College of Engineering, Pune
End Semester Examination- Nov 2013

Subject: (DE 09006) Operations Research   **Class:** T.Y. B. Tech. (Mechanical)

[Max. Marks: 60]

Instructions to candidates:
1. *All questions are compulsory.*
2. *Figures to right indicate full marks.*
3. *Assume necessary assumptions and data if required.*
4. *Use of non-programmable electronic calculator is allowed.*

Q. No. 1 **a** A duplicating machine maintained in an office to make copies. The work to be copied varies in length (number of pages in original) and number of copies required is also variable for those reasons the service rate is randomly distributed but approximates a Poisson's distribution having mean service rate of 10 jobs per hour. Generally the requirements of use are random over the entire 8-hours working day but arrive at the rate of 6 jobs per hour. Several people noted that a waiting line develops occasionally and have questioned the policy of having only one machine. If the time of clerk requiring copy Rs 50 per hour find

    1. Equipment utilization
    2. The percent of wait an arrival
    3. Average time of waiting and operating machine
    4. Average cost of waiting

                                                                 4

b A company produces three types of parts for automatic washing machines. It purchases castings of the parts from a local foundry and then finishes the parts on drilling, shaping and polishing machines. The selling prices of parts A, B and C are Rs 8, Rs 10 and Rs 14. All parts made can be sold. Castings for parts A, B and C respectively cost Rs 5, Rs 6 and Rs 10. The company possesses only one of each type of machine. Costs per hour to run each of the three machines are Rs 20 for drilling, Rs 30 for shaping and Rs 30 for polishing. The capacities (parts per hour) for each part on each machine are shown as below.

Machine	Capacities per hour		
	Part A	Part B	Part C
Drilling	25	40	25
Shaping	25	20	20
Polishing	40	30	40

The manger of the company wants to know how many of each

type to produce per hour in order to maximize profit for the hour's run. Formulate the problem and obtain its dual.

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OR

b Form the information given below draw a network and find the critical path and total duration of the project. Also calculate total float for each activity by calculating earliest start and finish times and latest start and finish time

Activity	Time (Days)	Immediate Predecessors	Activity	Time (Days)	Immediate Predecessors
A	3	---	G	4	C
B	2	---	H	2	D
C	2	---	I	5	E
D	4	A	J	6	F,G
E	4	B	K	3	H,I
F	7	B			

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c Solve

$$Max z = 5x_1 + 3x_2$$

$$x_1 + x_2 \leq 6$$
$$2x_1 + 3x_2 \leq 12$$
$$x_1 \leq 3$$
$$x_2 \leq 3$$
$$x_1, x_2 \geq 0$$

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Q. No. 2 **a** Describe briefly the different phases of operations research.

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OR

a Explain the following terms
1. Arrival rate   2. Service rate
1. Service discipline   4. Traffic intensity

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b Solve the following game

			Player B	
		1	**2**	**3**
	1	60	50	40
Player	**2**	70	70	50
A	**3**	80	60	75

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c Solve the game.

Player B

		1	2	3
	1	1	-1	-1
Player A	**2**	-1	-1	3
	3	-1	2	-1

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Q. No. 3 **a** What do you understand by two person zero sum game?

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b Solve the following transportation problem for minimization.

Market Areas

		A	B	C	D	Supply
	I	40	25	22	33	100
Factories	II	44	35	30	30	30
	III	38	38	28	30	70
Demand		40	20	60	30	

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c Using the data below calculate
1. Economic order quantity
2. Annual purchasing cost
3. Annual inventory carrying cost
4. Annual total cost

Annual demand- 20,000 units
Inventory carrying cost -18%
Ordering cost per order-Rs 35
Unit price   -Rs 250

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Q. No.4 **a** For the following sequencing problem; find total elapsed time & machine utilization for each machine.

Jobs		1	2	3	4	5	6
Mach-	A	3	12	5	2	9	11
ines	B	8	6	4	6	3	1
	C	13	14	9	12	8	13

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b The project has the following time durations in weeks, find the duration required to complete the project also find the probability of completing the project within 22 , 18 and 19 weeks.

Activity	Optimistic time	Most likely time	Pessimistic time
1-2	1	1	7
1-3	1	4	7
1-4	2	2	8
2-5	1	1	1
3-5	2	5	14
4-6	2	5	8
5-6	3	6	15
6-7	1	2	3

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c   Write short note on "Traveling salesman problem" and solve

		TO			
	1	2	3	4	5
1	0	2	5	7	1
2	6	0	3	8	2
From 3	8	7	0	4	7
4	12	4	6	0	5
5	1	3	2	8	0

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