SBCA—(2.1)

2019

Time : 3 hours

Full Marks : 80

Answer **all** questions.

The figures in the right-hand margin indicate marks.

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

(NUMERICAL ANALYSIS AND STATISTICAL METHODS)

1. (*a*) Using Newton-Raphson method, find a root of the equation $x^4 + x^3 - 7x^2 - x + 5 = 0$ correct up to four decimal places. 10

(*b*) Solve the following system of equations using Gauss-Seidel method : 10

$$20x + y - 2z = 17$$
$$3x + 20y - z = -18$$
$$2x - 3y + 20z = 25$$

Or

(*c*) Use Regula-Falsi method to find a root of the following equation correct up to 3-decimal places $x^3 - x + 5 = 0$. 10

(*d*) Find the inverse of the matrix using Gauss elimination method. 10

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 4 & 3 & -1 \\ 3 & 5 & 3 \end{bmatrix}$$

2. (*a*) Use Lagrange's formula, find the polynomial for the following data : 10

x	0	1	2	4
$f(x)$	2	3	12	147

(*b*) Find the value of $\log 2^{1/3}$ from $\int_0^1 \frac{x^2}{1+x^3}$ using Simpson's $\frac{1}{3}$rd rule with $h = 0.25$. 10

(*Continued*)

Or

(*c*) Using Newton's forward interpolation formula, find the cubic polynomial which takes the following values : 10

x	:	0	1	2	3
$f(x)$	:	1	2	1	10

(*d*) Evaluate $\int_1^2 \int_3^4 \frac{1}{(x+y)^2} dx\, dy$ using Trapezoidal rule taking $h = 0.5$, $k = 0.5$. 10

3. (*a*) State and prove Baye's theorem. 10

(*b*) An urn contains 6 red marbles and 4 black marbles. Two marbles are drawn without replacement from the urn. What is the probability that both the marbles are black ? 10

Or

(*c*) Given the joint probability distribution

$$f(x,y) = \begin{cases} \frac{x(1+3y^2)}{4}, & 0 < x < 2,\ 0 < y < 1 \\ 0, & \text{elsewhere} \end{cases}$$

Find $g(x), h(y), f(x|y)$ and evaluate

$$P\left(\frac{1}{4} < X < \frac{1}{2} | Y = \frac{1}{3}\right)$$ 10

(*d*) Prove that the variance of random variable X is :

$$\nabla^2 = E[X]^2 - \left(E[X]^2\right) \quad \text{and}$$

$$\text{cov}(X, Y) = E[XY] - E[X] \cdot E[Y] .$$ 10

4. (*a*) Prove that for any integers a and b with $a > 0$, there exist unique integers q, r such that $b = aq + r;\ 0 \le r < a$. 10

(*b*) (*i*) Solve the system of congruences

$$x \equiv 3 (\text{mod } 11)\ x \equiv 5 (\text{mod } 19)\ x \equiv 10 (\text{mod } 29)$$ 5

(*ii*) If $\gcd(a, m) = 1$ then prove that

$$a^{\phi(m)} = 1 (\text{mod } m)$$ 5

Or

(*c*) (*i*) Find the number of positive solutions of $3x + 5y = 1$. 5

(*ii*) Prove that if a belongs to exponent 3 modulo a prime p then $1+a+a^2 \equiv 0 \pmod{p}$ and $1+a$ belongs to exponent 6. 5

(*d*) If (x, y, z) is a primitive triple, then show that at least one of x, y and z is divisible by 5. 10

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(COMPUTER ORGANIZATION)

1. (*a*) Simplify the following expression using Boolean algebra :

(*i*) $(A+C)(AD+AD')+AC+C$

(*ii*) $A'(A+B)+(B+AA)(A+B')$

(*b*) Explain the different types of Flip-Flops.

Or

(*c*) Simplify the following Boolean functions using three variable maps :

(*i*) $F(x, y, z) = \Sigma(1, 2, 3, 6, 7)$

(*ii*) $F(x, y, z) = \Sigma(3, 5, 6, 7)$

(*d*) What do you mean by a multiplexer ? Draw a 4 to 1 line multiplexer and its function table.

