M.Sc 4th Semester Examination, 2011

APPLIED MATHEMATICS WITH OCEANOLOGY AND COMPUTER PROGRAMMING

(*Lab. on Special Paper*)

(Practical)

PAPER—MA - 2212 (OR)

Full Marks : 25

Time : 2 hours

Answer **one** question

The figures in the right-hand margin indicate marks

[Question to be selected by Lottery]

1. Write a program in C/C^{++} to solve the following LP problem by revised simplex method : 20

$$\text{Max. } Z = x_1 + 2x_2$$

subject to
$$x_1 + x_2 \leq 3$$
$$x_1 + 2x_2 \leq 5$$
$$3x_1 + x_2 \leq 6$$
$$x_1, \; x_2 \geq 0.$$

2. Write a program in C/C^{++} to solve the following LP problem by simplex method : 20

$$\text{Max. } Z = 3x_1 - x_2$$

$$\begin{aligned} \text{subject to } \quad & 2x_1 + x_2 \geq 2 \\ & x_1 + 3x_2 \leq 2 \\ & x_2 \leq 4 \\ & x_1, \ x_2 \geq 0. \end{aligned}$$

3. Write a program in C/C^{++} to evaluate the value of π (pi) by Monte Carlo simulation technique. 20

4. Write a program in C/C^{++} to solve the following Q.P.P. by Beale's method : 20

$$\text{Minimize } Z = 6 - 6x_1 + 2x_1^2 - 2x_1x_2 + 2x_2^2$$

$$\begin{aligned} \text{subject to } \quad & x_1 + x_2 \leq 2 \\ & x_1, \ x_2 \geq 0. \end{aligned}$$

5. Write a program in C/C^{++} to solve the following Q.P.P by Wolfe's method : 20

$$\text{Max. } Z = 2x_1 + x_2 - x_1^2$$

$$\text{subject to } \begin{aligned} 2x_1 + 3x_2 &\leqslant 6 \\ 2x_1 + x_2 &\leqslant 4 \\ x_1, \; x_2 &\geqslant 0. \end{aligned}$$

6. Write a program in C/C^{++} to solve the following bimatrix game : 20

$$\begin{bmatrix} (1,2) & (0,3) \\ (2,1) & (-1,0) \end{bmatrix}.$$

7. Write a program in C/C^{++} to solve the following probabilistic linear programming problem by stochastic programming : 20

Max. $f = 50\,x_1 + 100\,x_2$

subject to $P[a_{11}x_1 + a_{12}x_2 \leq 2500] \geq 99/100$

$P[a_{21}x_1 + a_{22}x_2 \leq 2000] \geq 99/100$

$P[a_{31}x_1 + a_{32}x_2 \leq 450] \geq 99/100$

$x_1, x_2 \geq 0.$

Means and standard deviations of a_{ij} are follows (for $i = 1, 2, 3, \quad j = 1, 2$) :

	Mean	Standard deviation		Mean	Standard deviation
a_{11}	10	6	a_{12}	5	4
a_{21}	4	4	a_{22}	10	7
a_{31}	1	2	a_{32}	1·5	3

Since a_{ij} follows normal distribution.

8. Write a program in C/C^{++} to solve the following problem by geometric programming : 20

Min. $f(X) = 7x_1x_2^{-1} + 3x_2x_3^{-2} + 5x_1^{-3}x_2x_3 + x_1x_2x_3$.

9. Write a program in C/C^{++} to solve the following queueing problem : 20

Arrivals at a telephone booth are considered to be Poisson, with an average time of 10 minutes between one arrival and the next. The length of a phone call assumed to be distributed exponentially with mean 3 minutes. Then.

(*a*) What is the probability that a person arriving at the booth will have to wait ?

(*b*) What is the average length of the queues that from time to time ?

(*c*) The telephone department will install a second booth when convinced that an arrival would expect to have to wait at least three minutes for the phone. By how much must the flow of arrivals be increased in order to justify a second booth ?

10. Write a program in C/C^{++} to solve the following queueing problem : 20

If for a period of 2 hours in a day (8–10) A.M. trains arrive at the yard every 20 minutes but the service time continues to remain 36 minutes, then calculate for this period :

(*a*) The probability that the yard is empty

(*b*) Average queue length, on the assumption that the line capacity of the yard is limited to 4 trains.

11. Write a program in C/C^{++} to solve the following queueing problem : 20

A telephone exchange has two long distance operators. The telephone company finds that, during the peak load, long distance calls arrive in a Poisson fashion at an average rate of 15 per hour. The length of service on these calls is approximately exponentially distributed with mean length 5 minutes.

(*a*) What is the probability that a subscriber will have to wait for his long distance call during the peak hours of the day ?

(*b*) If the subscribers will wait and serviced in turn, what is the expected waiting time ?

12. Write a program in C/C^{++} to solve the following Inventory problem : 20

A contractor has to supply 10,000 bearings per day to an automobile manufacturer. He finds that, when he starts a production run, he can produce 25,000 bearings per day. The cost of holding a bearing in stock for one year is 20 paise, and set-up cost of a production run is Rs. 180·00. How frequently should production run be made ?

13. Write a program in C/C^{++} to solve the following Inventory problem : 20

The demand of an item is uniform at a rate of 25 units per month. The fixed cost is Rs. 15 each time a production run is made. The production cost is Re. 1 per item, and the inventory carrying cost is Rs. 0·30 per item per month. If the shortage cost is Rs. 1·50 per item per month, determine how often to make a production run and of what size it should be ?

14. Write a program in C/C^{++} to solve the following Inventory problem : 20

The demand for an item in a company is 18,000 units per year, and the company can produce the item at a rate of 3,000 per month. The cost of one set-up is Rs. 500·00 and the holding cost of one unit per month is 15 paise. The shortage cost of one unit is Rs. 20·00 per year. Determine the optimum manufacturing quantity and the number of shortages. Also, determine the manufacturing time and the time between set-ups.

15. Write a program in C/C^{++} to solve the following Inventory problem : 20

Consider a shop which produces three items. The items are produced in lots. The demand rate for each item is constant and can be assumed to be deterministic. No back orders are to be allowed.
The pertinent data for the items is given in the following table :

Item	1	2	3
Holding cost (Rs.)	20	20	20
Set-up cost (Rs.)	50	40	60
Cost per unit (Rs.)	6	7	5
Yearly demand rate	10,000	12,000	7,500

Determine approximately the Economic Order Quantities when the total value of average inventory levels of three items is Rs. 1000.

16. Write a program in C/C^{++} to solve the following Inventory problem : 20

A company producing three items has a limited storage space of averagely 750 items of all types. Determine the optimal production quantities for each item separately, when the following information is given :

Product	1	2	3
Holding cost (Rs.)	0·05	0·02	0·04
Set-up cost (Rs.)	50	40	60
Demand rate (per unit)	100	120	75

17. Write a program in C/C^{++} to solve the following LPP by simplex method : 20

$$\text{Maximize} \quad Z = x_1 + 2x_2$$

subject to constraints
$$-x_1 + 2x_2 \leq 8$$
$$x_1 + 2x_2 \leq 12$$
$$x_1 - 2x_2 \leq 3$$
$$x_1, \; x_2 \geq 0.$$

18. Write a program in C/C^{++} to solve the following LPP by revised simplex method : 20

Minimize $Z = x_1 + x_2$

subject to constraints $x_1 + 2x_2 \geq 7$

$4x_1 + x_2 \geq 6$

$x_1, x_2 \geq 0.$

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