



University of Kelaniya - Sri Lanka

External Examinations Branch

**Bachelor of Arts (General) Degree Third Examination (External) – 2009
August / September 2010**

Faculty of Social Sciences

Social Statistics– SOST – E3025

Operational Research

Answer five (05) questions only

No. of questions : 08

Time : Three hours

01. i. What are the basic data requirements to establish a linear programming problem.
- ii. A company produces three products A, B and C and can sell as much of each as it can produce. The contribution margin of each product is respectively , Rs.8.00, Rs. 20.00 and Rs. 10.00. The three products must be processed through two different departments. The processing time required for each product in each department and the departmental capacities are as follows.

Processing Requirements (hrs)

Department	Product			Hours Available
	x ₁	x ₂	x ₃	
A	2	3	1	200
B	4	5	3	400

- i. Formulate as a linear programming problem to maximize the contribution margin with available capacity and calculate the maximum profit.
- ii. State your answer.

02. i. Identify the differences between Graphical method and simplex method.
- ii. Solve the following linear programming problem graphically.

$$\text{Min. } z = 5x_1 + 4x_2$$

$$\text{St. } 4x_1 + 6x_2 \geq 12$$

$$12x_1 + 6x_2 \geq 24$$

$$3x_1 + 4x_2 \leq 24$$

$$x_1, x_2 \geq 0$$

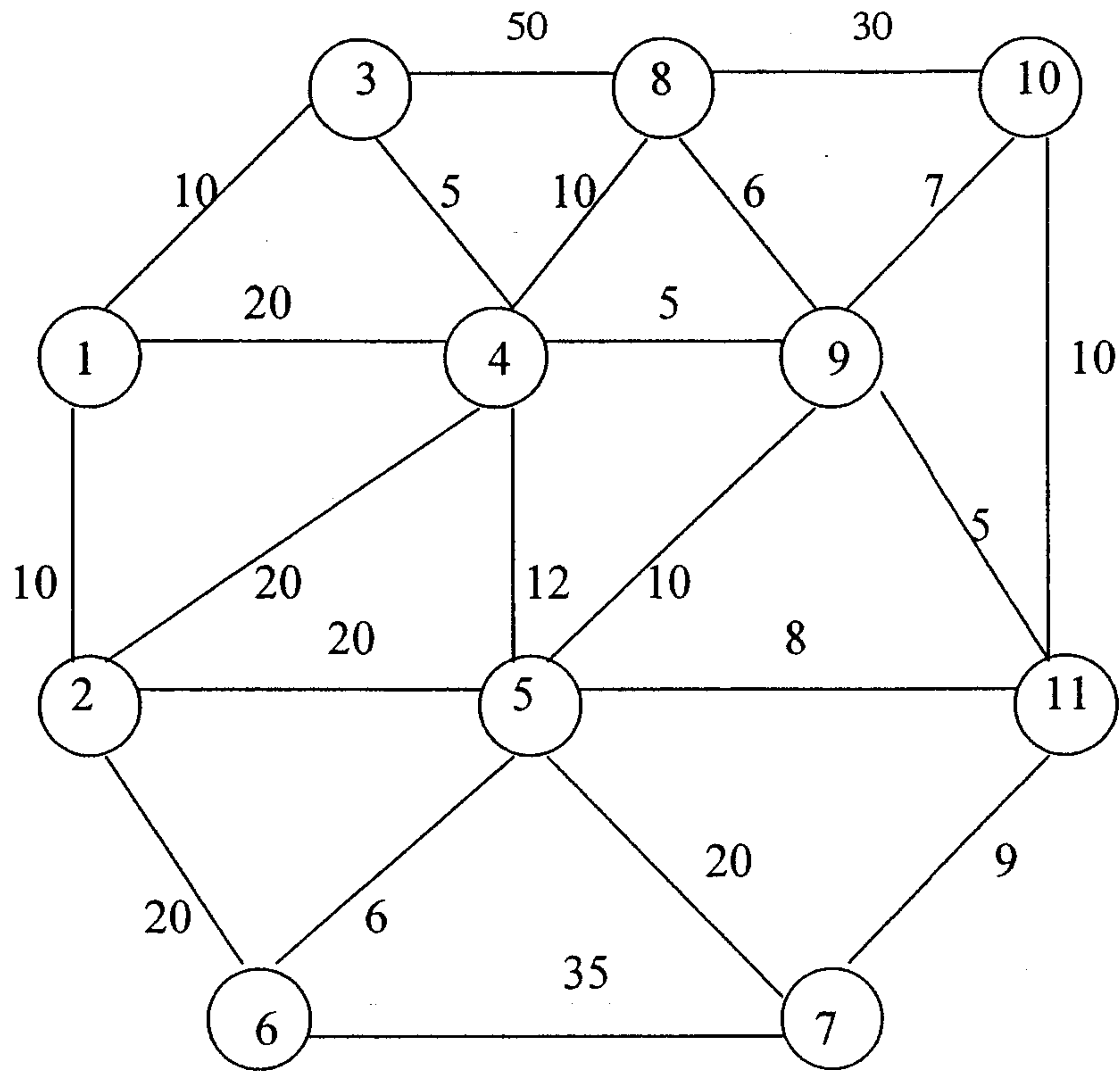
03. An advertising agency is developing a magazine advertising campaign for a new client. The following activities have been identified as necessary in order to complete the project.

