

CBCS SCHEME

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20MCA14

First Semester MCA Degree Examination, July/August 2021

Mathematical Foundation for Computer Applications

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions.
2. Distribution tables are allowed.

1. a. Define: i) Symmetric difference of two sets ii) Power set , with an illustration for each. (06 Marks)
- b. State pigeonhole principle. ABC is an equilateral triangle whose sides of length 1m. If we select 10 points inside the triangle, prove that at least two of these points are such that the distance between them is less than 1/3m. (07 Marks)
- c. Find all the eigen values and eigen vectors of the matrix

$$A = \begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$$
 (07 Marks)
2. a. For any two sets A and B, prove that
 i) $A - (A \cap B) = A - B$
 ii) $A - (A - B) = A \cap B$. (06 Marks)
- b. Among the integers from 1 to 200, find the number of integers that are
 i) Not divisible by 5
 ii) Divisible by 2 or 5 or 9
 iii) Not divisible by 2 or 5 or 9. (07 Marks)
- c. State and prove Demorgan laws, distributive laws of set theory. (07 Marks)
3. a. State the laws of logic.
 b. Prove the following is valid argument:

$$\begin{array}{c} \sim p \leftrightarrow q \\ q \rightarrow r \\ \hline \therefore p \end{array}$$
 (07 Marks)
- c. Negate and simplify each of the followings
 i) $\exists x, [p(x) \vee q(x)]$
 ii) $\forall x, [p(x) \wedge \sim q(x)]$
 iii) $\exists x, [\{p(x) \vee q(x)\} \rightarrow r(x)]$. (07 Marks)
4. a. Prove the following logical equivalences without using truth tables:
 i) $[p \vee q \vee (\sim p \wedge \sim q \wedge r)] \Leftrightarrow (p \vee q \vee r)$
 ii) $[(\sim p \vee \sim q) \rightarrow (p \wedge q \wedge r)] \Leftrightarrow p \wedge q$ (06 Marks)
- b. Define converse, inverse and contra positive of a conditional $p \rightarrow q$. State the converse, inverse and contrapositive of the conditional. "If a quadrilateral is a parallelogram, then its diagonal bisect each other". (07 Marks)
- c. Define Tautology; contradiction and contingency, prove that, for any propositions p, q, r the compound proposition $\{p \rightarrow (q \rightarrow r)\} \rightarrow \{(p \rightarrow q) \rightarrow (p \rightarrow r)\}$ is a tautology. (07 Marks)

- 5 a. Define partial order relation R defined on the set A. Let $A = \{1, 2, 3, 4, 6, 12\}$, define the relation R by aRb , if and only if a divides b. Prove that R- is a partial order on A, draw Hasse diagram for the relation. (06 Marks)
- b. Consider $A = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$. The relation R is defined as $(x, y) \in R$, if and only if $x - y$ is multiple of 5. Verify that R- is an equivalence relation. (07 Marks)
- c. Let $A = \{1, 2, 3\}$, and $B = \{1, 2, 3, 4\}$. The relations R and S from A to B are represented by the matrices.

$$M_R = \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}, \quad M_S = \begin{bmatrix} 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1 \\ 0 & 1 & 0 & 1 \end{bmatrix}$$

Determine the relations \bar{R} , \bar{S} , $R \cup S$, $R \cap S$, S^c and their matrix representations. (07 Marks)

- 6 a. Let $A = \{1, 2, 3, 4, 6\}$ and R be the relation on A defined by aRb if and only if a is multiple of b. Represent the relation R as a matrix and draw its diagram. (06 Marks)
- b. Let $A = \{a, b, c\}$, and R and S be relations on A whose matrices are given as

$$M_R = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 1 \\ 0 & 1 & 0 \end{bmatrix}; \quad M_S = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$$

Find the composite relations ROS, SOR, ROR, SOS and their matrices. (07 Marks)

- c. Let $A = \{1, 2, 3, 4, 5\}$. Define a relation R on $A \times A$ by $(x_1, y_1) R(x_2, y_2)$ if and only if $x_1 + y_1 = x_2 + y_2$
- Verify that R- is an equivalence relation on $A \times A$.
 - Determine the equivalent classes $[(1, 3)]$, $[(2, 4)]$ and $[(1, 1)]$. (07 Marks)

