Total No. of Questions : 10]

SEAT No. :

**P3060**

[Total No. of Pages : 5

# [5059]-505
## B.E. (Civil)
## SYSTEMS APPROACH IN CIVIL ENGINEERING
## (2012 Course) (End Semester) (Semester - 1) (Elective - I)
## (401004B)

*Time : 2½ Hours]* *[Max. Marks : 70*

***Instructions to the candidates:***

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8, Q9 or Q10.***
2) ***Neat diagrams must be drawn whenever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data if necessary.***

***Q1)*** a) What are the scope and limitations of systems Approach? **[6]**

b) Explain with sketch. Global optima and local optima. **[4]**

OR

***Q2)*** a) Using golden section method, solve following using 3 iterations Minimize $Z = x^2 - x + 2$ in the range (0,2) **[6]**

b) State any two applications of NLP. **[4]**

***Q3)*** a) A company has one nob sharpening machine. The nobs required regrinding are sent from the companies tool crib to this machine which at present is operated one shift per day of 8 hrs duration. Arrival of the nobs at tool crib is random with an average time of 60 min between one arrival and next. The regrinding time of nob is distributed negative exponentially with the mean of 30 min. **[6]**

i) For what fraction of time, the machine is busy?

ii) How does a nob wait in the queue?

iii) What is the average length of queue that is formed from time to time?

iv) The management has decided to purchase another grinder and thereby start another shift on this machine, when the utilization of machine on single shift basis increases by 85%, what should be the arrival rate then?

b) Explain the process of sequencing of n jobs through 3 machines. **[4]**

OR

***P.T.O.***

***Q4)*** a) Write algorithm for steepest gradient method. **[4]**

b) Interarrival and service time in a waiting line problem have the following frequency distribution based on 100 such iterations. **[6]**

| Interarrival time (min) | 3 | 6 | 9 | 12 | 15 | 18 |
|---|---|---|---|---|---|---|
| frequency | 6 | 9 | 25 | 37 | 16 | 7 |

Random numbers: 15,19,61,49,54,73,85,96,31,22

| Service time (min) | 4 | 6 | 8 | 10 | 12 |
|---|---|---|---|---|---|
| frequency | 4 | 10 | 18 | 44 | 24 |

Random numbers: 9,11,90,64,37,29,43,78,87,56

Calculate average waiting time and average idle time.

***Q5)*** a) What is Dynamic programming? What sort of problems can be solved using it? **[5]**

b) Explain Bellman's Principle of optimality. **[5]**

c) A distance network consists of eleven nodes which are distributed as shown in following table. Find the shortest path from node 1 to node 11 and the corresponding distance. **[6]**

| Arc | Distance | Arc | distance |
|---|---|---|---|
| 1-2 | 5 | 5-8 | 9 |
| 1-3 | 8 | 5-9 | 6 |
| 1-4 | 3 | 6-9 | 7 |
| 2-5 | 9 | 7-10 | 4 |
| 3-6 | 10 | 8-11 | 6 |
| 3-7 | 12 | 9-11 | 5 |
| 4-7 | 5 | 10-11 | 2 |

OR

***Q6)*** a) What is the need of Dynamic Programming? How is it different from LP? Write some applications of DP. **[8]**

b) An organization is planning to diversify its business with a maximum outlay of Rs 4 crores. Out of there identified locations of plants; it can invest in one or more of these plants subject to availability of funds. The different possible alternatives and their investment and present worth of returns (both in crores of rupees) during the useful life of each plant is given below. **[8]**

| Alternatives | Plant 1 | | Plant 2 | | Plant 3 | |
|---|---|---|---|---|---|---|
| | Cost | Returns | Cost | Returns | Cost | Returns |
| 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2 | 1 | 12 | 2 | 16 | 2 | 9 |
| 3 | 2 | 15 | 3 | 20 | 3 | 12 |
| 4 | 3 | 19 | 4 | 25 | 4 | 15 |

Find optimum allocation of the capital to different plants which will maximize the corresponding sum of present worth of returns.

***Q7)*** a) Explain graphical method of solving Linear Programming problem. What are its limitations? **[6]**

b) An engineering company is planning to diversify its operations during the year 2016-17. The company has allocated capital expenditure budget equal to Rs 5.15 crore in year 2016 and Rs 6.5 Crores in year 2017. The company has five investment projects under considerations. The estimated net returns and expected cash expenditure are as follows. **[6]**

| Project | Estimated net returns (in lakh of Rs) | Capital expenditure (in Lakh of Rs) | |
|---|---|---|---|
| | | Year 2016 | Year 2017 |
| A | 12.4 | 2.4 | 3.6 |
| B | 13.9 | 4.5 | 5.7 |
| C | 18.3 | 5.6 | 7.8 |
| D | 24.6 | 7.9 | 8.6 |
| E | 28.9 | 8.5 | 10.2 |

Formulate the capital budgeting problem as an LP model to maximize the net returns.

c) Solve using simplex method **[6]**

Maximize $Z = 20\ x_1 + 80\ x_2$

Subject to $4\ x_1 + 6\ x_2 \leq 90$

$8\ x_1 + 6x_2 \leq 100$

$5\ x_1 + 4\ x_2 \leq 80$

$x_1\ ,\ x_2 \geq 0$

OR

***Q8)*** a) Solve by using big M method. **[8]**

Minimize $Z = 2\ x_1 + 3\ x_2$

Subject to

$x_1 + x_2 \geq 6$

$7\ x_1 + x_2 \geq 14$

$x_1\ ,\ x_2 \geq 0$

b) What are the characteristics of Duality? **[6]**

c) Construct dual of the primal problem. **[4]**

Minimize $Z = 3\ x_1 - 2\ x_2 + 6\ x_3$

Subject to $4\ x_1 + 5\ x_2 + 4\ x_3 \geq 7$

$5\ x_1 + x_2 + 2\ x_3 \geq 5$

$7\ x_1 - 2\ x_2 - x_3 \leq 10$

$2\ x_1 - x_2 + 5\ x_3 \geq 6$

$4\ x_1 + 7\ x_2 - x_3 \geq 2$

$x_1, x_2, x_3 \geq 0$

***Q9)*** a) Find initial solution of the transportation problem given in Que 10 c) using VAM. **[5]**

b) What is degeneracy in transportation problem? How is it resolved? **[5]**

c) Following are the details of processing time required for five jobs by five operators. Assign these jobs to operators to give minimum processing time. **[6]**

operators

| Jobs | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| 1 | 10 | 12 | 15 | 12 | 8 |
| 2 | 7 | 16 | 14 | 14 | 11 |
| 3 | 13 | 14 | 7 | 9 | 9 |
| 4 | 12 | 10 | 11 | 13 | 10 |
| 5 | 8 | 13 | 15 | 11 | 15 |

OR

***Q10)***a) Write short note on assignment problem and its applications. **[5]**

b) State the steps to handle following situations in assignment problem **[5]**

i) Maximization

ii) Unbalanced problem

c) Solve the following transportation problem to minimize total transportation cost using row maxima and column minima method. **[6]**

To warehouses

| From plants | | A | B | C | D | E | Plant capacity |
|---|---|---|---|---|---|---|---|
| | 1 | 1 | 2 | 6 | 2 | 3 | 800 |
| | 2 | 3 | 4 | 5 | 8 | 1 | 600 |
| | 3 | 3 | 1 | 1 | 2 | 6 | 200 |
| | 4 | 4 | 7 | 3 | 5 | 4 | 400 |
| demand | | 400 | 100 | 700 | 300 | 500 | |