REGNO : 3 1 2 4 2 2 2 0 5 1 2 1

We Make You Shine

St. JOSEPH'S INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

St. Joseph's Group of Institutions

OMR, Chennai - 119

MODEL EXAM III - May 2024

Subject : Probability and Statistics — Code : MA4401

Branch : COMMON TO ALL BRANCHES — Sem : IV

DURATION : 3 hours — MAX MARKS: 100

PART - A (10 X 2 = 20 Marks)

1.	Test whether the function $p(x)=\frac{2}{3}\left(\frac{1}{3}\right)^x$, $x=0,1,2,\ldots$ is the probability mass function of a discrete random variable X.	(2)	BL2	CO1
2.	The second order moment of the Poisson distribution is 2, find the parameter of the distribution.	(2)	BL2	CO1
3.	The joint probability density function of bivariate random variable (X , Y) is given by $f(x,y)=\begin{cases}4xy, 0<x<1, 0<y<1\\ 0 \quad ,elsewhere\end{cases}$. Find P (X + Y < 1)	(2)	BL2	CO2
4.	Let X and Y be two independent R.Vs with Var(X) = 9 and Var(Y) = 3. Find Var (4X – 2Y + 6)	(2)	BL2	CO2
5.	Define Stationary Process.	(2)	BL1	CO3
6.	When do we say that Markov chain is irreducible?	(2)	BL1	CO3
7.	Write the advantages of Non-parametric test?	(2)	BL1	CO4
8.	When is Mann-Whitney 'U' test used?	(2)	BL2	CO4
9.	What are the uses of statistical quality control?	(2)	BL2	CO5
10.	Find the lower and upper control limits for np-chart, when n=100 and $\bar{p}$ = 0.09?	(2)	BL2	CO5

PART - B (5 X 16 = 80 Marks)

11.a	(i) If X has the probability density function $f(x)=\begin{cases}Ke^{-3x}, & x>0\\ 0, & \text{otherwise}\end{cases}$. Find the value of K, $P(0.5\le X\le 1)$ and mean of X.	(16)	BL4	CO1
	(ii) If X is a random variable with probability mass function $P(X=x)=pq^{x-1}$, $x=1,2,3,\ldots$. Find the moment generating function of X and mean of X.		BL4	CO1
	OR			
11.b	(i) A machine manufacturing screws is known to produce 5% defective. In a random sample of 15 screws, what is the probability that there are exactly 3 defectives and what is the probability that not more than 3 defectives.	(16)	BL4	CO1
	(ii) The time (in hours) required to repair a machine is exponentially distributed with parameter $\lambda=\frac{1}{2}$. Find the probability that the repair time exceeds 2 hours and find the conditional probability that a repair takes at least 10 hours given that its duration exceeds 9 hours?		BL4	CO1
12.a	(i) Let the joint probability density function of R.V. (X, Y) be given as $f(x,y)=\begin{cases}cxy^2, 0\le x\le y\le 1\\ 0 \quad ,elsewhere\end{cases}$ Determine (i) the value of C (ii) the marginal p.d.fs of X and Y (iii) the conditional p.d.f. of X given Y = y.	(16)	BL5	CO2
	(ii) Let X and Y be two independent identically distributed exponential R.V.s with parameter 1. Find the joint p.d.f of R.V.s $U=X+Y$ and $V=\frac{X}{Y}$ and hence obtain the marginal p.d.f of random variable U.			
	OR			
12.b	Obtain the equation of the regression line Y on X from the following data.	(16)	BL3	CO2

X	3	5	6	8	9	11
Y	2	3	4	6	5	8

13.a	(i) Show that the random process $X(t)=A\cos(\omega_0 t+\theta)$ is not stationary, if A and ω_0 are constants and θ is uniformly distributed random variable in $(0,\pi)$.	(16)	BL4	CO3
	(ii) Show that the random process $X(t)=A\sin(\omega t+\phi)$ is first order stationary, if A and ω are constants and ϕ is uniformly distributed random variable in $(0,2\pi)$.			
	OR			
13.b	(i) A man either drives a car or catches a train to go to office each day. He never goes 2 days in a row by train but he drives one day, then the next day he is just as likely to drive again as he is to travel by train. Now suppose that on the first day of the week, the man tossed a fair dice and drove to work if and only if a 6 appeared. Find the probability that he takes a train on the third day also find the probability that he drives to work in the long run.	(16)	BL5	CO3
	(ii) If customers arrive at a counter in accordance with a Poisson process with a mean rate of 2 per minute. Find the probability that the interval between 2 consecutive arrivals is (a) more than 1 min (b) between 1 min and 2 min and (c) 4 min or less.			