- 7 a. The probability distribution function P(X) of a variate X is given by the following table.

$$X: \quad 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6$$

$$P(X): \quad K \quad 3K \quad 5K \quad 7K \quad 9K \quad 11K \quad 13K$$

- For what value of K, above data represent a valid probability distribution.
 - Find $P(X \leq 4)$, $P(X \geq 5)$ and $P(3 \leq X \leq 6)$. (06 Marks)
- b. Given 2% of fuses manufactured by a firm are defective. Find the probability that a box containing 200 fuses has
- At least one
 - 3 or more
 - exactly two, defective fuses. (07 Marks)
- c. In a test on electric bulbs, it was found that the life of a particular brand was distributed normally with an average life of 2000 hours and standard deviation of 60 hours. If a firm purchases 2500 bulbs find the number of bulbs that are likely to last for
- More than 2100 hrs
 - Less than 1950 hrs
 - Between 1900 to 2100 hrs. (07 Marks)

- 8 a. For the standard normal distribution of a random variable Z, evaluate the followings:

$$\text{i) } P(0 \leq z \leq 1.45) \quad \text{ii) } P(-3.40 \leq z \leq 2.65) \quad \text{iii) } P(-2.55 \leq z \leq -0.8) \quad \text{iv) } P(z \leq -3.35). \quad (06 \text{ Marks})$$

- b. The length of a telephone conversation has an exponential distribution with a mean of 3-minutes. Find the probability that a call ends.
- in less than 3-minutes
 - taken between 3 and 5 minutes. (07 Marks)
- c. A random variable X has the following probability function for various values of x

| | | | | | | | | |
|-------|---|---|------|------|------|-------|--------|------------|
| x: | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| p(x): | 0 | k | $2k$ | $2k$ | $3k$ | k^2 | $2k^2$ | $7k^2 + k$ |

- i) Find k ii) evaluate $p(x < 6)$, $p(x \geq 6)$, $p(3 < x \leq 6)$ (07 Marks)

- 9 a. Explain the followings: i) Circuit ii) Euler and Hamiltonian path problem.
 b. Prove that whether the two following graphs are isomorphic or not:

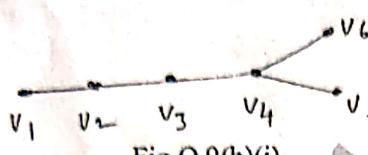


Fig.Q.9(b)(i)

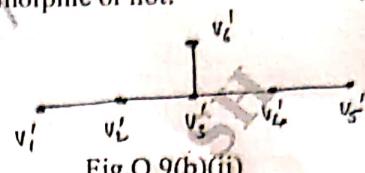


Fig.Q.9(b)(ii)

- c. Determine whether the following graphs given are bipartite or not. (07 Marks)

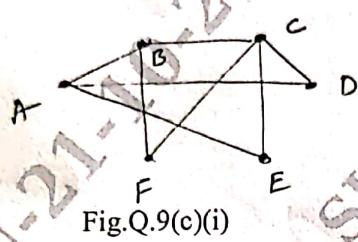


Fig.Q.9(c)(i)

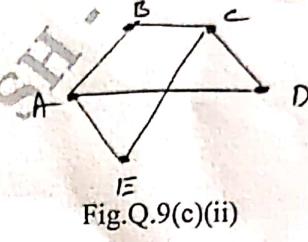


Fig.Q.9(c)(ii)

- 10 a. Define the terms:
 i) Regular graph
 ii) K-regular graph
 iii) Complete graph
 b. Find the in-degree and out-degree of each vertex of each of the following directed graphs. Also verify that the sum of the in-degrees (or the out-degrees) equals the number of edges. (06 Marks)
 (07 Marks)

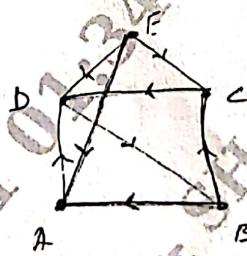


Fig.Q.10(b)

- c. Determine whether the graphs shown are isomorphic. (07 Marks)

