23SSP208 / 22SSP211

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc(SS) DEGREE EXAMINATION DECEMBER 2024
(Second Semester)

Branch- **SOFTWARE SYSTEMS(Five Years Integrated)**

PROBABILITY AND STATISTICS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	The probability of getting two tails when two coins are tossed is a) 1/2 b) 1/3 c) 1/4 d)1/6	K2	CO1
	2	In 30 balls, a batsman hits the boundary 6 times. What will be the probability that he did not hit the boundaries? a) 1/5 b) 2/5 c) 3/5 d) 4/5	K2	CO1
2	3	Let X be the number of books in library, then X is called ---------- random variable. a) discrete b) continuous c) neither discrete nor continuous d) None	K1	CO2
	4	Mean and variance are equal in ---------- distribution. a) Binomial b) Poisson c) Normal d) None	K2	CO2
3	5	The length of the interval (2 , 8) is a) 4 b) 6 c) 10 d)16	K1	CO2
	6	In hypothesis testing ,which of the following is refers to type I error a) Accept H_0, when H_0 is true b) Reject H_0 , when H_0 is true c) Reject H_0 , when H_0 is false d) Accept H_0 , when H_0 is false	K2	CO3
4	7	The 95% confidence limits for estimation of the population mean μ are a) $\bar{x}$- 1.96SE($\bar{x}$) b) $\bar{x}$- 2.58SE($\bar{x}$) c) $\bar{x} \pm$ 1.96SE($\bar{x}$) d) $\bar{x} \pm$ 2.58SE($\bar{x}$)	K1	CO4
	8	In a χ^2- goodness of fit , the validity of test holds only when the sum of a) observed frequency= expected frequency b) observed frequency< expected frequency c) observed frequency> expected frequency d) observed frequency≠expected frequency	K2	CO2
5	9	In the regression equation Y = 12+5X, the intercept is a) 5 b) -5 c) 12 d) -12	K1	CO5
	10	In the principles of least squares, residual error will be a) minimum b) maximum c) positive d) negative	K2	CO4

Cont...

SECTION – B (35 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 × 7 = 35)

<table>
<tr><th>Module No.</th><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td rowspan="3">1</td><td>11.a.</td><td>State and prove total probability theorem.</td><td rowspan="3">K2</td><td rowspan="3">CO2</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>11.b.</td><td>There are 2 red , 3 green and 4 black balls of identical size in an urn. 3 balls are drawn at random , find the probability that (i) they are of different colours (ii) 2 are green and 1 is black and (iii) 2 are red and one is green</td></tr>
<tr><td rowspan="3">2</td><td>12.a.</td><td>Write a note on : (i) Probability mass function
(ii) Probability density function
(iii) Distribution function (iv) Expectation</td><td rowspan="3">K2</td><td rowspan="3">CO2</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>12.b.</td><td>Define normal distribution. State its characteristics.</td></tr>
<tr><td rowspan="3">3</td><td>13.a.</td><td>Distinguish between the point estimation and interval estimation. In what way, an interval estimate is better than a point estimate?</td><td rowspan="3">K3</td><td rowspan="3">CO3</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>13.b.</td><td>Intelligence test on two groups of boys and girls gave the following results:
<table>
<tr><th></th><th>Mean</th><th>S.D</th><th>N</th></tr>
<tr><td>Girls</td><td>75</td><td>15</td><td>150</td></tr>
<tr><td>Boys</td><td>70</td><td>20</td><td>250</td></tr>
</table>
Is there a significance difference (1% l.o.s) in the mean score obtained by boys and girls?</td></tr>
<tr><td rowspan="3">4</td><td>14.a.</td><td>How can t-test be applied for the significance of the difference between two sample means?</td><td rowspan="3">K3</td><td rowspan="3">CO4</td></tr>
<tr><td></td><td>(OR)</td></tr>
<tr><td>14.b.</td><td>A sample of 200 people with a particular disease was selected. Out of these , 100 were given a drug and the others were not given any drug. The results are as follows:
<table>
<tr><th></th><th>Drug</th><th>No Drug</th><th>Total</th></tr>
<tr><td>Cured</td><td>65</td><td>55</td><td>120</td></tr>
<tr><td>Not cured</td><td>35</td><td>45</td><td>80</td></tr>
<tr><td>Total</td><td>100</td><td>100</td><td>200</td></tr>
</table>
Test whether the drug is effective or not (5% level of significance)</td></tr>
<tr><td rowspan="3">5</td><td>15.a.</td><td>Define regression. State its properties.</td><td rowspan="3">K3</td><td rowspan="3">CO5</td></tr>
<tr><td colspan="2">(OR)</td></tr>
<tr><td>15.b.</td><td>For the following data, find out the two regression equations. Also estimate the production when the capacity utilization is 70%.
<table>
<tr><th></th><th>Average</th><th>S.D</th></tr>
<tr><td>Production(in lakh units)</td><td>35.6</td><td>10.5</td></tr>
<tr><td>Capacity utilization (in %)</td><td>84.8</td><td>8.5</td></tr>
</table>
Correlation coefficient is r =0.62</td></tr>
</table>

