Four Year Undergraduate Examination, 2024
Semester-III
Computer Science (Major)
Paper: MJCS06T (Theory)
(Computer Organization and Architecture)

Time: 3 Hours | Full Marks: 60

Questions are of value as indicated in the margin.
Answer **Question No. 1** and **any five** from the rest.

1. Answer **any five:**
a) Differentiate between microprocessor and microcontroller.
b) What is a tri-state buffer?
c) What are the phases involved in an instruction cycle?
d) When a floating point number is called normalized?
e) How are Infinity and NaN represented in IEEE-754 single precession floating point representation?
f) What are the functionalities of the Program Counter and Instruction Register in the 8085 microprocessor?
g) Draw the flag register of the 8085 microprocessor and write the name of each flag.

5×2=10

2. a) Distinguish between signed-magnitude and signed-2's complement representations for integers with examples.
b) Convert -14.625 into IEEE-754 single precession floating point representation.
c) Design a common bus system for four registers of 8-bit each using multiplexers.

3+3+4=10

3. a) Differentiate between Von Neumann and Harvard Architecture.
b) What data structure is used in subroutine call and how? Explain Briefly.
b) Briefly explain Booth's algorithm for multiplication.

3+3+4=10

4. a) Consider a cache consisting of 64 blocks of 16 words each, and the corresponding main memory is of 2K blocks having 16 words each. Considering the direct mapping, associative, and set-associative mapping, how is the memory address divided into various fields (Tag, Block, Word, and Set) in each mapping example?
b) Distinguish between interrupt-driven I/O and programmed I/O.
c) Briefly explain the carry-look-ahead adder with an example.

3+3+4=10

5. a) Distinguish between I/O mapped I/O and memory mapped I/O.
b) Draw a diagram that depicts the organization of 64K×16 memory with the help of 32K×8 memory chips.
c) Briefly explain the hardwired control unit with the help of a diagram.

2+3+5=10

6. a) Briefly explain how AD_0 - AD_7 pins are demultiplexed in the 8085 microprocessor.
b) Draw the timing diagram of the opcode machine cycle in the 8085 microprocessor.
c) Write an assembly language program to add *n* 8-bit integers on the 8085 microprocessor. Assume

that *n*, the number of integers to be added, is kept in a specific memory location, and the integers to be added are also kept in the memory locations contiguously. The result must also be stored in a different memory location(s).

2+4+4=10

7. a) What is the use of CALL and RET instructions in the 8085 microprocessor? How many bytes are required to keep each of them in memory? Further, mention the number of machine cycles required to execute each.
b) Briefly explain different interrupts in the 8085 microprocessor.
c) Describe the RIM and SIM instructions in the 8085 microprocessor with examples.

3+3+4=10

8. Write short notes on **any two** of the following: 5×2=10
a) Addressing modes supported by the 8085 microprocessor
b) Microprogrammed control unit
c) RISC vs. SISC architecture
d) Direct memory access (DMA)

B.Sc.(CS) Examination, 2024
Semester-III
Subject: Computer Science
Course: MJCS05T
(Design and Analysis of Algorithms (Theory))

Time: 3 Hours | Full Marks: 60

Questions are of values as indicated in the margin.
Answer **Question No.1** and any ***four*** from the rest.

1. (a) Explain all asymptotic notations.

   (b) Solve the following recurrence relation by using the recursion tree method:
   $T(n) = 3T(n/3) + n^2$ if $n = 3^p$ where p is a natural number and $T(1) = \Theta(1)$.

   (c) What is the time complexity of the following code:

```
A(int n)
{
    for(i = 1; i <= n^2; i++)
        for(j = 1; j <= n; j+ = i)
            for(k = 1; k <= j; k++)
                printf("ALGORITHM");
}
```

[4.5+3+4.5=12]

2. (a) Let $A_1, A_2, ..., A_n$ be n matrices of order $p_1 \times p_2, p_2 \times p_3, ..., p_n \times p_{n+1}$, respectively. Write an algorithm to parenthesize $(A_1 \times A_2 \times ... \times A_n)$. Analyze its time complexity.

   (b) With the help of the previous algorithm, illustrate all the steps for the matrices A_1, A_2, A_3, A_4, and A_5 having the orders 10×20, 20×25, 25×40, 40×5, and 5×50, respectively.