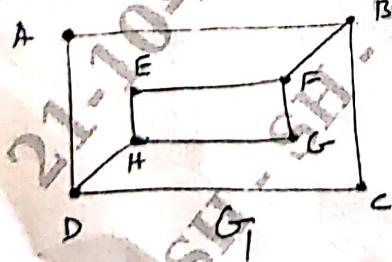
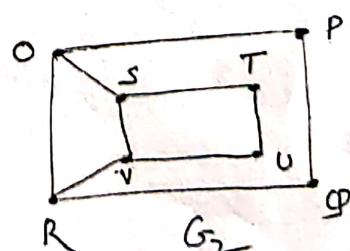


Fig.Q.10(c)



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20MCA15

First Semester MCA Degree Examination, Jan./Feb. 2021

Research Methodology and IPR

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What is Research? Discuss the objectives and motivations in research. (10 Marks)
 b. Explain how significance of research is different for different people. (10 Marks)

OR

- 2 a. Differentiate between research method and research methodology. (10 Marks)
 b. What are the problems that are encountered by researchers in India? (10 Marks)

Module-2

- 3 a. When can a problem become a research problem? (10 Marks)
 b. Why is it needed to define research problem? (04 Marks)
 c. What are the techniques involved in defining a research problem? (06 Marks)

OR

- 4 a. What is literature review? How can it help in research? (10 Marks)
 b. How do you think researcher should collect literature for review? (10 Marks)

Module-3

- 5 a. What is research design? What are the components of research design? (10 Marks)
 b. List and explain few important experimental designs. (10 Marks)

OR

- 6 a. What are the characteristics of a good sample design? (04 Marks)
 b. Under what circumstances would you recommend (i) a probability sample
 probability sample (iii) a stratified sample and (iv) a cluster sample. (16 Marks)

Module-4

- 7 a. Discuss how can a researcher collect data through (i) Interview (ii) Questionnaire. (10 Marks)
 b. What are the techniques of interpretation? (04 Marks)
 c. Explain the different steps involved in report writing. (06 Marks)

OR

- 8 a. What are the types of report that you know of? (10 Marks)
 b. What are the precautions that should be taken while writing research report? (10 Marks)

Module-5

- 9 a. What is intellectual property? What are the different types of it? (10 Marks)
 b. Why do you think IPR is important in recent times? (10 Marks)

OR

- 10 Write short notes on [Any Two]: (20 Marks)
- a. Indian Patent Act 1970
 b. Copyright Act 1957
 c. Industrial Design Act 2000

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First Semester MCA Degree Examination, Jan./Feb. 2021
Operating System with Unix

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

- 1 a. What are the various services of an operating system? Explain briefly. (10 Marks)
b. Define process. Explain the five state process model with a neat diagram. (10 Marks)

OR

- 2 a. Calculate the average waiting time, turn around time for (i) SJF (ii) Priority scheduling and (iii) Round Robin [quantum = 2 ms] with the following set of processes.

| Process | P ₁ | P ₂ | P ₃ | P ₄ | P ₅ |
|------------|----------------|----------------|----------------|----------------|----------------|
| Burst time | 10 | 1 | 2 | 1 | 5 |
| Priority | 3 | 1 | 3 | 4 | 5 |

- b. Define System call. Classify the types of system calls. (15 Marks) (05 Marks)

Module-2

- 3 a. What is demand paging? Explain how TLB improves the performance of demand paging with neat diagram. (10 Marks)
b. Consider following page reference string :
7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1
How many page fault would occur in the case (i) FIFO (ii) Optimal page replacement (iii) LRU. Assume there are 3 frames. (10 Marks)

OR

- 4 a. Consider the following snapshot of a system

| Allocation | Max | | | | Available | | | |
|----------------|-----|---|---|---|-----------|---|---|---|
| | A | B | C | D | A | B | C | D |
| P ₀ | 0 | 0 | 1 | 2 | 0 | 0 | 1 | 2 |
| P ₁ | 1 | 0 | 0 | 0 | 1 | 7 | 5 | 0 |
| P ₂ | 1 | 3 | 5 | 4 | 2 | 3 | 5 | 6 |
| P ₃ | 0 | 6 | 3 | 2 | 0 | 6 | 5 | 2 |
| P ₄ | 0 | 0 | 1 | 4 | 0 | 6 | 5 | 6 |

Answer the following questions using Banker's algorithm.