SECTION -C (30 Marks)

Answer **ANY THREE** questions
ALL questions carry **EQUAL** Marks (3 × 10 = 30)

<table>
<tr><th>Module No.</th><th>Question No.</th><th>Question</th><th>K Level</th><th>CO</th></tr>
<tr><td>1</td><td>16</td><td>In a post office , three clerks are assigned to process incoming mail. The first clerk, B1, processes 40 % , the second clerk, B2, processes 35% and the third clerk, B3, processes 25% of the mail. The first clerk has an error rate of 0.04 , the second has an error rate of 0.06 and the third has an rate of 0.03. A mail selected at random from a day's output is found to have an error.The post master wishes to know the probability that the mail was processed by the first, second or third clerk respectively.</td><td>K2</td><td>CO1</td></tr>
<tr><td>2</td><td>17</td><td>The incidence of a certain disease is such that on the average 20% of workers suffer from it. If 10 workers are selected at random , find the probability that
i) exactly 2 workers suffer from the disease
ii) not more than 2 workers suffer from the disease.</td><td>K2</td><td>CO1</td></tr>
<tr><td>3</td><td>18</td><td>Out of 20000 customers ledger accounts , a sample of 600 accounts was taken to test the accuracy of posting and balancing where in 45 mistakes were found. Assign the limits within which the number of defective cases can be expected at 5% level.</td><td>K3</td><td>CO3</td></tr>
<tr><td>4</td><td>19</td><td>Two random samples drawn from normal populations are:
<table><tr><td>60</td><td>65</td><td>71</td><td>74</td><td>76</td><td>82</td><td>85</td><td>87</td><td></td><td></td></tr><tr><td>61</td><td>66</td><td>67</td><td>85</td><td>78</td><td>63</td><td>85</td><td>86</td><td>88</td><td>91</td></tr></table>Test whether the two samples have the same variance at 5% level</td><td>K2</td><td>CO4</td></tr>
<tr><td>5</td><td>20</td><td>Find the linear regression by the method of least squares.
<table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>2</td><td>5</td><td>3</td><td>8</td><td>7</td></tr></table></td><td>K4</td><td>CO5</td></tr>
</table>

Z-Z-Z END

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc(SS) DEGREE EXAMINATION DECEMBER 2024
(Fourth Semester)

Branch – **SOFTWARE SYSTEMS (Five years Integrated)**

OPTIMIZATION TECHNIQUES

Time: Three Hours Maximum: 50 Marks

SECTION-A (5 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (5 x 1 = 5)

1 Which of the following is the objective of linear programming?
(i) To maximize or minimize a linear function (ii) To solve nonlinear equations
(iii) To find the roots of polynomials (iv) To analyze statistical data

2 In a transportation problem, if there are more supply points than demand points, the problem is termed:
(i) Balanced (ii) Unbalanced
(iii) Feasible (iv) Optimal

3 In a zero-sum game, the gain of one player is:
(i) Equal to the loss of the other player (ii) Independent of the other player's actions
(iii)Always positive (iv) None of the above

4 In a queuing system, the arrival rate (λ) refers to:
(i) The rate at which customers are served
(ii) The rate at which customers arrive at the queue
(iii)The total number of customers in the system
(iv) The average time a customer spends in the queue

5 In **PERT**, the time estimates for tasks are typically represented as:
(i) A single deterministic value
(ii) Three estimates: optimistic, pessimistic, and most likely
(iii) A range of possible values
(iv) Only the average time

SECTION - B (15 Marks)
Answer **ALL** Questions
ALL Questions Carry **EQUAL** Marks (5 x 3 = 15)

6 a Discuss about operations research with its limitations.

OR

b The manager of an oil refinery must decide on the optimum mix of two possible blending processes of which the input and output production runs are as follows:

Process	Input		Output	
	Crude A	Crude B	Gasoline X	Gasoline Y
1	6	4	6	9
2	5	6	5	5

The maximum amounts available of crudes A and B are 250 units and 200 units respectively. Marked demand shows that atleast 150 units of gasoline X and 130 units of gasoline Y must be produced. The profits per production run from process 1 and process 2 are Rs. 4 and Rs. 5 respectively. Formulate the problem for maximizing the profit.

Cont...

7 a Obtain an initial basic feasible solution to the following transportation problem using the matrix minima method.