   (c) After solving 2(b), is it possible to parenthesize $(A_2 \times A_3 \times A_4)$? Justify your answer.

[6+4.5+1.5=12]

3. (a) Design an algorithm to find the k^{th} smallest element in an unsorted array. Analyze its time complexity.

   (b) Devise an algorithm to solve the shortest path problem in a weighted graph using Dijkstra's algorithm. Explain the algorithm, provide a step-by-step illustration with an example, and analyze its time complexity. [4.5+7.5=12]

4. (a) How does the Floyd-Warshall algorithm find all pairs shortest paths in a graph?

   (b) Find the time complexity and the space complexity of the algorithm.

   (c) Execute the Floyd-Warshall algorithm for the following adjacency matrix of a graph G:

$$\begin{pmatrix} 0 & 3 & \infty & 5 \\ 2 & 0 & \infty & 4 \\ \infty & 1 & 0 & \infty \\ \infty & \infty & 2 & 0 \end{pmatrix}$$

[4.5+1.5+6=12]

Turn Over

5. (a) Define p-ary minheap.

   (b) Find the index of the parent node for its child indexed at i and index all the p children where their parent node is indexed at i. Assume that the root is indexed at 0.

   (c) Write heapsort algorithm through p-ary minheap.

   (d) Create a 3-ary minheap for the following elements and then sort all the elements in descending order:
   50,70,40,30,80,90,10,20,60,100. [1.5+3+3+4.5=12]

6. (a) Create a Red-Black tree for the dataset 99,88,66,33,77,22,55,44,11. Explain all the steps.

   (b) Write an algorithm to merge two sorted arrays. Analyze its time complexity. [6+6=12]

7. (a) Explain the concept of backtracking algorithm.

   (b) How is the divide-and-conquer approach used in Strassen's algorithm.

   (c) Prove that the time complexity of Strassen's algorithm is $\mathcal{O}(n^{log_2 7})$. [3+4.5+4.5=12]

Undergraduate Examination, 2025
Semester-III
Computer Science (Minor)
Papers: MNCS02T (Computer Science)
Data Structures (Theory)

Time: 3 Hours

Full Marks: 60

Questions are of value as indicated in the margin
Answer Question No.1 and any four from the rest.

1. a) What are linear and non-linear data structures?
   b) What is Binary Search Tree?
   c) Write a program in C to sort an array using bubble sort.

   3+2+7

2. a) Explain merge sort algorithm with example.
   b) Write a C program to create and display a single linked list.

   8+4

3. a) Define linked list. Mention the applications of the linked list.
   b) Write a program for searching a value in an unsorted array.

   (2+2)+8

4. a) Write an algorithm to delete an element from an array.
   b) What are the advantages of doubly linked list over singly linked list? Explain with example.

   6+6

5. a) What is queue ? Mention its underflow and overflow conditions.
   b) Write C functions to perform insertion and deletion operations of a queue.

   (2+2)+8

6. a) Write a recursive C function to find the n-th Fibonacci number.
   b) Define the terms with example:
   i) Graph ii) Tree.

   6 + (3+3)

7. a) Write recursive functions for three types of tree traversals.

   b) Write a C function to perform insertion and deletion operations on stack.

   8+4

Four Year Undergraduate Programme Semester III Examination 2024
Computer Science
Course : MDCS01 (Computer Science)
(Fundamentals of Computer Science (Theory))

Time : 3 Hours **Full Marks : 60**

Section A

1. Answer all questions

1.5X8=12

a. Find x such that $(10110110)_8 = (x)_{16}$

b. The group of wires used to connect the components of CPU to transfer the data is called _____.

c. Which of the following devices uses photoelectric cells for character recognition?

(i) Hand-held scanner (ii) OCR (iii) OMR (iv) Bar code reader

d. Which of the following operating systems makes use of CLI ?

(i) MS-DOS (ii) Windows 2000 (iii) Windows Server 2003 (iv) Windows 7

e. Which of the following provides complete information related to a process?

