Assignment 3 [80 marks]

1.ABC produces two models of an assembled product that use milling, drilling, and grinding facilities respectively. The table below shows the details: [5+3+2]

Resource	Unit Resource Requirements		Maximum Availability
	Model 1	Model 2	
Milling (m/c Hrs)	2	3	1200
Drilling (m/c Hrs)	2	1	1000
Grinding (m/c Hrs)	0	4	800
Unit Profit (Rs.)	30	40	

a) Find the optimum number of the models to be produced for the next plan period.
b) If the available Milling machine-hours increase to 1300 units, find the new optimum solution
c) If the available grinding machine-hours are reduced to 350 units, will you be able to determine the new optimum solution directly from the given information? Explain.

2. An electronics firm manufactures 4 types of recorders: portable, Popular, Super and Deluxe. Assembly, Testing, and Recording head resource requirements per unit and total availabilities, along with the profit per unit is shown below: [10]

	Portable	Popular	Super	Deluxe	Resource Availability
Assembly	6 hours	9 hours	10 hours	10 hours	1600hours
Testing	1 hour	2 hours	4hours	5 hours	600 hours
Recording heads	1	1	1	1	300
Profit at Rs.Per unit	250	300	400	750	

Taking x_1, x_2 , x_3 , x_4 as the number Portable, Popular, Super and Deluxe recorders to be manufactured by the company, we get the following final simplex table representing the optimal solution (x_5, x_6, x_7 are the slack variables):

Ci			250	300	400	750	0	0	0
Ci	Basis	RHS	x_1	x_2	x_3	x_4	x_5	x_6	x_7
250	x_1	100	1	5/4	1/2	0	1/4	-1/2	0
750	x_4	100	0	3/20	7/10	1	-1/20	3/10	0
0	x_7	100	0	-2/5	-1/5	0	-1/5	1/5	1
	z		0	-125	-250	0	-25	-100	0

Find out, by sensitivity analysis, the new optimal solution, if by process improvement, deluxe recorder needs only 3 hours (instead of 5 hours) of testing resources per unit.

3. a) Use simplex method to find the optimal solution to the following linear programming problem: [5]

Minimize Z= x_1-$2x_2$-x_3

S.t. $x_1+x_2+x_3 \leq 6$

$x_1-2x_2 \leq 4$

All variables non-negative

b) Now find the new optimal solution by sensitivity analysis using the already obtained optimal solution solution from a) when the following new constraint is also added: [5]

$-x_2 + 2x_3 \geq 4$

4. a) Solve the following linear programming problem. [5]

Maximize Z=$3x_1+x_2$

S.t. $x_1+x_2 \leq 6$

$2x_1+3x_2 \leq 8$

All variables non-negative

b) Find the new optimal solution by sensitivity analysis when the constraints are changed as given below $x_1+2x_2 \leq 6$ [5]

$2x_1 \leq 8$

5. A firm producing a single product has two plans (A and B) and three customers (1, 2, 3). Plants A and B produce 60 units and 80 units respectively. Customers 1, 2 and 3 have placed an order for 50, 60 and 70 units respectively. The management has committed to meet 50% of the demand of the customer 2 and 3. The net profit associated with shipping a unit from plant i to customer j is given below: [10 Marks]

	Customer 1	Customer 2	Customer 3
Plant A	Rs 5	Rs 7	Rs 6
Plant B	Rs 2	Rs 3	Rs 5

Work out the optimal shipping schedule.

6. Three collieries supply coal to four power stations. Colliery outputs, power station requirements and unit transportation costs are shown in the table below. How should be distribution be made, given that no shortage is allowed in meeting the demand of power station 1 and at least 80% of the requirement of power station 3 must be met?
[10 Marks]

	POWER STATIONS				CAPACITY
	1	2	3	4	
A	7	10	14	8	30
B	7	11	12	6	35
C	5	8	15	8	25
REQUIREMENT	20	20	35	40	

7. Consider the problem of assigning four machines to four different jobs. The profit (hundreds of Rs.) resulting from the allocation any particular machine to any of the jobs is shown in the following table. However, it is seen that machine 4 is not suitable to handle the job 4.
[10 Marks]

	Job 1	Job 3	Job 3	Job 4
Machine 1	10	2	3	15
Machine 2	5	10	15	2
Machine 3	15	5	14	7
Machine 4	20	15	13	-

Work out the optimal assignment of jobs to machines.

8. An airline has two-way flights between two cities A and B. Crews can be stationed at either city A or B. IATA rules require that the crew reaching any destination should not pickup the return flight within 3 hours of their arrival. In view of the excessive layover costs the airline is interested in the minimization of the total layover time. If the airline operates between the cities as per the following schedule work out the best arrangement for the pairing of flights and the location of the crews: [10 Marks]

	From	To			From	To
Flight	A	B		Flight	B	A
1	6.00	8.30		10	7.30	9.30
2	8.15	10.45		20	9.15	11.15
3	13.30	16.00		30	16.30	18.30
4	15.00	17.30		40	20.00	22.00