14.a (16) BL3 CO4

(i) The following are the number of mistakes counted on pages randomly selected from reports typed by a company's two secretaries.

Male secretary	15	10	5	6	8	10	12
Female secretary	12	8	7	9	10	5	4

Use Mann – Whitney U-Test at 1% level of significance to test the null hypothesis that the 2 secretaries average equal mistakes per page.

(ii) A technician is asked to analyze the results of 22 items made in a preparation run. Each item has been measured and compared to engineering specifications. The order of acceptance 'a' and rejections 'r' is *aarrrarraaaaarrarraara.* Determine whether it is a random sample or not?

OR

14.b (16) BL3 CO4

An experiment designed to compare three preventive methods against corrosion yielded the following maximum depths of pits (in thousands of an inch) in pieces of wire subjected to the respective treatments. To test the three samples come from identical population using Kruskal - Wallis test.

Methods A	77	54	67	74	71	66	-
Methods B	60	41	59	65	62	64	52
Methods C	49	52	69	47	56	-	-

15.a (16) BL3 CO5

The following data gives the average life in hours and range in hours of 12 samples each of 5 lamps. Construct $\overline{X}$ - chart and R- chart, comment on state of control.

Sample No.	1	2	3	4	5	6	7	8	9	10	11	12
Mean $\overline{X}_i$	120	127	152	157	160	134	137	123	140	144	120	127
Range R_i	30	44	60	34	38	35	45	62	39	50	35	41

OR

15.b (16) BL4 CO5

i) Construct a suitable control chart from given data

Sample No.	1	2	3	4	5	6	7	8	9	10
No. of items inspected	90	65	85	70	80	80	70	95	90	75
No. of defectives	9	7	3	2	9	5	3	9	6	7

(ii) The following data gives the number of defectives in 10 samples each of size 100. Construct a np – chart for these data and also determine whether the process is in control

Sample no	1	2	3	4	5	6	7	8	9	10
No. of defectives	24	38	62	34	26	36	38	52	33	44

REGNO : 3 1 2 4 2 2 2 0 5 1 2 1

We Make You Shine

St. JOSEPH'S INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

St. Joseph's Group of Institutions

OMR, Chennai - 119

MODEL EXAM III - May 2024

Subject : Operating Systems | **Code : CS4452**

Branch : CSE, IT & ADS | **Sem : IV**

DURATION : 3 hours | **MAX MARKS: 100**

PART - A (10 X 2 = 20 Marks)

1.	What are the three main purposes of an operating system?	(2)	BL1	CO1
2.	What is the purpose of system programs?	(2)	BL1	CO1
3.	Define process state.	(2)	BL1	CO2
4.	Define spinlock with its advantage.	(2)	BL1	CO2
5.	Define Throughput.	(2)	BL1	CO3
6.	What can the operating system do to recover from deadlock?	(2)	BL1	CO3
7.	Define logical address and physical address.	(2)	BL1	CO4
8.	What is thrashing and how to resolve this problem?	(2)	BL5	CO4
9.	Define C-SCAN scheduling.	(2)	BL1	CO5
10.	What are the various layers of a file system?	(2)	BL1	CO5

PART - B (5 X 13 = 65 Marks)

11.a	Explain in detail about Computer System Organization.	(13)	BL2	CO1
	OR			
11.b	Describe in detail about the objectives and functions of operating system.	(13)	BL2	CO1
12.a	Explain process concept in detail.	(13)	BL4	CO2
	OR			
12.b	Discuss about the concept of monitors.	(13)	BL2	CO2
13.a	Consider the following set of processes, with the length of the CPU-burst time given in milliseconds:	(13)	BL3	CO3

Process Id	Arrival time	Burst time
P1	0	7
P2	1	2
P3	5	5
P4	6	4

Apply FCFS and SJF non-preemptive mode and draw Gantt chart. Also deduce completion time, turn-around time, waiting time and the average of turn-around time and waiting time.

