Marks Scored:

KATHMANDU UNIVERSITY
End Semester Examination
March/ April, 2017

Level : B.Sc.
Year : III

Course : COMP 317
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : MAR 27 2017

SECTION "A"

[10 Q × 0.5 = 5 marks]

Fill in the blank(s) (question number 1 through 10) by the most appropriate word(s) or symbol(s):

1. The variables that can assume positive, negative or zero value are called..

2. In final table of solution of LP problem the reduced cost corresponding to basic variables ....

3. ....method is based on the concept of duality in transportation problem.

4. If $r_0 = 23, m = 5, p = 6$ then first random r_1= ....

5. Subtracting all the elements from largest one converts the maximizing profit of assignment into ....cost.

6. In salesman problem if traveling salesman has to travel n cities starting from any one of cities then number of ways of his tour planes = ...

7. If the initial solution of the transportation problem has number of basic cells = value of (m+ n –1) where m and n are the number of rows and columns of transportation matrix then the solution is said to be..

8. The formula $L_j - E_i - t_{ij}$ is networking planning calculates the ....

9. If A, B, C, D, E are the cities where press -Van has to make round trip starting from the city E then city E is called...

10. In a queueing system customer is classified as .... when he joins a queue for a while then leave the queue without being served.

SECTION "B"

[10 Q × 0.5= 5 marks]

Fill in the blank spaces (Question number 11 through 20) by choosing the most appropriate answers from among the given ones. Do not tick the answers.

11. If in a single sever queue $\lambda = 8$ per hour , μ = per hour then the proportion of time that the sever is idle is ....
[0.33, 2.66, 2.33, 0.66]

12. Dual constraints for the maximization LP-problem is

....

[$\sum a_{ij} y_i \geq C_j$, $\sum a_{ji} y_i \geq C_j$, $\sum a_{ij} y_j \leq C_j$, $\sum a_{ji} y_i \leq C_j$,]

13. On the critical path of network ....holds

(i) $E_j - E_i = L_j - L_i = t_{i\,j}$

(ii) $E_j - L_j - E_i = L_i - t_{i\,j}$

(iii) $E_i - E_j - L_i = E_i - t_{i\,j}$

(iv) $E_i - L_i = E_j - L_j = t_{i\,j}$

14. Indication of existence of multiple solution by simplex method is that

(i) Element of $Z_j - C_j$ row corresponding to basic variable is zero

(ii) Element of $Z_j - C_j$ row corresponding to non-basic variable is zero

(iii) Element of $Z_j - C_j$ row corresponding to slack variable is zero

(iv) Element of $Z_j - C_j$ row corresponding to surplus variable is zero

15. While solving the LP problem by simplex method sometimes artificial variable still stays in the basis even after the optimization criterion is met then the problem is said to have

....

[Feasible solution, infeasible solution, basic solution, non-basic solution]

16. The objective function of assignment problem for the assignment of i th job to j th machine is ....

[$MinimizeZ = \sum_{j=1}^{n} \sum_{i=1}^{n} c_{ij} x_{ij}$ $MinimizeZ = \sum_{j=1}^{n+1} \sum_{i=1}^{n} c_{ij} x_{ij}$

$MinimizeZ = \sum_{j=1}^{n+1} \sum_{i=1}^{n-1} c_{ij} x_{ij}$ $MinimizeZ = \sum_{j=1}^{n} \sum_{i=1}^{n+1} c_{ij} x_{ij}$]

deterministic]

17. ---is not the assumption of travelling salesman problem

(i) Traveler should know the number of cities to be visited.

(ii) Cost of travelling from one city to another.

(iii) City from which the tour to be started.

(iv) Number of travelers per route per day.

18. Maximize $Z = 6x_1 + 4x_2$ subject to the constraints $x_1 + x_2 \geq 5$, $x_2 \geq 8$, $x_1, x_2 \geq 0$ has the auxiliary objective function ....

[Max Z = $-A_1 - A_2$, Max Z = $A_1 - A_2$,, Max Z = $A_1 + A_2$, Max Z = $A_1 * A_2$]

19. The rate by objective function value improves as the R.H.S quantity is increased by unity is called ....

[Reduced cost, Opportunity cost, Relative cost, Dual price]

20. In integer programming problem solving procedure by branch and bound method the further branching is stopped and problem is said to have ....

[Infeasible solution, multiple solutions, fathom, cutting plane]

KATHMANDU UNIVERSITY
End Semester Examination
March/ April, 2017

MAR 27 2017

Level : B.Sc.
Year : III
Time : 2 hrs. 30 mins.

