PGDORM SEM I

ASSIGNMENTS

Academic Year 2019-20

***Please follow the instructions and submit the assignment in the given time.**

1. Assignment is compulsory.

2. Last date to submit these assignments is the last date of your semester-1 examination (which will be held in the month of January, 2020). On the date of the examination, get your assignment answer sheet for the corresponding subject.

3. All assignments should be in written format. Assignment sheets to be collected from IDOL, Room no. 5.

4. No typed assignment or Xerox will be accepted.

5. Outstation students have to send the assignments by post, no assignment on mails to be approved.

6. Outstation students can send on the address:
   PGDFM / PGDORM Section, Room no 112, Institute of Distance and Open Learning, University of Mumbai, Kalina, Santacruz (East), Mumbai-400098.

APPLIED MATHEMATICS

(MARKS: 20)

NOTE: ATTEMPT ANY 5 **(20 marks)**

1) Monthly incomes of two persons are in the ratio 4:5 and their monthly expenses are in the ratio 7:9. If each saves Rs. 50 per month, find their monthly incomes.

2) If α and β are the roots of the quadratic equation $2x^2 - 4x - 1 = 0$ then the value of $\frac{\propto^2}{\beta} + \frac{\beta^2}{\alpha}$.

3) Reduce the following to normal form and hence find the rank of the matrix $\begin{bmatrix} 2 & 1 & -3 & -6 \\ 3 & -3 & 1 & 2 \\ 1 & 1 & 1 & 2 \end{bmatrix}$

4) A sum of Rs. 6, 55,000 is invested in a fixed deposit giving 10% p.a. compound interest. Find the interest in 4th year.

5) Evaluate: $\lim_{n\to\infty} \frac{1^3+2^3+3^3+.....}{n^4}$

6) The material demanded 1000 units per year the cost price of material Rs. 2 per unit, and it cost Rs. 50 to make the factory ready for production run of the items regardless of the number of units x producers in a run, and the cost of staring material is 25% yearly on the rupee value of the average inventory x on hand.

7) State Euler's theorem on homogeneous function and
If $z = \log\left[\frac{x^3+y^3}{x+y}\right]$. Show that $x.\frac{\partial z}{\partial x} + y.\frac{\partial z}{\partial y} = 2$.

8) The marginal cost function of manufacturing x shares is $6 + 10x - 6x^2$.The total cost of producing a part of shares is 12. Find the total and average cost function.

BASIC STATISTCS

(MARKS: 20)

Q.1) Calculate Median, Mean, Mode, 7^{th} Decile, 35^{th} Percentile ***(04 Marks)***

Weekly wages	40 - 50	50 - 60	60 - 70	70 - 80	80 - 90	90 -100	100-110
frequency	1 5	19	25	23	21	22	15

Q.2) Draw histogram & hence find mode. ***(04 Marks)***

Marks	65 – 70	70 -75	75-80	80 – 85	85 = 90	90 - 95	95 - 100
Number of candidates	2	10	10	25	20	18	15

Q.3) Which salesman is more consistent in sales. ***(04 Marks)***

Salesman I	40	45	50	55	60	65	70	75
Salesman II	15	30	30	35	35	50	60	60

Q.4) Find the Standard Deviation & Coefficient of variation. ***(04 Marks)***

Marks	15 _ 17	17 - 19	19- 21	21-23	23-25	25-27	27-29
Frequency	7	3	3	5	4	5	3

Q.5) SOLVE ANY ONE. ***(04 Marks)***

a) A bag contains 5 white & 7 black balls.
Find the probability of drawing i) 3 white ball ii) 2 white & 1 black ball.

b) There are 40 tickets numbered 1 to 40. One ticket is drawn at random, what is the probability that the number on the ticket drawn is divisible by i) 3 or5 ii) 3 or 7.

