OPERATIONS RESEARCH ENGINEERING APPLICATIONS
(CHEN 4244)

Time Allotted : 3 hrs **Full Marks : 70**

Figures out of the right margin indicate full marks.

Candidates are required to answer Group A and any 5 (five) from Group B to E, taking at least one from each group.

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1. Choose the correct alternative for the following: **10 × 1 = 10**

(i) For maximization of LP model, the Simplex method is terminated when all values
(a) $c_j - z_j <= 0$ (b) $c_j - z_j >= 0$
(c) $c_j - z_j = 0$ (d) $z_j <= 0$

(ii) The Hungarian algorithm is associated with
(a) assignment problem (b) Monte-Carlo simuation
(c) queuing theory (d) Markov Chain

(iii) If any value in X_B - column of final Simplex Tableaux is negative, then the solution is
(a) Unbounded (b) Infeasible
(c) Optimal (d) Degenerated

(iv) Charnes' Big M method is synonymous with
(a) Dual- Simplex method (b) Revised Simplex method
(c) Introduction of Artificial variables (d) Sensitivity Analysis

(v) An assignment problem is a special case of a Transportation problem with
(a) non-feasible solution (b) unbounded solution
(c) degenerate solution (d) None of the above

(vi) Gradient Search Method is an example of
(a) Constrained Optimization (b) unconstrained Optimization
(c) Partial Constrained Optimization (d) Waiting line problem

(vii) PERT Network is
(a) Deterministic (b) Probabilistic
(c) both (a) and (b) (d) Virtual

(viii) Slack time (τ_s^j) is equal to
(a) $T_L^j - T_E^j$ (b) $T_E^j - T_L^j$
(c) $T_E^j + t_E^{ij}$ (d) $T_L^j - t_E^{ij}$

(ix) The upper bound of Correlation coefficient is.
(a) 0 (b) 1
(c) 5 (d) -1

(x) The calling population is assumed to be infinite when
(a) arrivals are independent of each other (b) capacity of the system is infinite
(c) service rate is faster than arrival rate (d) all of the above

Group – B

2. Find the Optimized value of z subject to:
$x_1+ 3x_2+ 2x_3+ 5x_4 <= 20$; $2x_1+ 16x_2+ x_3+ x_4 >= 4$; $3x_1- x_2-5x_3+ 10x_4 <= -10$;
$x_1, x_2, x_3, x_4 > = 0$; min $z = -2x_1- x_2-4x_3- 5x_4$

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3. (a) Prove that Hyperplane is a Convex set.

(b) Solve the following formulations:
$x_1 – x_2 >= 0$; $3x_1 - x_2 <= -3$; $x_1, x_2 >=0$, max $z=x_1+x_2$

5 + 7 = 12

Group – C

4. Solve the following by dual Simplex method:
Minimize $f=x_1+ 3x_2+2x_3$ subject to $4x_1-5x_2+ 7x_3<=8$, $2x_1-4x_2+2x_3>=2$, $x_1-3x_2 +2x_3<=2$, $x_1, x_2, x_3, >= 0$.

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5. A famous Detergent Manufacturing Company is producing a single product for cleaning utensils and is selling it through five agencies located in different cities. All of a sudden, there is a demand for the product in another five cities not having any agency of the company. The company is faced with the problem of deciding on how to assign the existing agencies to dispatch the product to needy cities in such a way that the travelling distance is minimized. The distance between the surplus and deficit cities (in km) is given in the following table:

Tasks	Deficit cities				
	a	b	c	d	e
A	85	75	65	125	75
B	90	78	66	132	78
C	75	66	57	114	69
D	80	72	60	120	72
E	76	64	56	112	68

Determine the optimum assignment schedule

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Group – D

6. The calculated values of friction factor (f) as a function Reynolds number (Re) is given below:

Re	4530	5010	5780	9600	12600	15600
f	0.0097	0.0095	0.0092	0.0081	0.0075	0.0071

Obtain a Regression equation involving these parameters.

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7. What do you mean by Response surface methodology? Discuss the algorithm for conducting a first order model.

(5 + 7) = 12

Group – E

8. What is Fulkerson's rule? Enumerate the basic differences between PERT and CPM network.

(3 + 9) = 12

9. The following table gives data on normal time-cost and crash time-cost for a project

Activity	Normal		Crash	
	Time (days)	Cost (Rs.)	Time (days)	Cost (Rs.)
10--20	6	600	4	1000
10--30	4	600	2	2000
20--40	5	500	3	1500
20--50	3	450	1	650
30--40	6	900	4	2000
40--60	8	800	4	3000
50—60	4	400	2	1000
60--70	3	450	2	800

The indirect cost per day is Rs. 100. Drawing the Network, Crash the relevant activities systematically and determine the optimum project completion time and cost.

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Department & Section	Submission Link
CHE	https://classroom.google.com/c/MzYwOTgzOTc4NjY2/a/MzYwOTgzOTc4NzQw/details