marks/bubbles in fixed positions	Magnetic-ink characters (E-13B/CMC-7 font)
Principle	Optical scanning + pattern matching	Light reflection from marks	Magnetic sensing
Output	Editable text	Marked/unmarked data	Numeric cheque data
Accuracy	Depends on font and print quality	High for clean marks	Very high
Use	Digitising documents, passports, number plates	Exam answer sheets, surveys	Cheque clearing in banks

7. Summarize high-yield differences frequently asked in technical interviews.

Answer:

Topic	Key difference
RAM vs ROM	RAM is volatile, read/write working memory; ROM is non-volatile and holds firmware
Primary vs secondary memory	Primary is fast, small and directly accessed by the CPU; secondary is slow, large and permanent
Compiler vs interpreter	Compiler translates the whole program at once; interpreter translates and runs line by line
System vs application software	System software manages the machine; application software serves the user
Bit vs byte	Bit = 0 or 1; byte = 8 bits; 1 KiB = 1024 bytes
Analog vs digital	Analog signals are continuous; digital signals are discrete (0/1)
Hardware vs software	Hardware is the physical part; software is the set of instructions
Data vs information	Data is raw facts; information is processed, meaningful data
HDD vs SSD	HDD uses spinning magnetic platters; SSD uses flash memory and is much faster
32-bit vs 64-bit	A 32-bit CPU addresses up to 4 GiB; a 64-bit CPU addresses far more memory

8. A bank needs to store 250,000 customer identification numbers, each containing exactly 12 ASCII digits. Calculate the raw storage requirement in bytes, KiB and MiB, assuming one byte per digit and no record overhead. Distinguish MB from MiB.

Answer: Storage per ID = 12 digits × 1 byte = 12 bytes.

Total = 250,000 × 12 = **3,000,000 bytes**.

In KiB = 3,000,000 ÷ 1024 = **2,929.69 KiB**.

In MiB = 3,000,000 ÷ 1024^2 = 3,000,000 ÷ 1,048,576 ≈ **2.86 MiB**.

MB vs MiB: 1 MB (megabyte, SI/decimal unit) = 10^6 = 1,000,000 bytes, whereas 1 MiB (mebibyte, IEC/binary unit) = 2^{20} = 1,048,576 bytes. So the same data is exactly 3 MB but only about 2.86 MiB.

9. Compare ASCII, Unicode code points, UTF-8 and UTF-16. Explain why the number of characters in a multilingual customer name does not necessarily equal the number of bytes required to store it.

Answer:

Item	Description
ASCII	7-bit code with 128 characters (English letters, digits, symbols); 1 byte per character
Unicode code point	A unique number (U+0000 to U+10FFFF) assigned to every character of every language; it is an abstract number, not a storage format
UTF-8	Variable-length encoding, 1 to 4 bytes per code point; ASCII-compatible; dominant on the web
UTF-16	Variable-length encoding, 2 bytes for the BMP and 4 bytes (surrogate pair) for other characters

Characters ≠ bytes: the number of bytes depends on the encoding and on each character. In UTF-8 an English letter takes 1 byte but a Bangla letter takes 3 bytes and an emoji 4 bytes. Moreover, one visible character may consist of several code points (e.g. a Bangla consonant + kar or a conjunct). For example, "Rahim" needs 5 bytes, but "রহিম" has 4 code points and needs 12 bytes in UTF-8 (8 bytes in UTF-16). Therefore database column sizes must be planned in bytes/code units, not just visible characters.

10. An uncompressed true-colour image has resolution 1600 × 1200 pixels and uses 24 bits per pixel. Calculate its size in bytes and MiB, excluding file headers and padding. Explain why a compressed JPEG can occupy much less space.

Answer: Total pixels = 1600 × 1200 = 1,920,000.

Bytes per pixel = 24 ÷ 8 = 3.

Size = 1,920,000 × 3 = **5,760,000 bytes**.

In MiB = 5,760,000 ÷ 1,048,576 ≈ **5.49 MiB**.

Why JPEG is smaller: JPEG uses lossy compression. It converts RGB to luminance/chrominance and subsamples colour, applies the DCT on 8 × 8 blocks, quantises (discards) high-frequency detail that the eye hardly notices, and then applies run-length and Huffman coding. Thus spatial redundancy and visually unimportant information are removed, and the file is typically 10–20 times smaller.