OR

13.b	Explain the various deadlock recovery mechanisms.	(13)	BL2	CO3
14.a	Explain the need and concept of Paging Technique in Memory Management.	(13)	BL3	CO4
	OR			
14.b	Explain in detail about the Allocation of frames. Compare Global and Local Allocation techniques.	(13)	BL5	CO4
15.a	Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The FCFS, SSTF, SCAN, LOOK, C-SCAN, C-LOOK scheduling algorithm is used. The head is initially at cylinder number 53. The cylinders are numbered from 0 to 199. The total head movement (in number of cylinders)	(13)	BL3	CO5
	OR			
15.b	Discuss in detail about file concept.	(13)	BL2	CO5

PART - C (1 X 15 = 15 Marks)

16.a	Consider the following snapshot of a system	(15)	BL5	CO3

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	2	0	0	1	4	2	1	2	3	3	2	1
P1	3	1	2	1	5	2	5	2				
P2	2	1	0	3	2	3	1	6				
P3	1	3	1	2	1	4	2	4				
P4	1	4	3	2	3	6	6	5				

Answer the following questions using Banker's algorithm

(i) Illustrate that the system is in safe state by demonstrating an order in which the processes may complete.

(ii) If a request from a process P1 arrives for (1,1,0,0), Can the request be granted immediately?

OR

16.b	Compare Windows 10 Operating system with various version of Windows OS. Explain the unique features of Windows 10 Operating system.	(15)	BL6	CO2

REGNO : 3 1 2 4 2 2 2 0 5 1 1 6

We Make You Shine

St. JOSEPH'S INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

St. Joseph's Group of Institutions

OMR, Chennai - 119

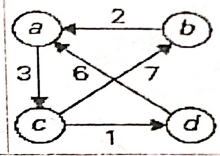
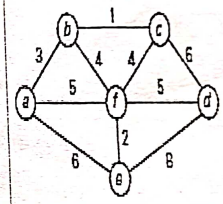
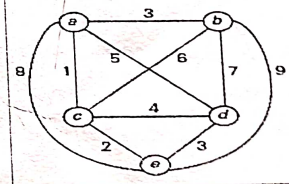
MODEL EXAM III - May 2024

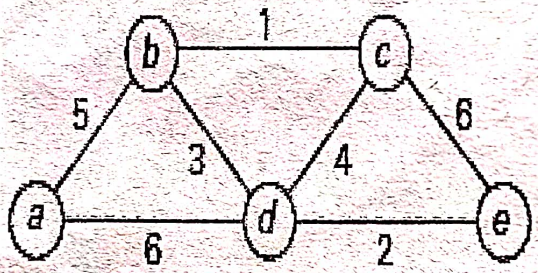
Subject : Design and Analysis of Algorithm **Code : IT4454**

Branch : IT & ADS **Sem : IV**

DURATION : 3 hours **MAX MARKS: 100**

PART - A (10 X 2 = 20 Marks)

1.	Mention the sorting problems and its properties.	(2)	BL1	CO1
2.	Mention the various Asymptotic Notations.	(2)	BL1	CO1
3.	What is Brute Force?	(2)	BL1	CO2
4.	Define divide and conquer design technique.	(2)	BL1	CO2
5.	Write the equation for calculating binomial coefficient.	(2)	BL1	CO3
6.	Define Huffman tree.	(2)	BL1	CO3
7.	What is meant by linear programming?	(2)	BL1	CO4
8.	Define simplex method.	(2)	BL1	CO4
9.	Define Non-Deterministic algorithm.	(2)	BL1	CO5
10.	Define Live and Dead nodes.	(2)	BL2	CO5
	PART - B (5 X 13 = 65 Marks)			
11.a	a) Discuss the general plan for analyzing the efficiency of non-recursive algorithm. b) Write an algorithm to find the number of binary digits in the binary representation of a positive decimal integer and analyze its efficiency.	(13)	BL1	CO1
	OR			
11.b	Design a recursive algorithm to compute the factorial function F (n) =n! and derive the recurrence relation.	(13)	BL1	CO1
12.a	Sort the following set of elements using quick sort. 12,24,8,71,4,23,6.	(13)	BL2	CO2
	OR			
12.b	Write Strassen's matrix multiplication algorithm. Is there any time efficiency improvement compared to ordinary matrix multiplication?	(13)	BL2	CO2
13.a	Write and explain Floyd's algorithm for the all-pairs shortest path problem. Using this find the length of the shortest path between all pairs of vertices of thefollowing graph. 	(13)	BL4	CO3
	OR			
13.b	Explain the pseudo code for prim's algorithm and apply the same to minimum spanning tree for the following graph. 	(13)	BL4	CO3
14.a	Write down the optimality condition and algorithmic implementation for finding M-augmenting paths in bipartite graphs.	(13)	BL1	CO4
	OR			
14.b	Discuss the graphical method in detail.	(13)	BL1	CO4
15.a	Solve the following instance of the travelling salesman problem by branch andbound method and explain in detail. 	(13)	BL4	CO5
	OR			