(i) Process state (ii) Process scheduling (iii) Process communication (iv) PCB

f. Differentiate between a bit, a nibble, a byte, and a word.

g. _____ input device is used for converting the sound waves into the electrical waves.

h. A set of rules that are used for communication between two networks is referred to as:

(i) Network software (ii) Network media (iii) Network protocol (iv) Network operating system

2. Answer any four of the following:

2X4=8

a. What is a pointing device? Give examples of common types used in computing.

b. Which technology was used in the fourth-generation computers? How does it compare with the technology used in the third-generation computers?

c. What is the difference between low-level and high-level programming languages? Which one of these is considered more user-friendly and why?

d. Differentiate between LAN and WAN.

e. Describe the classification of storage systems with the help of a diagram.

Section B

Answer any four questions

3. Explain the importance of a bus in the computer system. What are the different types of buses usually found in the computer system? Describe them in detail, supported by an appropriate diagram. What do you understand by CPU cycle? What are the primary operations accomplished using the CPU cycle?

1+1+5+1+2=10

4. Explain the different types of semiconductor memory and their uses, including RAM, ROM, PROM, and EPROM. Additionally, compare the characteristics and applications of Hard Disk

Drives (HDDs), Solid State Drives (SSDs), and Optical Storage Devices. Illustrate the memory hierarchy and describe its structure and components.

4+2+4=10

5. Explain the various functions of an operating system and provide examples for each function. Differentiate between a thread and a process. What is a PCB? Discuss the Shortest Job First process scheduling algorithm.

4+2+2+2=10

6. What are the different types of network topologies? Explain any two network topologies through suitable illustrations. What is the difference between Internet and Intranet? Explain hybrid topology in detail.

2+3+2+3=10

7. Write short notes on any two.

   a. Optical recognition devices

   b. Dot-matrix and daisy wheel printers

   c. Positional number system

   d. Boolean operations

2X5=10

Four Year Undergraduate Programme, Examination, 2024

SUBJECT : HINDI

COURSE : AECC-3 (MIL Hindi)

(हिन्दी भाषा और संप्रेषण)

(Questions are of equal value or as indicated in the margin)

Time : 2 hours **Full Marks: 40**

1. निम्नलिखित प्रश्नों में से किन्हीं दो के उत्तर दीजिए : 2x12=24

(क) भाषा क्या है ? भाषा की विविध परिभाषा लिखिए।
(ख) भाषा के विविध रूप की चर्चा कीजिए।
(ग) संधि किसे कहते हैं ? संधि के प्रमुख प्रकारों को परिभाषित करते हुए उदाहरण सहित समझाइए।

2. निम्नलिखित प्रश्नों में से किन्हीं दो के संक्षिप्त उत्तर दीजिए : 2x8=16

(क) बलाघात किसे कहते हैं ? उदाहरण देकर स्पष्ट कीजिए।
(ख) स्वर वर्ण किसे कहते हैं ? इसके कितने प्रकार हैं ? उदाहरण के साथ लिखिए।
(ग) अल्पप्राण और महाप्राण व्यंजन किसे कहते हैं ? उदाहरण देकर स्पष्ट कीजिए।

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Undergraduate Examination (NEP) 2024
Semester-III
Subject AECC / MIL-2
AECC BENG02 Course 2

প্রশ্নের মান দক্ষিণ প্রান্তে উল্লিখিত

Time : 2 Hours **Full Marks: 40**

যে-কোনো দুটি প্রশ্নের উত্তর দাও: ২×১০ =২০

১। হাসির গল্প হিসেবে 'কুম্ভীর-বিভ্রাট' ও 'ডমরুধরের হীরকলাভ' গল্প দুটির সার্থকতা বিচার করো।

২। ছকভাঙা বাঙালি ছেলে হিসেবে শঙ্কর চরিত্রটি আলোচনা করো।

৩। পুরাণের গল্পকথাকে ছোটোদের উপযোগী করে তুলেছেন উপেন্দ্রকিশোর। পাঠ্যগল্প অবলম্বনে বিষয়টি ব্যাখ্যা করো।

৪। 'নন্টে ফন্টে' কমিকসের সংলাপের গুরুত্ব বিচার করো।

৫। যে-কোনো চারটি বিষয়ে টীকা লেখো: ৪×৫=২০

ক) ডমরুধর

খ) বুনিপ

গ) ডিয়েগো আলভারেজ

ঘ) উপেন্দ্রকিশোরের ফটোগ্রাফিচর্চা

ঙ) 'সন্দেশ' পত্রিকার সম্পাদক উপেন্দ্রকিশোর

চ) নারায়ণ দেবনাথের কমিক্সে 'বাস্তব'।
