2019

Time : 3 hours

Full Marks : 80

Answer **all** the questions.

The figures in the right-hand margin indicate marks.

Candidates are required to answer in their own words as far as practicable.

(OPERATING SYSTEM)

1. What is operating system ? Explain different types of operating system with examples and discuss about their advantages and disadvantages in detail.   20

Or

(a) What is I/O interrupts ? Discuss about memory mapped I/O devices and I/O interface.   10

(b) State and explain different operating system architecture and services in detail.   10

2. (a) What are the objectives and minimal set of requirement for the file management system? Write down the file attributes in detail.　　10

(b) What is directory ? Explain directory structure and operation with example.　　10

Or

(c) What are different access methods to a File ? Discuss about sequential and index sequential access in detail.　　10

(d) Discuss about the method of File Protection and Access control.　　10

3. (a) Define process and its type. Give a brief description about the different states of a process life cycle with suitable diagram.　　10

(b) Explain the characteristics of deadlock. How can you prevent deadlock from a system using resource allocation graph ?　　10

Or

(c) Explain different scheduling criteria for SJF and FCFS for the given data: 10

Process	Arrival time	Brust time
P_1	00	05
P_2	02	02
P_3	04	02
P_4	07	03
P_5	09	04

(d) What do you mean by PCB ? Explain with suitable diagram the working of PCB controller. 10

4. (a) What is virtual memory ? How it is implemented ? Discuss about the working principle of virtual memory. 10

(b) What is paging ? Discuss basic paging techniques in detail. How a page table is implemented ? 10

Or

(c) What is Fragmentation ? What are its different types ? Compare between internal and external fragmentation. 10

(d) Consider the following page reference string:

2, 1, 0, 2, 3, 1, 0, 3, 0, 2, 1, 2, 0, 1

Assume demand paging with three frames, how many page faults would occurs for the following page replacement algorithm: FIFO, LRU, optimal 10

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(NUMERICAL ANALYSIS AND STATISTICAL METHODS)

1. (a) Write down Newton-Raphson Formula for finding $\sqrt{a}$ where a is a positive number and hence $\sqrt{5}$.   10

   (b) Solve the following equation using Gauss Jordan method

$$x_1 + 2x_2 + x_3 = 8$$
$$2x_1 + 3x_2 + 4x_3 = 20$$
$$4x_1 + 3x_2 + 2x_3 = 16$$

   10

Or

(c) Solve by Gauss–Jacobi method

$$5x + 2y + z = 12$$
$$x + xy + 2z = 15$$
$$x + 2y + 5z = 20$$

10

(d) Solve the following system of equation by Gauss elimination method.

$$2x + 3y - z = 5$$
$$4x + 4y - 3z = 3$$
$$2x - 3y + 2z = 2$$

10

2. (a) Use Lagrange's interpolation formula, find $y(10)$ given that $y(5) = 12$, $y(6) = 13$, $y(9) = 14$ and $y(11) = 16$.

10

(b) By dividing the range into 10 equal parts evaluate $\int_0^\pi \sin x \, dx$ using Trapezoidal rule and verify your answer with actual integration.

10

Or

(c) Evaluate $I = \int_1^2 \dfrac{2x^2}{1+x^4} dx$ using Simpson's $\dfrac{1}{3}$rd rule.   10

(d) Use Newton's backward interpolation formula to construct an polynomial of degree 3 for the given data.

$f(-0.75) = -0.07181250$ $f(-0.5) = -0.024750$
$f(-0.25) = 0.33493750$ $f(0) = 1.10100$ 10

3. (a) If X is uniformly distributed over $(0, 20)$ calculate the probability that (i) $X < 3$ (ii) $X > 10$ (iii) $1 < X < 8$ and also define cumulative distribution function of a random variable.   10

(b) Find mean and variance of Binomial distribution with Parameter n and P using moment generating function. Also define expected value of Discrete and continuous random variable.   10

Or

(c) At a party N men throw their hats into the center of a room. The hats are mixed up and each man randomly selects one. Find the expected number of men that select their own hats.   10