Activity	Duration (weeks)	Immediate Predecessor (s)
A	2	-----
B	3	A
C	4	B
D	4	B
E	5	D
F	3	C,D
G	2	A
H	4	A
I	5	E, F, G
J	3	H, I

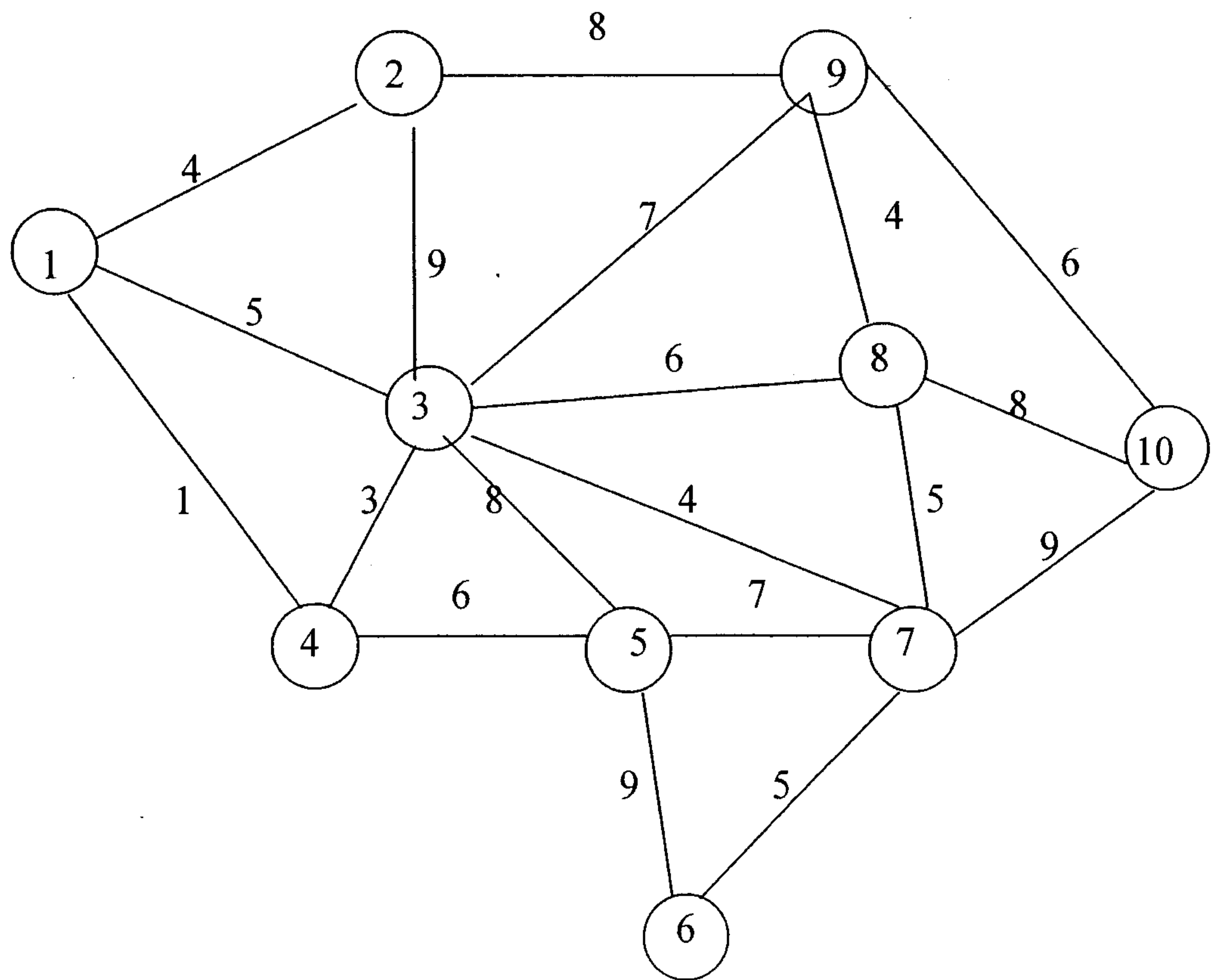
- i. Draw the network for this project.
- ii. Identify the critical path.