Course : COMP 317
Semester : I
F. M. : 50

SECTION "C"
[3 Q × 7 = 21 marks]

1. The owner of a chain of fast food restaurant is considering a new computer system for accounting and inventory control. A computer company sent the following information about the computer installation: [3+2+2]

			Times(days)		
Activity	Activity description	Immediate predecessor	t_0	t_m	t_p
A	Select the computer model	---	4	6	8
B	Design input/output systems	A	5	7	15
C	Design monitoring systems	A	4	8	12
D	Assemble computer hardware	B	15	20	25
E	Develop the main programs	B	10	18	26
F	Develop input/output routines	C	8	9	16
G	Create data base	E	4	8	12
H	Install the system	D,F	1	2	3
I	Test and implement	G,H	6	7	8

a) Construct the network diagram for the project
b) Find the expected completion time of the project
c) Find the probability of completing the project in 55 days

2. In a single channel queuing system random numbers for arrivals of customers are 36,60,82,14,14,62,62,10,55,14 and random numbers for services of customers are 34,35, 31,62,48,73,88,70,19,40 and using Monte Carlo simulation for the queuing system for 10 periods for the table given below: Find [7]
(i) Mean queue length.
(ii) Mean inter arrival time of a customer
(iii) Mean service time of a customer.
(iv) Mean idle time of server.
(v) Mean time that a customer spends in the system
(vi) Mean number of customers waiting in the queue.
(vii) Percentage of time that the server remains busy.

Inter-arrival time (min)	Probability	Service time (min)	Probability
5	0.15	7	0.10
6	0.35	8	0.35
7	0.40	9	0.45
8	0.10	10	0.10

OR

Solve the following integer programming problem by the method of branch and bound method
Minimize $Z = 3x_1 + 2.5x_2$ subject to the constraints

$$x_1 + 2x_2 \geq 20,$$
$$3x_1 + 2x_2 \geq 50,\ x_1, x_2 \geq 0$$ [7]

3. A salesman has to visit five cities A, B, C, D and E. The distances(in hundred km) between the five cities are as follows: [7]

	To city					
		A	B	C	D	E
From City	A	–	17	16	18	14
	B	17	–	18	15	16
	C	16	18	–	19	17
	D	18	15	19	–	18
	E	14	16	17	18	–

Find the routing schedule so that the total distance travelled by him is minimized

SECTION "D"

[5 Q × 5 = 25 marks]

4. What is the linear programming problem? A company manufactures two products: **A** and **B.** Product **A** yields a contribution of Rs.30 per unit and Product **B**, Rs.40 per unit towards the fixed costs. It is estimated that the sales of product A for the coming moth will not exceed 20 units. Sales of Product **B** have not yet been estimated but the company does have a contract to supply at least 10 units to a regular customer. There are 100 machine- hours available for the coming month. It takes 4 hours to produce both product A and product **B** .There are 180 labor hours available and products **A** and product **B** require 4 hours and 6 hours of labor respectively .Material available are restricted to 40 units for the products .One unit of each product requires one unit of material. The company wishes to maximize its profits.(a) Set up the mathematical model as the linear programming problem (b) solve the problem by graphical approach to find optimum product mix. [3+2]

OR

Find two optimal solutions set of following LP-problem:

Maximize Z = $6x_1 + 3x_2$

Subject to

$2x_1 + x_2 \le 8$,

$3x_1 + 3x_2 \le 18$

$x_2 \le 3$

$x_1, x_2 \ge 0$

5. A petrol station has a single pump and space for not more than 3 cars. A car arriving when the space is filled to capacity goes elsewhere for petrol. Cars arrive according to a Poisson distribution at a mean rate of one every 8 minutes. Their service time has an exponential distribution with a mean of4 minutes. Find (a) Mean number of cars altogether in petrol station for their turn to come (b) Mean time to spend in the station. [2.5+2.5=5]

6. Justify that the transportation model is the special type of linear programming problem. Find optimal solution of following transportation problem : [5]

	P	Q	R	s	Supply
A	11	13	17	14	250
B	16	18	14	10	300
C	21	24	13	10	400
Demand	200	225	275	250	

7. Solve linear programming problem by Simplex method Minimize Z = $x_2 - 3x_3 + 2x_5$ subject to

$$3x_2 - x_3 + 2x_5 \le 7$$
$$-2x_2 + 4x_3 \le 12$$
$$-4x_2 + 3x_3 + 8x_5 \le 10$$
$$x_2, x_3, x_5 \ge 0$$

[5]

8. By using big M-method solve the following LP-problem:

Maximize Z = $2x_1 + x_2 + 3x_3$ Subject to [5]

$$x_1 + x_2 + 2x_3 \le 5$$
$$2x_1 + 3x_2 + 4x_3 = 12$$
$$x_1, x_2, x_3 \ge 0$$

SECTION "E"

[2Q × 2= 4 marks]

9. State two applications of Operations Research in Computer Engineering.

10. Convert following assignment problem into linear programming problem.

	X	Y	Z
A	3	4	5
B	6	7	8
C	2	1	3

Standard Normal Distribution Function

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

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−5.0	0.0000003									
−4.0	0.00003									
−3.5	0.0002									
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
−3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

TABLE 3 Standard Normal Distribution Function

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

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998
3.5	0.9998									
4.0	0.99997									
5.0	0.9999997									