KATHMANDU UNIVERSITY
End Semester Examination [C]
December, 2024

Marks Scored:

Level : B.E.
Year : III

Course : COMP 304
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

Date : 17 DEC 2024

SECTION "A"

[10 Q. × 1 = 10 marks]

Fill in the blank space(s) by writing the most appropriate word(s) or symbol(s).

1. If optimistic time is 3, pessimistic time is 5, and most likely time is 4 then expected time for this activity is _____

2. Maximize Z $=6x_1 + 4x_2$ has vertices convex polygon as $(2,3), \left(5, \frac{1}{2}\right), \left(\frac{1}{2}, 5\right), \left(\frac{1}{3}, \frac{1}{2}\right)$ then optimal value vertex is_____

3. If there are m cities then a traveling salesman has to travel these cities starting from one of these cities then its objective function is _____

_____

4. $r_0 = 27, m = 1000, p = 519$ *then* $r_1 =$_____

5. Queueing theory is the science of _____

6. In project network diagram the dummy activity is used to avoid _____

_____

7. The transportation problem has the demand amount less than supply amount then before finding the initial solution we have to introduce _____

_____

8. While numbering the nodes of project network tail node gets _____ than head node

9. From the perspective of cost of providing the service to the customers outs of M/M/4/7 and M/M/10/5 one should choose to use_____

_____

10. If minimize Z $=75x_1 + 90x_2$ then 75 indicates _____

_____

SECTION "B"

[10 Q. × 1 = 10 marks]

Fill in the blank space(s) by selecting the most appropriate answer from among the given ones. (**DO NOT TICK** THE ANSWER).

11. In queueing model, the inter-arrival time and service time distribution follow _____

[Poisson distribution — Exponential distribution
Erlang distribution — Geometric distribution]

12. If LP-problem possesses alternative solutions then it can have _____

[Unique solution — Infinitely many solution
Infeasible solution — Degenerate solution]

13. _____ is not the assumption of travelling salesman

[The travelling salesman should come back to home city
The priority visit of the city is the prime objective of travelling salesman problem
No back-trekking is allowed in the travelling salesman
The cost or time or distance between pair city should be known priorly by the salesman]

14. Simulation is not _____

[Representative Process — Optimization Process
Costlier Process — Easier Process]

15. If m troops be deployed to m -border sentry with their logistics then which of the following technique be applied for the process _____

[Travelling salesman technique — Transportation technique
Assignment technique — Project Network technique]

16. If there are n workers and n jobs in the assignment problem then there would be _____ _____ solutions

[$n!$ — $(n-1)!$ — $(n!)^n$ — n]

17. Single server queueing system has 2 customers waiting in queue with $\lambda = 3, \mu = 4$capacity then probability of server being idle .is _____

[0.34 — 0.43 — 2.34 — 2.43]

18. Problem gets optimal solution for assignment problem but not for travelling salesman problem then to find the optimal solution for travelling salesman problem we have to proceed _____ _____

[to draw minimum number of vertical and horizontal line to cover all the zero
to add dummy row
to extract the new matrix corresponding to least cost
to extract the new matrix corresponding to largest cost]

19. Loop starts from the _____ cell in MODI method of transportation problem that has

[largest $d_{ij} > 0$ — largest $d_{ij} < 0$ — $d_{ij} = 0$ — least $d_{ij} > 0$]

20. $F(F_{ij}), I(F_{ij}), T(F_{ij})$, *are the free float , independent float and total float then their relation is*

[If $F(F_{ij}) \leq I(F_{ij}) \leq T(F_{ij})$ $\quad$ $I(F_{ij}) \leq F(F_{ij}) \leq T(F_{ij})$
$F(F_{ij}) \geq I(F_{ij}) \geq T(F_{ij})$ $\quad$ $I(F_{ij}) \geq F(F_{ij}) \geq T(F_{ij})$]

KATHMANDU UNIVERSITY
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Level : B.E.
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Course : COMP 304
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SECTION "C"
[3 Q. × 7 = 21 marks]

1. In what way does Two-phase method is superior to Big-M method? Use -Two phase method to find the optimal solution of following LP-problem: *Minimize* $Z = x_1 + x_2$ subject to the constraints

$$2x_1 + x_2 \geq 4\,; x_1 + 7x_2 \geq 7;\ \ x_1, x_2 \geq 0$$

OR

Maximize $Z = 5x_1 + 3x_2$ subject to the constraints $x_1 + x_2 \leq 2\,; 5x_1 + 2x_2 \leq 10\,;\ \ 3x_1 + 8x_2 \leq 12;\ x_1, x_2 \geq 0$ has the following optimal solution table:

