Bengal Engineering and Science University, Shibpur

M. E. (CE) 2nd Semester Final Examination, 2013

OPTIMIZATION IN TRANSPORT PLANNING (CE 1025)

Full Marks 70 Time 3 hours

Assume data if necessary

Answer any **FIVE** questions

1. For a particular city five alternative transportation infrastructure development project proposals are in consideration. It is decided that the proposals will be judged on the basis of six criteria. The values of each criterion for each proposal are shown in the following table. The relative weights of the criteria, A to F, are 0.20, 0.22, 0.17, 0.13, 0.10 and 0.18 respectively. Rank the proposal using any suitable method. Also discuss the method used. [14]

Criterion → Proposal ↓	A	B (Rs in crore)	C (km/h)	D	E	F
I	Fair	34	40	Very Good	IV	3
II	Fair	42	50	Moderate	I	2
III	Excellent	52	65	Bad	III	1
IV	Good	40	60	Very Bad	V	2
V	Poor	28	35	Good	II	4

A: Safety Improvement; B: Capital Cost; C: Average Running Speed; D: Rehabilitation Condition; E: Social Benefit (I: Minimum; V: Maximum); F: Improvement in Environmental Condition (1: worst; 5: best)

2. a) A traffic speed study involves collection of field data. The mean and standard deviation of a set of data of 65 vehicles are 41.00 km/hr and 4.80 km/hr respectively. Calculate the probability that a) the speed of a vehicle is 50 km/hr or more; b) speed of a vehicle is within the range of 30 km/hr and 40 km/hr. Use standard normal distribution table as attached with the question. [6]

   b) For the above data find the limit of speeds that lies within 97.5% confidence bound. [4]

   c) Comment on the sample size in the above problem if the accepted confidence limit is 90% and tolerance limit is 1.0 km/hr. [4]

3. It is planned to rank three flyover projects, X, Y and Z, on the basis of the opinion of the experts. For this purpose two groups of experts, one group from the government officers and other from the social activists, are randomly selected. It is decided that the ranking of the flyovers will be made on the basis of two criteria, congestion reduction

and pollution control. Each group makes pair wise comparison of congestion reduction and pollution control in a scale of 1 to 9. Accordingly the government officers judge congestion reduction more important than pollution control by assigning value 4. But the experts from social activists think pollution control is more critical and puts value 5. All experts compare the three modes according to congestion reduction and pollution control separately. These rating are given below. Rank the flyovers using AHP technique. Also discuss whether there is any inconsistency in assigning weights. [14]

For Congestion Reduction:

Between X and Y, Y is significantly better and value assigned is 7

Between X and Z, X is better and value assigned is 5

Between Y and, Z, Y is significantly better and value assigned is 6

For Pollution Control:

Between X and Y, M is better and value assigned is 5

Between X and Z, Z is slightly better and value assigned is 2

Between Y and, Z, Y is better and value assigned is 4

4. Discuss on [4 x 3½]

   a) Delphi method

   b) Sensitivity analysis

   c) Dijkstra's algorithim

   d) Simplex method in Tabular Form

5. a) What is meant by linear programming? Discuss the basic steps of formulation of linear programming models. [2+3]

   b) Explain the following: [2x4]
   i) Basic variables, ii) Pivot operation, iii) Basic feasible solution, iv) Artificial Neural Network

6. Solve the following L.P.P. by simplex table: [14]

$$\text{Maximize } z = 2x_1 + 4x_2 + x_3 + 5x_4 - 2x_5$$
$$\text{Subject to } 2x_1 + 3x_2 + x_3 + 4x_4 = 6$$
$$3x_1 + 2x_2 + 2x_4 + x_5 = 9$$
$$x_1, x_2, x_3, x_4, x_5 \geq 0$$

7. Using the Floyd's algorithm find out the shortest routes and distances between every two nodes of the network given in figure 1.0. The distances are given on the arcs. The node 3 to node 5 is one directional so that no traffic is allowed from node 5 to node 3. All the other arcs allow traffic in both directions.

