Total No. of Questions : 12]

SEAT No. :

P3775

[Total No. of Pages : 5

[4760]-85

M.E. (Civil)

WATER RESOURCES AND ENVIRONMENTAL ENGG.

Optimization Techniques

(2012 Pattern)

Time : 3 Hours] *[Max. Marks : 100*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***Answer any three questions from each section.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of Calculator is allowed.***
6) ***Assume suitable data if necessary.***

SECTION - I

Q1) a) Distinguish between convex and concave sets and local maxima, global maxima. **[8]**

b) Write the applications of system approach in civil engineering? Explain the 'need' implementation of system approach in civil engineering field? Explain with suitable example. **[8]**

OR

Q2) a) Explain the terms: key decision, objective, alternatives and constraints in the context of linear optimization model by assuming a suitable industrial example. **[8]**

b) Solve the problem by simplex method to Maximize. **[8]**

$Z = 6x_1 + 4x_2$,

subject to :

$$2x_1 + 3x_2 \leq 30$$
$$3x_1 + 2x_2 \leq 24$$
$$x_1 + x_2 \geq 3$$
$$x_1, x_2 \geq 0$$

P.T.O.

Q3) a) What is dual? When is the solution of it preferred to that of primal? Distinguish between Big M method and Two phase method. **[8]**

b) Use Big M technique to Maximize $Z = 2X_1+4X_2$, **[8]**
Subject to :

$$2X_1 + X_2 \leq 18$$
$$3X_1 + 2X_2 \geq 30$$
$$X_1 + 2X_2 = 26$$
$$X_1, X_2 \geq 0$$

OR

Q4) a) Maximize **[10]**

$Z = 6x_1 + 10x_2 + 2x_3$

Subject to :

$$2x_1 + 4x_2 + 3x_3 \leq 40$$
$$x_1 + x_2 \leq 10$$
$$2x_2 + x_3 \leq 12 \text{ and}$$
$$x_1, x_2, x_3 \geq 0$$

b) Explain sensitivity analysis in L.P. **[6]**

Q5) a) Use the steepest descent to Minimize $Z=2(x_1-1)^2+(x_2-x_1)^2$ taking starting point as (–1, 2). Carry out only two iterations. **[10]**

b) Maximize $Z = 60x - x^2$ in the interval (0, 100) with an accuracy of 0.1% by using Dichotomous method. **[8]**

OR

Q6) a) Use the steepest gradient technique to Maximize

$f(x) = 3x_1 + x_1x_2 - x_1^2 - x_2^2$

Take initial point as (0, 0) and Carry out first two iterations. **[8]**

b) Use Fibonacci method to minimize the function, $Z = x^3 - 12x$
Within a range of 0 to 5 and an accuracy of 0.1%. Carry out first four iterations only. **[10]**

SECTION - II

Q7) a) State Bellman's Principal of optimality and give at least two examples of dynamic programming. **[6]**

b) Six units of power (1 unit = 100 MW) are to be distributed among three regions designated as 1, 2 and 3. The return functions are given below. Where P is the power supplied in units, Ri(p) is the return function from the region I when i = 1, 2 and 3. Using dynamic programming allocate the power optimally .(12) **[10]**

P Ri(p)	0	1	2	3	4	5	6
R_1	0	8	11	30	70	82	90
R_2	0	6	12	40	50	69	75
R_3	0	9	25	43	53	60	68

OR

Q8) a) It is proposed to develop the hydropower by building dams on 3 possible river sites. The total Financial resource available is 3 units. This is to be allocated optimally to these possible developments. The return functions of this investment are given below. Use dynamic programming and determine the maximum return and the allocation to various sites. **[10]**

Resource allocated	Return Form		
	Site 1	Site 2	Site 3
0	0	0	0
1	3	2	4
2	5	6	6
3	7	7	8

b) What are the applications of dynamic programming in Water resource and environmental engineering? **[6]**

Q9) a) In a queuing system a study of interarrival times and service times indicated the following frequency distribution for 100 such arrivals. **[10]**

Interarrival Time (min)	2	6	10	14
Frequency	40	30	20	10

Service Time (min)	1	3	5
Frequency	40	40	20

Estimate the average percentage waiting time of the units, average percentage idle time of the server and the average length of the queue by simulating 10 arrivals. Use the following random numbers.

Arrival	33	90	32	21	02	20	38	11	80	44
Service	61	48	05	61	58	77	05	85	31	20

b) What is simulation? Explain MONTE CARLO simulation in detail. **[8]**

OR

Q10) a) A manufacturing firm has to carry out processing of 5 jobs in 3 different departments A, B and C in that order. The time required by each job in each department is as follows. **[10]**

Jobs	Time in hours		
	Dept. A	Dept. B	Dept. C
1	15	8	20
2	12	10	24
3	13	14	18
4	19	11	14
5	16	13	10

Determine the sequence in which the jobs are to be processed when no-bye passing is allowed, so that the total elapsed time is minimum. Also determine the idle time of the department if any.

b) A company manufactures around 200 mopeds. Depending upon the availability of raw materials and other conditions, the daily production has been varying from 196 to 204 mopeds, whose probability distribution is as given below. The finished mopeds are transported in a specially designed three storeyed lorry that can accommodate only 200 mopeds. Using the following 15 random numbers 82, 89, 78, 24, 53, 61, 18, 45, 04, 23, 50, 77, 27, 54 and 10 simulate the process to find out :

i) what will be the average number of mopeds waiting in the factory?
ii) what will be the number of empty spaces in the lorry?

Production/day	196	197	198	199	200	201	202	203	204
Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

[8]

Q11) a) Explain the following : **[6]**

i) Minimax and maxmin principles.

ii) Pure and mixed strategies.

iii) Two person zero sum game.

b) Solve the following game : **[10]**

	Player B				
Player		I	II	III	IV
A	1	6	4	8	0
	2	6	8	4	8
	3	8	4	8	0
	4	0	8	0	16

OR

Q12) a) Solve the following 2 × 5 game by graphical method. **[8]**

	Player B				
Player	-5	5	0	-1	8
A	8	-4	-1	6	-5

b) Solve the following game by dominance method. **[8]**

	Player B			
Player		I	II	III
A	I	7	1	7
	II	9	-1	1
	III	5	7	6

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