		C_j	5	3	0	0	0
C_B	B	X_{B_i}	x_1	x_2	s_1	s_2	s_3
5	x_1	2	1	1	1	0	0
0	s_2	0	0	-3	0	1	0
0	s_3	6	0	5	0	0	1
Z_j			5	5	5	0	0
$Z_j - C_j$			0	2	5	0	0

a. State optimal solution set.
b. State whether the solution is non-degenerate or not
c. State basic variables and non-basic variables
d. Value of $s_3 = 6$ what does it mean?
e. Does this problem possess alternative solution? give reason
f. State from the table the solution for dual variables.
g. What is the new objective function value when x_2 is introduced into solution

2. In a KUSMS Teaching hospital, Dhulikhel patients' arrival are considered to be Poisson with an inter-arrival time of 20 mins. The doctor's examination time assumed to be exponentially distributed with an average of 10 mins find: [2+1+2+2]
   a. What is the chance that a new patient directly sees the doctor?
   b. For what proportion of the time the doctor is busy?
   c. What is the average number of patients in the system?
   d. What is the average waiting time of the system?

P.T.O.

3. In a single server queueing system, the arrival random number numbers 89,16,99,09,39 and service random numbers 23,06,87,92,55 with the following probabilities distributions of the interarrival and service times. System start 1:00 PM

Inter-arrival time (Min)	Prob	Service time (Min)	Prob.
15	0.10	10	0.25
10	0.20	10	0.20
3	0.27	5	0.35
8	0.13	8	0.20
2	0.30	10	

a. Find the mean number of customers waiting in queue
b. Find the mean time that a customer has to wait in queue
c. Find the mean time that the server remains idle
d. Find the mean inter-arrival time
e. Find the mean service time of a customer that he/she receives
f. Find mean time that a customer has to spent from arrival to departure
g. Find the percentage of time during which server remains busy

SECTION "D"

[5 Q. × 6 = 30 marks]

4. Find two optimal solutions by using Simplex method of the following linear programming problem:

$Maximize\ Z = 2x_1 + 3x_2$ subject to the constraints [1+5]

$$6x_1 + 9x_2 \leq 10\,; x_1 + 2x_2 \leq 5\,;\ x_1, x_2 \geq 0$$

OR

Find optimal solution of the following linear programming problem by using Big-M method:

$Minimize\ Z = 10x_1 - 3x_2$ subject to

$$3x_1 - 5x_2 - x_3 \geq 3;\ 2x_1 - 3x_2 + x_3 \geq 2\,;\ x_1, x_2, x_3 \geq 0$$

5. A project work consists of four major jobs for which an equal number of contractors have submitted tenders. The tender amount quotes (in lakh of rupees) are given in the matrix [4+2]

Contractors	Jobs			
	A	B	C	D
P	10	24	30	15
Q	16	22	28	12
R	12	20	32	10
S	9	26	34	16

a. Find the optimal assignment of contractors to the jobs that will result to the minimum total cost
b. Find total cost.

6. A plan consisting of the following tasks [2+2+2]

Activity	Immediate predecessors	t_0	t_m	t_p
A	---	5	6	7
B	---	8	12	16
C	A	7	8	9
D	B	1	3	5
E	D, A	2	3	4
F	B	4	5	6
G	C, E, F	10	14	18
H	G	18	20	34

a. Draw the network diagram
b. Find critical path and expected time to complete the project
c. What is the probability that the project can be completed in 50 days

7. Three factories F_1, F_2, F_3 in the country produces the Mountain-bikes and supplies to dealers A, B, C, D the demand, supply quantities and profit per unit bike have been given in the table below then find the net return of the company.

	A	B	C	D	Capacity
F_1	25	17	25	14	300
F_2	15	10	18	24	500
F_3	16	20	8	13	600
Demand	300	300	500	500	

8. The manager of an oil refinery must decide on the optimal mix of two possible blending processes of which the inputs and outputs per production run are as follows:

Process (Units)	Input (Units)		Output units	
	Grade A	Grade B	Gasoline X	Gasoline Y
1	5	3	5	8
2	4	5	4	4

The maximum amounts available of crudes A and B are 200 units and 150 units, respectively. Market requirements show that at least 100 units of gasoline X and 80 units of gasoline Y must be produced. The profits per production run for process 1 and process 2 are Rs.300 and Rs.400 respectively.

a. Formulate this problem as linear programing problem.
b. Find by graphical method how many units production run can be made so as to maximize the profit?