[14]

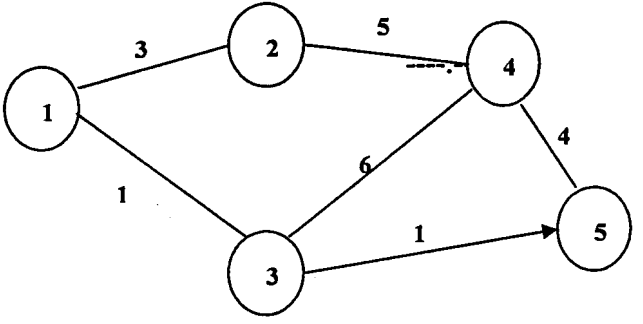

Figure 1.0

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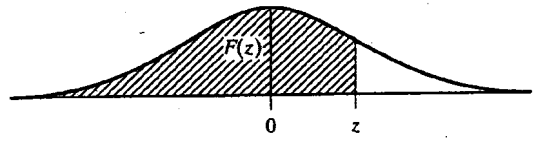
Tabulated Values of the Standard Normal Distribution



$$F(z) = \int_{-\infty}^{z} \frac{1}{\sqrt{2\pi}} e^{-z^2/2}\, dz$$

z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
.0	.5000	.5040	.5080	.5120	.5160	.5199	.5239	.5279	.5319	.5359
.1	.5398	.5438	.5478	.5517	.5557	.5596	.5636	.5675	.5714	.5753
.2	.5793	.5832	.5871	.5910	.5948	.5987	.6026	.6064	.6103	.6141
.3	.6179	.6217	.6255	.6293	.6331	.6368	.6406	.6443	.6480	.6517
.4	.6554	.6591	.6628	.6661	.6700	.6736	.6772	.6808	.6844	.6879
.5	.6913	.6950	.6985	.7019	.7054	.7083	.7123	.7157	.7190	.7224
.6	.7257	.7291	.7324	.7357	.7389	.7422	.7454	.7486	.7517	.7549
.7	.7580	.7611	.7642	.7673	.7704	.7734	.7764	.7794	.7823	.7852
.8	.7881	.7910	.7939	.7967	.7995	.8023	.8051	.8078	.8106	.8133
.9	.8159	.8186	.8212	.8238	.8264	.8289	.8315	.8340	.8365	.8389
1.0	.8413	.8438	.8461	.8485	.8508	.8531	.8554	.8577	.8599	.8621
1.1	.8643	.8665	.8686	.8708	.8729	.8749	.8770	.8790	.8810	.8830
1.2	.8849	.8869	.8888	.8907	.8925	.8944	.8962	.8980	.8997	.9015
1.3	.9032	.9049	.9066	.9082	.9099	.9115	.9131	.9147	.9162	.9177
1.4	.9192	.9207	.9222	.9236	.9251	.9265	.9279	.9292	.9306	.9319
1.5	.9332	.9345	.9357	.9370	.9382	.9394	.9406	.9418	.9429	.9441
1.6	.9432	.9463	.9474	.9484	.9495	.9505	.9515	.9525	.9535	.9545
1.7	.9554	.9564	.9573	.9582	.9591	.9599	.9608	.9616	.9625	.9633
1.8	.9641	.9649	.9658	.9664	.9671	.9678	.9686	.9693	.9699	.9706
1.9	.9713	.9719	.9726	.9732	.9738	.9744	.9750	.9756	.9716	.9767
2.0	.9772	.9778	.9783	.9788	.9793	.9798	.9803	.9808	.9812	.9817
2.1	.9812	.9826	.9830	.9834	.9838	.9842	.9846	.9854	.9854	.9857
2.2	.9861	.9864	.9868	.9871	.9875	.9878	.9881	.9884	.9887	.9890
2.3	.9893	.9896	.9898	.9901	.9904	.9906	.9909	.9911	.9913	.9916
2.4	.9918	.9920	.9922	.9925	.9927	.9929	.9931	.9932	.9934	.9936
2.5	.9938	.9940	.9941	.9943	.9945	.9946	.9948	.9949	.9951	.9952
2.6	.9953	.9955	.9956	.9937	.9959	.9960	.9961	.9962	.9963	.9964
2.7	.9965	.9966	.9967	.9968	.9969	.9970	.9971	.9972	.9973	.9974
2.8	.9974	.9975	.9976	.9977	.9977	.9978	.9979	.9979	.9980	.9981
2.9	.9981	.9982	.9982	.9983	.9984	.9984	.9985	.9985	.9986	.9986
3.0	.9987	.9987	.9987	.9988	.9988	.9989	.9989	.9989	.9990	.9990
3.1	.9990	.9991	.9991	.9991	.9992	.9992	.9992	.9992	.9993	.9993
3.2	.9993	.9993	.9994	.9994	.9994	.9994	.9994	.9995	.9995	.9995
3.3	.9995	.9995	.9995	.9996	.9996	.9996	.9996	.9996	.9996	.9997
3.4	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9997	.9998