2. (*a*) Perform the subtraction with the following unsigned binary numbers by taking the 2's complement of the subtrahend :

(*i*) 11010-10000

(*ii*) 11010-1101

(*iii*) 100-110000

(*iv*) 1010100-1010100

(*b*) Write short notes on :

(*i*) Binary adder

(*ii*) Floating point operation

Or

(*c*) Write the Booth's algorithm and explain it with suitable example.

(*d*) Write short notes on :

(*i*) Parallel adder

(*ii*) Carry look ahead adder

3. (*a*) Describe the instruction sequencing and instruction formats for one and two address instructions.

(*b*) Write short notes on :

(*i*) Absolute addressing modes

(*ii*) Auto increment and auto decrement

Or

(*c*) Explain the indexing and arrays of addressing modes.

(*d*) Write short notes on :

(*i*) Immediate addressing mode

(*ii*) Stacks and queues

4. (*a*) Explain the process of interrupts handling multiple devices.

(*b*) Explain the direct memory access technique.

Or

(*c*) Write short notes on :

(*i*) Interrupts

(*ii*) Vector interrupts

(*d*) Explain the difference between isolated and memory mapped I/O.

SBCA—(2.2)

2019

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(OPERATING SYSTEM)

1. (*a*) Briefly discuss about the evolution process of operating system. 10

(*b*) What is Operating System ? Write the advantages and disadvantages of various types of operating system. 10

Or

(*c*) Explain the following : 10

(*i*) Dual mode operation

(*ii*) I/O interrupts

(*d*) Discuss the various operating system services and their importance. 10

2. (*a*) Compare and contrast between sequential and direct access mechanism. 10

(*b*) Distinguish between file sequential access method and index sequential access method. 10

Or

(*c*) Explain the working process of directory structure in OS with a suitable diagram. 10

(*d*) Explain the following : 10

(*i*) File protection and access control

(*ii*) File operation

3. (*a*) Write the implementation of process control block with a neat diagram and its role in the context of switching of the process. 10

(*b*) What is CPU scheduling ? Explain any two scheduling algorithm (ex: FCFS, SJF, Round Robin) by giving a suitable example with Gantt chart. 10

Or

(*c*) What is Deadlock ? Explain the various methods to handle deadlock in operating system. 10

(*d*) Explain the FCFS, non-preemptive versions of SJF and Round Robin (time slice = 2) scheduling algorithm and find their Average Waiting Time, Average Turnaround Time and Throughput for the process given below : 10

Process :	P_1	P_2	P_3	P_4
Arrival Time :	0	1	2	3
Burst Time :	8	4	9	5

4. (*a*) Explain FIFO, optimal and LRU page replacement algorithms with an example reference string. Mention the merit and demerit of each of the above algorithms. 10

(*b*) Explain the principle of different partition technique in memory management with block diagram. 10

Or

(*c*) For the page reference string as
0, 2, 4, 2, 1, 9, 4, 3, 5, 7, 4, 5, 7, 8, 6, 3, 0, 2, 1 and with 3 memory frames, calculate the number of page fault using (*i*) LRU, (*ii*) OPT page replacement algorithm. 10

(*d*) Explain the following : 10

(*i*) Demand paging

(*ii*) Virtual memory.

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(INTRODUCTION TO DATABASE MANAGEMENT)

1. (*a*) State and explain the 3-level architecture of DBMS and also explain what is data independance along with its types. 10

   (*b*) Discuss the different components of DBMS and write down its advantages over file system. 10

   Or

   (*c*) What is data Model ? Explain what are different data model exist with example. 10

(*d*) What is E-R diagram ? Draw an ER diagram for Library Management system. 10

2. (*a*) What is indexing in database ? Write down different indexing methods in details. 10

(*b*) Differentiate between sequential and index-sequential method. 10

Or

What is hashing ? How many types of hashing techniques available for database ? Compare between hashing and indexing. 20

3. (*a*) Write down different set theoritic and basic operations of relational algebra. 10

(*b*) Write down what is the use of join operation. How many join operation used in Relational Algebra, explain with examples. 10

Or

Define Normal Form. What are its types. Discuss about 1NF, 2NF, 3NF, BCNF in details with example. 20

4. Write short notes on (any *four*) : 5×4

(*a*) Tree structure diagrams

(*b*) Data retrieval

(*c*) Network data model

(*d*) HDAM and HSAM

(*e*) DBTG CODASYL model

(*f*) Virtual records.