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SB-3595

M. Sc. (Part-II) Examination

March / April – 2011

Applied Mathematics : Paper - AM-205

(Optimization Techniques)

Time : **3** Hours] [Total Marks : **70**

Instructions :

(1)

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
Fillup strictly the details of ☛ signs on your answer book.

Name of the Examination :

☛ **M. Sc. (Part-2)**

Name of the Subject :

☛ **Applied Mathematics - AM-205**

☛ Subject Code No. : **3 5 9 5** ☛ Section No. (1, 2,.....) : **Nil**

Seat No. :

Student's Signature

(2) Attempt **all** questions.

(3) Follow usual notations.

(4) All question carries **equal** marks.

1 (a) Dived quantity b into n parts so as to maximize their product. Let $f_n(b)$ be the maximum value. Then show that $f_1(b) = b$, $f_n(b) = \max_{0 \le z \le b} \{z f_{n-1}(b-z)\}$. Hence find $f_n(b)$ and the division that maximizes it. **7**

(b) Use the dynamic programming to find **7**

Min. $Z = x_1^2 + 2x_2^2 + 4x_3$

subject to $x_1 + 2x_2 + x_3 \ge 8$ where $w_i \ge 0 (i = 1, 2, 3)$.

OR

1 (a) Use the dynamic programming to find the value of 7

Maximize $Z = y_1 \cdot y_2 \cdot y_3$

subject to $y_1 + y_2 + y_3 = 5$ where $y_i \geq 0 (i = 1, 2, 3)$

(b) Use the dynamic programming to solve the following linear programming problem : 7

Maximize $Z = 3x_1 + 5x_2$

subject to $x_1 \leq 4$

$x_2 \leq 6$

$3x_1 + 2x_2 \leq 18$ where $x_i \geq 0 (i = 1, 2)$

2 (a) Find the minimum of $f(x_1, x_2) = x_1 - x_2 + 2x_1x_2 + 2x_1^2 + x_2^2$ 7

using random jumping method. Assume the bounds on x_1 and x_2 as $-10 \leq x_i \leq 10; i = 1, 2$.

(b) Solve the following example by Simplex method : 7

Max. $Z = 3x_1 + 5x_2 + 4x_3$

subject to $2x_1 + 3x_2 \leq 8$

$2x_2 + 5x_3 \leq 10$

$3x_1 + 2x_2 + 4x_3 \leq 15$ where $x_i \geq 0 (i = 1, 2, 3)$

OR

2 (a) Find the minimum of $f(x_1, x_2) = 4x_1^2 + 3x_2^2 - 5x_1x_2 - 8x_1$ **7**

using random walk method from the point $X_1 = \begin{Bmatrix} 0.0 \\ 0.0 \end{Bmatrix}$

with a starting step length of $\lambda = 1.0$ take $\varepsilon = 0.05$

and $N = 100$.

(b) Solve the following example by two phase method. **7**

Min. $Z = 5x_1 + 8x_2$

subject to $3x_1 + 2x_2 \geq 3$

$x_1 + 4x_2 \geq 4$

$x_1 + x_2 \leq 5$ where $x_i \geq 0 (i = 1, 2)$

3 (a) Solve the following example by Interior Penalty function method : **7**

Minimize $f(x_1, x_2) = \frac{1}{3}(x_1 + 1)^3 + x_2$

subject to $g_1(x_1, x_2) = -x_1 + 1 \leq 0$

$g_2(x_1, x_2) = -x_2 \leq 0$

(b) Write down the Algorithm of Gradient Projection Method. **7**

OR

3 (a) Write down the Algorithm of Interior Penalty function method and Exterior Penalty function method. **7**

(b) Solve the following example by Gradient projection method : **7**

Minimize $f(x_1, x_2) = (x_1 - 1)^2 + (x_2 - 2)^2 - 4$

Subject to $g_1(x_1, x_2) = x_1 + 2x_2 \leq 5$

$g_2(x_1, x_2) = 4x_1 + 3x_2 \leq 10$

$g_3(x_1, x_2) = 6x_1 + x_2 \leq 7$

where $x_i \geq 0 \ (i = 1, 2)$

with starting point $X_1 = \begin{Bmatrix} 1.0 \\ 1.0 \end{Bmatrix}$

4 Mr. Sharma, the owner of small Grocery store wishes to evaluate his daily ordering policy for bread. His current rule is : order the amount demanded the previous day and he never runs out of stock. He purchases bread at the rate of Rs. 1.50 per bread and sells it for Rs. 1.75. The breads are ordered at the end of each day and are received the following morning. **14**

From past historical data the following distribution of demand for any day has been estimated :

Average Demand (D_n)(per day)	Probability
10	0.25
20	0.50
30	0.25

Mr. Sharma is considering the following two ordering policies.

Policy-1 : Order each day the amount of bread that was demanded previous days. That is $O_n = D_{n-1}$.

Policy-2 : Order each day the amount of bread that is equal to the average demand of previous two days. That is $O_n = \frac{1}{2}(D_{n-1} + D_{n-2})$.

Determine which policy will yield the highest profit ?

OR

4 (a) Describe Random jump method. **7**

(b) Construct the network diagram comprising activities B, C, . . ., Q and N such that the following constraints are satisfies $B < E, F$; $C < G, L$; $E, G < H$; $L, H < I$; $L < M$; $H < N$; $H < J$; $I, J < P$; $P < Q$. **7**

5 A construction company is preparing a PERT network for laying the foundation of art museum in the following table : **14**

Activity	Predecessors	Estimated duration (weeks)		
		Optimistic	Most likely	Pessimistic
A	—	2	4	3
B	—	8	8	8
C	A	7	11	9
D	B	6	6	6
E	C	9	11	10
F	C	10	18	14
G	C, D	11	11	11
H	F, G	6	14	10
I	E	4	6	5
J	I	3	5	4
K	H	1	1	1

(1) Draw the project network.

(2) Find the critical path of the network

(3) Calculate the earliest start time and earliest finish time for each activity.

(4) Find the total float and free float for each activity.

(5) Find the mean and variance of the each activity.

OR

5 A project consist of eight activities with the following relevant information : 14

Activity	Immediate Predecessor	Estimated duration (days)		
		Optimistic	Most likely	Pessimistic
A	—	1	1	7
B	—	1	4	7
C	—	2	2	8
D	A	1	1	1
E	B	2	5	14
F	C	2	5	8
G	D, E	3	6	15
H	F, G	1	2	3

(1) Draw the network and find out the expected project completion time.

(2) Find the critical path of the network.

(3) Calculate the earliest start time and earliest finish time for each activity

(4) Find the total and free float for each activity

(5) Find the variance of the each activity.