15.b	Explain how job assignment problem could be solved, given *n* tasks and n agents where each agent has a cost to complete each task, using Branch and bound technique. Solve the following assignment problem using branch and bound technique. job 1 job 2 job 3 job 4 $C = \begin{bmatrix} 9 & 2 & 7 & 8 \\ 6 & 4 & 3 & 7 \\ 5 & 8 & 1 & 8 \\ 7 & 6 & 9 & 4 \end{bmatrix}$ person *a* person *b* person *c* person *d*	(13)	BL4	CO5
	PART - C (1 X 15 = 15 Marks)			
16.a	Apply Kruskal's algorithm to find a minimum spanning tree of the following graph  	(15)	BL5	CO3
	OR			
16.b	Design a non-recursive algorithm for computing the product of two n*n matrices and also find time efficiency of algorithm.	(15)	BL5	CO1

REGNO : 3 1 2 4 2 2 2 0 5 1 2 1

We Make You Shine

St. JOSEPH'S INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

St. Joseph's Group of Institutions

OMR, Chennai - 119

MODEL EXAM III - May 2024

Subject : Database Management Systems | Code : CS4451

Branch : CSE, IT & ADS | Sem : IV

DURATION : 3 hours | MAX MARKS: 100

PART - A (10 X 2 = 20 Marks)

1.	Define query language.	(2)	BL1	CO1
2.	Name the three levels of data abstraction in a database system.	(2)	BL3	CO1
3.	What are the uses of SQL?	(2)	BL1	CO2
4.	Differentiate Static and Dynamic SQL.	(2)	BL1	CO2
5.	For a binary relationship set R between entity sets A and B, list the mapping cardinalities.	(2)	BL4	CO3
6.	Define Functional dependency. List the types of Functional Dependency.	(2)	BL1	CO3
7.	Give an example of two-phase commit protocol.	(2)	BL4	CO4
8.	List the four conditions for deadlock.	(2)	BL2	
9.	State the need for Query Optimization.	(2)	BL1	CO5
10.	State the properties of CAP theorem.	(2)	BL1	CO5
	PART - B (5 X 13 = 65 Marks)			
11.a	Illustrate the database system architecture with a neat diagram.	(13)	BL3	CO1
	OR			
11.b	List out the operations of the relational algebra and explain with suitable examples.	(13)	BL3	CO1
12.a	Explain in detail about the Scalar function with an example.	(13)	BL1	CO2
	OR			
12.b	Briefly explain about the PL/SQL with example.	(13)	BL4	CO2
13.a	What is Normalization? Explain in detail about the first Normal form.	(13)	BL2	CO3
	OR			
13.b	Compare and contrast BCNF with 3NF?	(13)	BL4	CO3
14.a	Define Transaction. Represent the transaction states and explain the various desirable properties of a transaction.	(13)	BL4	CO4
	OR			
14.b	Illustrate indexing and hashing techniques with suitable examples.	(13)	BL5	CO4
15.a	Write short notes on Distributed Transactions.	(13)	BL3	CO5
	OR			
15.b	Write about NoSQL databases and explain the way how they differ from traditional databases.	(13)	BL3	CO5
	PART - C (1 X 15 = 15 Marks)			
16.a	Consider the following two transactions: T1 read(A); read(B); if A=0 then B:=B+2; write(B). T2 read(B); read(A); if B=0 then A:=A+2; write(A). Add lock and unlock instructions to the transactions T1 and T2, so that they observe the two-phase locking protocol. Can the execution of these transactions result in deadlock?	(15)	BL4	
	OR			
16.b	Construct an ER- Diagram for a car- insurance company whose customers own one or more cars each. Each car has associated with it zero to any number of record accidents. State any assumptions you make.	(15)	BL5	