- (i) What is the content of the matrix need? (07 Marks)
(ii) If a request from process P₁ arrives for (0, 4, 2, 0) can the request be granted immediately? (08 Marks)
b. What is deadlock? What are the necessary conditions for a deadlock to occur? (05 Marks)

Module-3

- 5 a. Differentiate hard link with soft link. (10 Marks)
b. Explain the following in detail with example:
(i) chmod (ii) ls (iii) mkdir (iv) chgrp (04 Marks)
c. Discuss the different modes of Vi editor. (06 Marks)

OR

- 6 a. Explain the UNIX file system with a neat diagram. (10 Marks)
 b. Write differences between absolute pathname and relative pathname along with necessary examples. (10 Marks)

Module-4

- 7 a. Write a shell script to count the number of uppercase, small case, digit or special symbol using case conditional statement by taking input string. (10 Marks)
 b. What is a process? Explain the mechanism of process creation and states of a process. (10 Marks)

OR

- 8 a. Write short notes on :
 (i) at (ii) batch (iii) crm (iv) test (v) expr (10 Marks)
 b. Write a shell script to display the calendar for current month with current date replaced by * or ** depending on whether the date has one digit or two digits. (10 Marks)

Module-5

- 9 a. Write short notes on :
 (i) export (ii) eval (iii) exec (10 Marks)
 b. Write an awk script to delete duplicate line from text file. The order of original lines must remain unchanged. (10 Marks)

OR

- 10 a. What is awk? Explain the built-in variables used by awk. (10 Marks)
 b. Explain the associative array in awk with an example. Also explain environment array. (10 Marks)



First Semester MCA Degree Examination, July/August 2021
Operating System with UNIX

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

1. a. What is an operating system? Explain with a neat diagram the component of operating system. (10 Marks)
b. What is process, process state and Process Control Block (PCB)? Describe the contents of PCB. (10 Marks)
2. a. Consider the following set of processes with given length of CPU burst. Draw the Gantt chart for SJF (Preemptive) & SJF (Non Preemptive). Find the average waiting time for each scheduling algorithm.

| Processes | P ₁ | P ₂ | P ₃ | P ₄ | P ₅ |
|--------------|----------------|----------------|----------------|----------------|----------------|
| Burst time | 6 | 2 | 8 | 3 | 4 |
| Arrival time | 2 | 5 | 1 | 0 | 4 |

(10 Marks)
b. What do you mean by CPU scheduling? Explain the scheduling criteria of Algorithm. (10 Marks)
3. a. Write and explain Bankers Algorithm for deadlock avoidance. (10 Marks)
b. With a neat diagram, explain Resource allocation graph. (10 Marks)
4. a. Explain the difference between internal and external fragmentation. (10 Marks)
b. What is page fault? What action does the operating system take when a page fault occurs? Explain with the diagram. (10 Marks)
5. a. Explain UNIX file system with a neat diagram. (10 Marks)
b. What is the use of ls command? In detail explain the output of ls -l. (10 Marks)
6. a. Explain the relative and absolute permission with examples. (10 Marks)
b. Describe hard links and softlinks with suitable examples. (10 Marks)
7. a. Explain the process in UNIX and mechanism of process creation. (10 Marks)
b. State the difference between internal and external commands in UNIX. (10 Marks)
8. a. Explain the use of set, set-x, test and IJ with example. (10 Marks)
b. Explain : i) If conditional statement, case statement
ii) While and for looping with examples (10 Marks)
9. a. What is AWK? Explain the built-in variable and built-in function used by AWK. (10 Marks)
b. Write an AWK script to compute gross salary of an employee accordingly to rule given below.
If a basic salary is < 10,000 then
HRG = 15% of basic 2 DA = 45% of basic
If basic salary is ≥ 10,000 then HRA = 20% of basic 2, DA = 50% of basic. (10 Marks)
10. a. Explain the following : i) Exec ii) export iii) eval. (10 Marks)
b. Write an awk program the folds long lines into 40 columns. (10 Marks)

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