(d) A pair of dice is rolled 180 times. What is the probability that a total of 7 occurs

   (i)   at least 25 times

   (ii) between 33 and 41 time inclusive

   (iii) exactly 30 times   10

4. (a) (i)   Let P be an odd prime, prove that if there exists an integer x such that $P|x^2 + 2$ then $P \equiv 1$ or $3 \pmod 8$ 5

    (ii) Find $d(180)$, $\sigma(180)$, $\mu(180)$ 5

(b) Find a positive integer n such that $\dfrac{n}{2}$ is a square, $\dfrac{n}{3}$ is a cube and $\dfrac{n}{5}$ is a fifth power.   10

Or

(c) What is the remainder when the following sum is divided by 4

$$1^5 + 3^5 + \dots + 97^5 + 99^5$$ 10

(d) (i) Find all odd primes P for which 2 is square (mod P)   5

(ii) Find whether $x^2 = 219$ (mod 419) has a solution.   5

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(COMPUTER ORGANIZATION AND ARCHITECTURE)

1. (*a*) What is a Microprocessor ? What is need of Microprocessor ? Explain how an instruction is executed by a Microprocessor.   10

   (*b*) What is instruction cycle ? Explain the steps in a simple instruction cycle. Also explain how operations are performed during a fetch cycle. 10

Or

(c) What is addressing mode ? Explain different types of addressing modes. 10

(d) What is instruction set ? Explain elements of an instruction set. 10

2. (a) What is interfacing ? Explain the structure of I/O module. 10

(b) Define the term interrupt and its various classes with the help of a diagram, explain how interrupts are handled when they occur while an instruction is being executed. 10

Or

(c) What is an interrupt ? Explain the processing of an interrupt in 8086 microprocessor with diagram. 10

(d) Discuss the Direct Memory Access (DMA) with suitable diagram. 10

3. (a) Draw the Karnaugh map and simplify the following Boolean function. Draw the logic

diagram with

(i)   AND-OR gate

(ii) NAND gates

$F(A, B, C, D) = \Sigma(0, 2, 8, 9, 10, 11, 14, 15)$ 10

(b) What is meant by a functionally complete set of gates in digital circuits ? Show that a NAND gate is functionally complete.   10

Or

(c) Explain with example the different rules used in Boolean Algebra.   10

(d) Explain how AND, OR operation can be implemented using NAND Gate.   10

4. (a) What are Flip-flops ? Describe the J–K flip-flop with the help of a logic diagram.   10

(b) What is shift register ? Explain the general capabilities of shift registers.   10

Or

(c) What is decoder ? Explain 3 to 8 line decoder with diagram.   10

(d) Explain the working principle of Binary adder and Parallel adder.   10

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(INTRODUCTION TO DATABASE MANAGEMENT SYSTEM)

1. (*a*) What is Database Management System ? Why we should prefer database management system instead of file management system ?   10

   (*b*) Explain the three level of data abstraction with their function.   10

Or

   (*c*) What is ER diagram ? Explain the component of ER diagram.   10

(2)

(*d*) Differentiate between physical data independence and logical data independence.   10

2. (*a*) What is index sequential file ? Explain implicit index and limit indexing.   10

   (*b*) What do you mean by direct file ? How it is differ from index sequential file ?   10

Or

(*c*) Differentiate between series file and sequential file.   10

(*d*) What do you mean by file ? Explain different type of file organisation.   10

3. (*a*) What do you mean by normalization ? Explain the different types of normal forms.   10

   (*b*) What do you mean by integrity rule ? Explain Entity Integrity and Referential Integrity.   10

Or

(*c*) Explain the different types of relational algebra operations with examples.   10

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(d) What do you mean by join operator ? Explain inner and outer join. 10

4. (a) What do you mean by transaction ? Explain the property of a transaction. 10

(b) Explain concurrency control in Database Management system. 10

Or

(c) What is locking scheme ? Explain different types of locking. 10

(d) Differentiate between deadlock avoidance and deadlock defection technique. 10

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