2023
COMPUTER SCIENCE
PAPER-II

MWC(O)-COMP-II/23

Time Allowed – 3 Hours

Full Marks – 200

If the questions attempted are in excess of the prescribed number, only the questions
attempted first up to the prescribed number shall be valued
and the remaining ones ignored.

Answer may be given either in **English** or in **Bengali** but all answers must be
In one and same language.

Answer any FIVE questions

1. (a) Explain in brief about deadlock prevention.
What is the need of Page replacement? Consider the following reference string
7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1
Find the number of Page Faults with FIFO, Optimal Page replacement and LRU with four
free frames which are empty initially. Which algorithm gives the minimum number of page
faults?

(b) Explain the distinguishing features of i). Real time system ii) Multiprocessor system. 3+7
What are the benefits of a VM? With a neat diagram, explain the working of a VM.

(c) What are semaphores? Discuss the two primitive semaphore operations. Explain solution 3+2+5
to producer-consumer problem using Semaphores.

(d) Consider the following data with burst time given in milliseconds: 1+3+6

Process	Burst time	Priority
p1	10	3
p2	1	1
p3	2	3
p4	1	4
p5	5	2

The process has arrived in the order p1, p2, p3, p4, p5 all at time 0.
i. Draw Gantt charts for the execution of these processes using SJF, a nonpreemptive priority
and RR (quantum=1) scheduling.
ii. What is the turnaround time and waiting time of each process for each of the scheduling
algorithm.

2. (a) Distinguish between physical and abstract Systems. Discuss the primary characteristics of 6+4
open systems. What are the considerations in deciding on a candidate system and why are
they important?

2+3+5

P.T.O

(b) Describe the concept and procedure used in constructing DFDs. Give an example. Discuss the procedure for constructing a questionnaire. Under what circumstances would an analyst depend more heavily on external rather than internal information, and why?

3+3+4

(c) List and illustrate the primary uses and elements of a decision table. Discuss various cost estimation techniques.

5+5

(d) What types of test data are used in system testing? Explain the differences between White-box and Black-box testing. Discuss the role of the Data Processing Auditor in system testing.

2+3+5

3. (a) What is frame buffer memory? Explain clipping. Write the Mid-Point sub division Algorithm for line Clipping.

1+2+7

(b) What is refresh rate? Write the properties of Bezier's curve. Rotate a triangle [(4,6),(2,4),(6,2)] about the vertex (4,6) by 1800 clockwise and find the new vertices.

1+3+6

(c) Explain the characteristics of a good line. What are the main categories of animation tools? Explain three basic rules for animation with example.

2+3+5

(d) State the difference between CMY and HSV color models. What do you mean by principle vanishing point? Briefly explain about parallel and perspective projections.

2+2+6

4. (a) What is static data class? Explain with an example. Write the concept of abstract classes and virtual base classes with a suitable example. Explain the concept of reusability in with an example.

3+3+4

(b) Define encapsulation. Explain with examples: overloading vs. overriding. Discuss the concept of generalization and aggregation.

1+4+5

(c) Describe memory allocation for objects. Compare and contrast error and exception. When do we need multiple catch blocks for a single try block? Give an example.

3+3+4

(d) Explain operator precedence. Differentiate between nested if-else and switch statement. Discuss the benefits of returning objects from functions.

3+3+4

5. (a) Design a 4-bit combination circuit decrementer using four full adder circuits.

A computer uses a memory unit with 256K words of 32 bits each. A binary instruction code is stored in one word of memory. The instruction has four parts: an indirect bit, an operation code, a register code part to specify one of 64 registers, and an address part.

(i) How many bits are there in the operation code, the register code part, and the address part?
(ii) Draw the Instruction word format and indicate the number of bits in each part.
(iii) How many bits are there in the data and address inputs of the memory?

4+6

Contd.....P-3

(b) Briefly describe the hardware organization of associative memory. Discuss the read and write operations for associative memory.

6+4

(c) Discuss the difference between tightly coupled and multiprocessors and loosely coupled multiprocessors from the view point of hardware organization and programming techniques. Using a shift register with parallel load, explain how to convert serial input data to parallel output data and parallel input data to serial input data. How many 128 x 8 memory chips are needed to provide a memory capacity of 4096 x 16?

4+4+2

(d) List different types of addressing modes. Explain any one with suitable diagrams and examples.

The content of the top of a memory stack is 5320. The content of the stack pointer SP is 3560. A two-word call subroutine instruction is located in memory at address 1120 followed by the address field of 6720 at location 1121. What are the content of PC, SP, and the top of the stack?

(i) Before the call instruction is fetched from memory?

(ii) After the call instruction is executed?

(iii) After the return from subroutine?

4+6

6. (a) Explain serial and non-serial schedules. Explain lock and unlock operations for binary locks.

5+5

(b) Explain the design guidelines of relational schemas. Why is BCNF stronger than 3NF? Explain with the help of an example.

5+5

(c) What are JOINs? Explain INNER JOIN and OUTER JOIN. Write an E-R diagram of an employee salary database and also mention the type of association between the entities.

1+3+6

(d) Explain the following: Multi-valued dependencies and fourth normal forms. Given a relation R(A, B, C, D, E) and Functional Dependency set FD = { A → B, B → E, C → D}, determine whether the given R is in 2NF? If not convert it into 2 NF.

5+5

7. (a) Write the steps to convert Non-Deterministic Finite Automata (NDFA) into Deterministic Finite Automata (DFA).

Let M=({q0,q1}, {0,1}, $^\delta$, q0, {q1}).

Contd...P-4

Be NFA where δ(q0,0)={q0,q1}, δ(q1,1) = {q1}

δ(q1, 0)=ϕ, δ(q1, 1)={q0, q1}

Construct its equivalent DFA.

5+5

(b) Design the Analysis and Synthesis Model of Compiler. Construct Deterministic Finite Automata to accept the regular expression:

(0+1)* (00+11) (0+1)*

4+6

(c) Write the properties of LR parser with its structure. Show the following Grammar:

S-> AaAb|BbBa

A-> ϵ

B-> ϵ

Is LL(1) and parse the input string "ba".

4+6

(d) What are the problems associated with top-down parsing? Write the production rules to eliminate the left recursion and left factoring problems.

5+5

8. Write short notes on the following topics (Any four)   10x4

   (a) Generic classes
   (b) DMA controller
   (c) Network data model
   (d) Regular Expression
   (e) Ring-type topology networks
   (f) Memory mapped I/O