REGNO : 3 1 2 4 2 2 2 0 5 1 2 1

We Make You Shine

St. JOSEPH'S INSTITUTE OF TECHNOLOGY

(An Autonomous Institution)

St. Joseph's Group of Institutions

OMR, Chennai - 119

MODEL EXAM III - May 2024

Subject : Artificial Intelligence and Basics of Machine Learning **Code : CS4453**

Branch : CSE & IT **Sem : IV**

DURATION : 3 hours **MAX MARKS: 100**

PART - A (10 X 2 = 20 Marks)

1.	What is heuristic function?	(2)	BL1	CO1
2.	What is the difference between uninformed and informed search strategies?	(2)	BL1	CO1
3.	Define Knowledge representation,	(2)	BL1	CO2
4.	What are the Inference rules?	(2)	BL1	CO2
5.	Mention the advantages of Machine Learning.	(2)	BL1	CO3
6.	State the assumptions in a linear regression model.	(2)	BL2	CO3
7.	List the different ways in which multiple base learners are combined to generate the final output?	(2)	BL2	CO4
8.	What is the difference between voting and stacking using a linear perceptron as the combiner function?	(2)	BL2	CO4
9.	How do you do morphological analysis?	(2)	BL2	CO5
10.	What is the key difference between supervised and unsupervised learning in machine learning?	(2)	BL1	CO5
	PART - B (5 X 13 = 65 Marks)			
11.a	Explain the problem-solving agents with neat Structure.	(13)	BL2	CO1
	OR			
11.b	Discuss on different types of Agent Program.	(13)	BL2	CO1
12.a	Describe in detail about a simple knowledge base and a simple inference procedure.	(13)	BL4	CO2
	OR			
12.b	Consider the following facts Team India Team Australia Final match between India and Australia India scored 350 runs Australia scored 350 runs India lost 5 wickets Australia lost 7 wickets The team which scored the maximum runs wins If the scores are same then the team which lost minimum wickets wins the match Represent the facts in predicate logic and convert to clause form and prove by resolution "India wins the match".	(13)	BL5	CO2
13.a	What is Linear Discriminant Function and explain its categories.	(13)	BL2	CO3
	OR			
13.b	Suppose you work for a spam email filter company, and you are tasked with building a spam filter using the Naive Bayes classifier. You have a dataset of 1,000 emails, of which 600 are spam (class S) and 400 are legitimate (class L). You want to classify a new email as either spam or legitimate based on its content.	(13)	BL5	CO3
14.a	List out the similarities and differences between Bagging, Boosting and Stacking.	(13)	BL2	CO4
	OR			
14.b	Consider the dataset given below: X= { A1,A2,A3,A4,A5,A6,A7,A8,A9,A10,A11,A12,A13,A14,A15} Coordinates={(2,10),(2,6),(11,11),(6,9),(6,5),(1,2),(5,10),(4,9),(10,12),(7,5),(9,11),(4,6),(3,1 0),(3,8),(6,11) Class. Label={C2,C1,C3,C2,C1,C1,C2,C2,C3,C1,C3,C1,C2,C2,C2} Using KNN find out the class label for point P=(5,7).	(13)	BL3	CO4
15.a	Explain the concepts of Information Retrieval (IR) and Information Extraction (IE) and analyze how these techniques contribute to the effective utilization of textual data and address any challenges they might face.	(13)	BL2	CO5
	OR			
15.b	Discuss language models significance, architecture, and the role of pre-trained models in advancing NLP tasks. Provide examples and mention potential challenges associated with language models.	(13)	BL3	CO

PART - C (1 X 15 = 15 Marks)

16.a	You are working on a classification problem to predict whether a bank loan application will be approved (class "Yes") or denied (class "No") based on two features: Credit Score (ranging from 300 to 850) and Annual Income (in thousands of dollars). You have a dataset with the following sample data:	(15)	BL5	CO3

Applicant	Credit Score	Annual Income	Loan Approval
1	720	40	Yes
2	580	25	No
3	790	55	Yes
4	630	35	No
5	690	60	Yes
6	510	20	No
7	740	45	Yes
8	600	30	No

You need to build a classification tree to predict loan approval. Use Gini impurity as the splitting criterion. Create the tree until you reach a stopping criterion.

OR

16.b	Apply the A* Search Algorithm for the following structure and find the feasible cost from path A to J	(15)	BL5	CO1