04. i. What are the advantages of Network Analysis?

ii. Find the shortest routes from (1) to (7) and (1) to (11)



iii. Solve the following network as a Minimum Spanning Tree Problem.



07. The following measurements are obtained from samples of five items taken at regular intervals from a measuring process.

Sample									
1	2	3	4	5	6	7	8	9	10
0.996	0.902	0.905	0.885	0.995	0.895	0.965	0.953	0.943	0.999
0.998	0.899	0.992	0.901	0.982	0.902	0.973	0.966	0.903	0.985
0.901	0.953	0.964	0.942	0.964	0.963	0.890	0.943	0.925	0.963
0.952	0.921	0.955	0.940	0.982	0.945	0.902	0.931	0.971	0.992
0.966	0.946	0.966	0.980	0.988	0.962	0.891	0.870	0.906	0.945

- i. Plot the appropriate control charts and comment on the process.

08. i. Describe the importance of Statistical Quality control process.
- ii. A data processing company recently took random samples of 100 entries to determine the number of entries made incorrectly by its data entry personnel. The following information was gathered.

Sample	Errors per 100 entries	Sample	Errors per 100 entries	Sample	Errors per 100 entries
1	3	8	3	15	4
2	6	9	4	16	2
3	5	10	3	17	7
4	6	11	4	18	4
5	2	12	5	19	5
6	5	13	3	20	5
7	4	14	4		

Use this information to develop a P chart and make some statements about the test data.

Control Chart Limits

NO IN SAMPLE	MEANS		RANGE										
	Inner	Outer	Lower	Upper									
n	$A_{0.025}$	$A'_{0.001}$	$A_{0.025}$	$A'_{0.001}$	$D_{0.001}$	$D'_{0.001}$	$D_{0.025}$	$D'_{0.025}$	$D_{0.999}$	$D'_{0.999}$	$D_{0.975}$	$D'_{0.975}$	
2	1.128	1.386	1.229	2.185	1.937	0.00	0.00	0.04	0.04	4.65	4.12	3.17	2.81
3	1.693	1.132	0.668	1.784	1.054	0.06	0.04	0.30	0.18	5.06	2.99	3.68	2.17
4	2.059	0.980	0.476	1.545	0.750	0.20	0.10	0.59	0.29	5.31	2.58	3.98	1.93
5	2.326	0.877	0.377	1.382	0.594	0.37	0.16	0.85	0.37	5.48	2.36	4.20	1.81
6	2.534	0.800	0.316	1.262	0.498	0.54	0.21	1.06	0.42	5.62	2.22	4.36	1.72
7	2.704	0.741	0.274	1.168	0.432	0.69	0.26	1.25	0.46	5.73	2.12	4.49	1.66
8	2.847	0.693	0.244	1.093	0.384	0.83	0.29	1.41	0.50	5.82	2.04	4.61	1.62
9	2.970	0.653	0.220	1.030	0.347	0.96	0.32	1.55	0.52	5.90	1.99	4.70	1.58
10	3.078	0.620	0.202	0.977	0.317	1.08	0.35	1.67	0.54	5.97	1.94	4.79	1.56
11	3.173	0.591	0.186	0.932	0.294	1.20	0.38	1.78	0.56	6.04	1.90	4.86	1.53
12	3.258	0.566	0.174	0.892	0.274	1.30	0.40	1.88	0.58	6.09	1.87	4.92	1.51