	D1	D2	D3	D4	capacity
O1	1	2	3	4	6
O2	4	3	2	0	8
O3	0	2	2	1	10
Demand	4	6	8	6	

OR

b Write a short note on Hungarian method.

8 a Determine the range of value of p and q that will make the pay – off element a_{22} a saddle point for the game whose pay – off matrix (a_{ij}) is given below:

Player B

Player A $\begin{bmatrix} 2 & 4 & 5 \\ 10 & 7 & q \\ 4 & p & 8 \end{bmatrix}$

OR

b Define game and list some characteristics of game.

9 a What is queue? Mention the basic elements of queues.

OR

b Assume that the goods trains are coming in a yard at the rate of 30 trains per day and suppose that the inter arrival times follow an exponential distribution. The service time for each train is assumed to be exponential with an average of 36 minutes. If the yard can admit 9 trains at a time (there being 10 lines, one of which is reserved for shunting purposes), calculate the probability that the yard is empty and find the average queue length.

10 a Draw the network diagram for the following data.

Task	A	B	C	D	E	F	G
Immediate predecessor	-	-	B	B	B	E	A,D,C

OR

b Distinguish between CPM and PERT.

SECTION -C (30 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** Marks (5 x 6 = 30)

11 a Use the graphical method to solve the following LPP.

Maximize $Z = 2x_1 + 3x_2$

Subject to the constraints:

$x_1 + x_2 \leq 30,$

$x_1 - x_2 \geq 0$

$x_2 \geq 3,$

$0 \leq x_1 \leq 20,$

$0 \leq x_2 \leq 12.$

OR

b Find the maximum value of $Z = 107x_1 + x_2 + 2x_3$ subject to the constraints: $14x_1 + x_2 - 6x_3 + 3x_4 = 7,$ $16x_1 + x_2 - 6x_3 \leq 5,$ $3x_1 - x_2 - x_3 \leq 0.$ $x_1, x_2, x_3, x_4 \geq 0$ using simplex method.

12 a Find the starting solution in the following transportation problem by VAM method. Also find an optimum solution.

	D1	D2	D3	D4	Supply
S1	3	7	6	4	5
S2	2	4	3	2	2
S3	4	3	8	5	3
Demand	3	3	2	2	

OR

Q.no 12. Cont....

b A company wishes to assign 3 jobs to 3 machines in such a way that each job is assigned to some machine and no machine works on more than one job. The cost of assigning job I to a machine j is given by the matrix below:

cost matrix: $\begin{bmatrix} 8 & 7 & 6 \\ 5 & 7 & 8 \\ 6 & 8 & 7 \end{bmatrix}$

Draw the associated network. Formulate the network LPP and find the minimum cost of making the assignment.

13 a Obtain the optimal strategies for both-persons and the value of the game for zero-sum two-person game whose payoff matrix is as follows:

$$\begin{pmatrix} 1 & -3 \\ 3 & 5 \\ -1 & 6 \\ 4 & 1 \\ 2 & 2 \end{pmatrix}$$

OR

b Solve the following game

		Player B			
		I	II	III	IV
	I	3	2	4	0
	II	3	4	2	4
player A	III	4	2	4	0
	IV	0	4	0	8

14 a The rate of arrival of customers at a public telephone booth follows Poisson distribution, with an average time of 10 minutes between one customer and the next. The duration of a phone call is assumed to follow exponential distribution, with mean time of 3 minutes.

i) What is the probability that a person arriving at the booth will have to wait?
ii) What is the average length of the non-empty queues that form from time to time?
iii) Estimate the fraction of a day that the phone will be in use.
iv)What is the probability that it will take him more than 10 minutes altogether to wait for phone and complete his call?

OR

b A supermarket has two girls serving at the counters. The customers arrive in a Poisson fashion at the rate of 12 per hour. The service time for each customer is exponential with mean 6 minutes. Find i) the probability that an arriving customer has to wait for service. ii) the average number of customers in the system, and iii) the average time spent by a customer in the super market.

15 a Given the following information:

Activity	0-1	1-2	1-3	2-4	2-5	3-4	3-6	4-7	5-7	6-7
Duration	2	8	10	6	3	3	7	5	2	8

i) Draw the arrow diagram
ii) Identify the critical path and find the total project duration
iii) Determine total, free and independent floats.

OR

b A small project is composed of seven activities whose time estimates are given on the following table:

Activity	1-2	1-3	1-4	2-5	3-5	4-6	5-6
Name	A	B	C	D	E	F	G
t_o	6	6	12	6	12	12	18
t_m	6	12	12	6	30	30	30
t_p	24	18	30	6	48	42	54

i) Find the expected duration and variance for each activity.

ii) What is the expected project length?

Z-Z-Z END