LINEAR PROGRAMMING

(MARKS: 20)

Q. I **(5 marks)**

Three products are processed through three different departments. The time (in minutes required per unit of each product) the daily capacity of each department (in minutes per day) and the net profit per unit sold of each product (in Rs.) are as follows:

Table 1

Department	Time per unit (minutes)			Operation Capacity (minutes per day)
	Product A	Product B	Product C	
I	1	2	1	1000
II	3	6	2	2000
III	1	4	8	1500
Profit per unit In Rs.	13	12	15	

It is assumed that all units produced are sold. The goal of the model is to determine optimum level of daily production for the three products that maximizes total profit. Formulate the problem as LP Problem. Solve by both the methods that you know. Compare your answers. Write your conclusion.

Q. II **(5 marks)**

Solve the following LPP graphically. Also reformulate the same for Simplex method.

Minimize $Z = 3x_1 + 4x_2$

Subject to 1) $x_1 \leq 4$

2) $x_2 \geq 2$

3) $-3x_1 + 4x_2 = 12$

4) $2x_1 + 3x_2 \geq 12$

5) $2x_1 - x_2 \geq -2$ x_1 and $x_2 \geq 0$

Solve the L.P.P. graphically. Answer the following questions

1. Can we solve this by Simplex?
2. Discuss on number of slack, surplus and auxiliary variables needed to be introduced and state why for inclusion of your every variable used.

Q. III **(5 marks)**

Solve the following LPP by Simplex method for optimality.

Maximize $Z = 3x_1 + 4x_2 + x_3 + 7x_4$

Subject to

1) $8x_1 + 3x_2 + 4x_3 + x_4 \leq 7$

2) $2x_1 + 6x_2 + x_3 + 5x_4 \leq 3$

3) $x_1 + 4x_2 + 5x_3 + 2x_4 \leq 8$

$x_1 , x_2 , x_1 , x_2 \geq 0$

Answer the following:

1) What are the shadow prices obtained from your optimal solution?
2) State the meaning of shadow prices you obtained.
3) Just mention the different post optimality tests. Do not discuss on any.

Q. IV **(5 marks)**

The simplex tableau for a maximization problem of linear programming is given below in the table

Basic		Solution	$C_j \longrightarrow$	4	5	0	0
C_i	X_i	b_i	$X_j \longrightarrow$	X_1	X_2	S_1	S_2
5	X_2	10		1	1	1	0
0	S_2	3		1	0	-1	1
		z_j		5	5	5	0
		$(C_j-Z_j)\ \Delta_j$		-1	0	-5	0

Carefully observe the table and answer the following question, giving reasons.

1. Is this solution optimal?
2. Are there more than one optimal solution?
3. Is this solution degenerate?
4. Is this solution feasible
5. If s_1 is the slack in machine A and s_2 is the slack in machine B in hours/week, which of these machines is being used to the full capacity when producing according to this solution?
6. A customer would like to have one unit of product x_1 and is willing to pay in excess of the normal price in order to get it. How must should the price be increased in order to ensure no reduction of profits?
7. How many units of x_1 and x_2 are produced according to this solution and what is the total profit?
8. Machine A associated with s_1 has to be shut down for 2 hours next week for repairs. What will be the effect on profit?
9. How much would you be prepared to pay for another hour (per week) or capacity each on machine A and machine B.

OPTIMIZATION MODELS 1

(MARKS: 20)

Q.1. A company operating 50 weeks in a year is concerned about its stocks of copper cable. This costs Rs. 240 per meter and there is a demand for 8,000 meters a week. Each replenishment costs Rs. 1,050 for administration and Rs. 1,650 for delivery, while holding costs are estimated at 25 per cent of value held a year.

Assuming no shortages are allowed, what is the optimal inventory policy for the company? How would this analysis differ if the company wanted to maximize profit rather than minimize the cost? What is the gross profit if the company sell cable for Rs. 360 a meter. ***(10 Marks)***

Q.2. A research team is planned to raise its strength to 50 chemists and then to remain at that level. The wastage of recruits depends on their length of service, which is as follows:

Year	Total percentage who have left up to the end of the year.	Year	Total percentage who have left up to the end of the year.
1	5	6	73
2	36	7	79
3	56	8	87
4	63	9	97
5	68	10	100

What is the recruitment per year necessary to maintain the strength? There are 8 senior posts for which the length of service is the main criterion for promotion. What is the average length of service after which new entrant can expect his promotion to one of these posts? ***(10 Marks)***