KERALA AGRICULTURAL UNIVERSITY

B.Tech (Food.Engg) 2011 Admission

Vth Semester Special Re- Examination- June -2015

Cat. No: Meen.3106 **Marks: 30.00**

Title: Systems Engineering (2+0) **Time: 3 hours**

PART A (10 x 1 = 10.0)

Fill in the blanks

1. The method used for finding initial feasible solution in a transportation problem by giving initial allocation to the upper right hand corner of the tableau is called ___________
2. In two phase simplex method, in the first phase, the objective function formulated as the sum of artificial variables is to be ___________
3. The dual of a dual LP is ___________
4. To solve problems of repair and maintenance of broken-down machines, traffic congestion etc. ______________________ theory can be used.
5. ______________________ models are used to determine economic order quantities, safety stocks, maximum and minimum stock levels etc.

Write TRUE or False

6. The CPM approach to time – cost trade-offs assumes that cost is a linear function of time.
7. In canonical form of Linear Programming problem, all constraints are equalities.
8. An artificial variable column can be dropped completely from the simplex tableau, once that variable become non-basic.
9. In an assignment problem, if some assignment is infeasible then that assignment can be effectively avoided by putting a large cost in that cell.
10. A Linear programming problem with one decision variable having unrestricted sign cannot be converted to standard form.

PART B (Answer any ten) (10 x 3 = 30.0)

1. With suitable examples differentiate between slack and surplus variables.
2. Explain with example, how constrain of equality type can be modified to suit canonical form.
3. Explain the constituents of a single channel queuing model.
4. Explain the Vogel's Approximation Method (VAM) for finding initial feasible solution.
5. Discuss the application of PERT and CPM
6. What are the characteristics of standard form of Linear programming problem.

7. Write the dual of the following Linear Programming Problem.

Minimize $Z = X_1 - 3X_2 - 2X_3$

Subject to: $3X_1 - X_2 + 2X_3 \leq 7$

$2X_1 + 4X_2 \geq 12$

$-4X_1 + 3X_2 + 8X_3 = 10$

$X_1, X_2 \geq 0$, X_3 unrestricted

9. Explain with the help of graph, unbounded solution in the context of linear programming.

10. Discuss degeneracy in Transportation problem.

11. Explain Big M simplex Method.

12. Write short note on Monte Carlo Simulation.

13. Explain when and why are artificial variable included in linear programming problem for solving using simplex method.

PART C (Answer any six) **(6 x 5 = 30 .0)**

1. The activities and duration (provided in brackets) of a maintenance project are given below. Draw the project network; find the critical path and duration of the project.

Activity (Duration) : 1–2 (2 months), 1-3 (2 months), 1–4 (1 month), 2–5 (4 months), 3–6 (5 months), 3-7 (8 months), 4-7 (3 months), 5-8 (1 month), 6-8 (4 months), 7-9 (5 months), 8-9 (3 months).

2. Solve the following Linear Programming Problem, graphically.

Maximize $Z = 7X_1 + 10X_2$

Subject to: $X_1 + 4X_2 \leq 60$

$X_1 \leq 36$

$X_2 \leq 12$

$2X_1 + X_2 \geq 30$

$X_1 - X_2 \geq 0$

$X_1, X_2 \geq 0$

3. An airline which operates 7 days a week has the following time table. Crew must have a minimum layover time of six hours between the flights. Obtain the pairing of planes that minimizes the layover time away from the home for any given pair. The crew will be based at the city that results in smaller layover.

Flight No	Departure Delhi	Arrival Kolkatta	Flight No	Departure Kolkatta	Arrival Delhi
001	7 AM	9 AM	101	9 AM	11 AM
002	9 AM	11 AM	102	10 AM	12 NOON

003	1.30 PM	3.30 PM	103	3.30 PM	5.30 PM
004	7.30 PM	9.30 PM	104	8 PM	10 PM

4. An agriculturist has a farm with 125 acres. He produces Radish, Muttar and Potato. Whatever he raises is fully sold in the market. He gets Rs 50/kg for Radish, Rs 40/kg for Muttar and Rs 50 / kg for Potato. The average yield (kg/acre) for Radish, Muttar and Potato are 1500, 1800, 1200 respectively. To produce each 100 kg of Raddish and Mutter and to produce each 80 kg of potato a sum Rs 125 has to be used for manure. The labour requirements for raising the crop in each acre are 6, 5, 6 man days for Radish, Muttar and Potato respectively. A total 500 man days at a labour rate RS 400 / day are available. Formulate this as a linear programming model to maximize profit of the agriculturist.

5. Solve the following Linear Programming Problem by simplex method

Maximize $Z = 2X_1 + X_2$

Subject to: $X_1 + 2X_2 \leq 10$

$X_1 + X_2 \leq 6$

$X_1 - X_2 \leq 2$

$X_1 - 2X_2 \leq 1$

$X_1, X_2 \geq 0$

6. A company needs to schedule its weekly production of an item for the next four weeks. The production cost of the item is Rs 100 for the first two weeks and Rs 150 for the last two weeks. Weekly demands which have to be met are in week one to four are 300, 700, 900 and 800 respectively. In addition to the maximum production of 700 per week, the company can employ overtime to increase the production by another 200 units in the second and third week, but this involves an additional cost of production of Rs 30 per unit. Excess production in a week can be stored at a cost of Rs 30 per week. Formulate the problem and express it in transportation table form.

7. An investor has Rs 1000 with him on Monday. He has the following investment option available on each day. If he invests two units of money on one day, and one unit on the next day, then on the following day he gets a return of four units. Formulate a programming problem to determine the optimal investment policy, which will maximize the money he has on Saturday of the same week.

8. A potato chip manufacture has three plants and four warehouses. The transportation costs for shipping from plants to warehouses, plant availability and warehouse requirements are tabulated below.

PLANT	WAREHOUSE				Availability (* 100 kg)
	W1	W2	W3	W4	
P1	7	4	3	5	235
P2	6	8	7	4	280
P3	5	6	9	10	110
Requirements (*100 kg)	125	160	110	230	

Find the initial feasible solutions by Vogel's approximation method and test its optimality.

PART D (Answer any one) **(1 x 10 = 10.0)**

1. A company produces three types of juices (J1, J2 and J3), which has excellent market demand and all the produce will be sold out. The production of each type of juice involves three different processes. The company has always will have pre orders and as per the policy of the company, this has to be supplied without any failure. The details pertaining to the next production batch tabulated below:

Juice	Process 1	Process 1	Process 1	Profit per unit	Committed Orders
J1	1	2	2	10	10
J2	2	1	1	15	20
J3	3	1	2	8	30
Total available hours the process	200	220	180		

Prepare a product mix so as to maximize the profit.

2. Solve the assignment problem given in the following table. The figures in the table represent the time required for each combination.

	PERSONS			
JOBS	1	2	3	4
I	12	30	21	15
II	18	33	9	31
III	44	25	24	21
IV	23	30	28	14