SECTION "E"

[2 Q. × 2 = 4 marks]

9. Give Four applications of queueing model in the study of computer engineering

10. Discuss Floating

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Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.50000	0.50399	0.50798	0.51197	0.51595	0.51994	0.52392	0.52790	0.53188	0.5358
0.1	0.53983	0.54380	0.54776	0.55172	0.55567	0.55962	0.56356	0.56749	0.57142	0.5753
0.2	0.57926	0.58317	0.58706	0.59095	0.59483	0.59871	0.60257	0.60642	0.61026	0.6140
0.3	0.61791	0.62172	0.62552	0.62930	0.63307	0.63683	0.64058	0.64431	0.64803	0.6517
0.4	0.65542	0.65910	0.66276	0.66640	0.67003	0.67364	0.67724	0.68082	0.68439	0.6879
0.5	0.69146	0.69497	0.69847	0.70194	0.70540	0.70884	0.71226	0.71566	0.71904	0.7224
0.6	0.72575	0.72907	0.73237	0.73565	0.73891	0.74215	0.74537	0.74857	0.75175	0.7549
0.7	0.75804	0.76115	0.76424	0.76730	0.77035	0.77337	0.77637	0.77935	0.78230	0.7852
0.8	0.78814	0.79103	0.79389	0.79673	0.79955	0.80234	0.80511	0.80785	0.81057	0.8132
0.9	0.81594	0.81859	0.82121	0.82381	0.82639	0.82894	0.83147	0.83398	0.83646	0.8389
1.0	0.84134	0.84375	0.84614	0.84849	0.85083	0.85314	0.85543	0.85769	0.85993	0.8621
1.1	0.86433	0.86650	0.86864	0.87076	0.87286	0.87493	0.87698	0.87900	0.88100	0.8829
1.2	0.88493	0.88686	0.88877	0.89065	0.89251	0.89435	0.89617	0.89796	0.89973	0.9014
1.3	0.90320	0.90490	0.90658	0.90824	0.90988	0.91149	0.91309	0.91466	0.91621	0.9177
1.4	0.91924	0.92073	0.92220	0.92364	0.92507	0.92647	0.92785	0.92922	0.93056	0.9318
1.5	0.93319	0.93448	0.93574	0.93699	0.93822	0.93943	0.94062	0.94179	0.94295	0.9440
1.6	0.94520	0.94630	0.94738	0.94845	0.94950	0.95053	0.95154	0.95254	0.95352	0.9544
1.7	0.95543	0.95637	0.95728	0.95818	0.95907	0.95994	0.96080	0.96164	0.96246	0.9632
1.8	0.96407	0.96485	0.96562	0.96638	0.96712	0.96784	0.96856	0.96926	0.96995	0.9706
1.9	0.97128	0.97193	0.97257	0.97320	0.97381	0.97441	0.97500	0.97558	0.97615	0.9767
2.0	0.97725	0.97778	0.97831	0.97882	0.97932	0.97982	0.98030	0.98077	0.98124	0.9816
2.1	0.98214	0.98257	0.98300	0.98341	0.98382	0.98422	0.98461	0.98500	0.98537	0.9857
2.2	0.98610	0.98645	0.98679	0.98713	0.98745	0.98778	0.98809	0.98840	0.98870	0.9889
2.3	0.98928	0.98956	0.98983	0.99010	0.99036	0.99061	0.99086	0.99111	0.99134	0.9915
2.4	0.99180	0.99202	0.99224	0.99245	0.99266	0.99286	0.99305	0.99324	0.99343	0.9936
2.5	0.99379	0.99396	0.99413	0.99430	0.99446	0.99461	0.99477	0.99492	0.99506	0.9952
2.6	0.99534	0.99547	0.99560	0.99573	0.99585	0.99598	0.99609	0.99621	0.99632	0.9964
2.7	0.99653	0.99664	0.99674	0.99683	0.99693	0.99702	0.99711	0.99720	0.99728	0.9973
2.8	0.99744	0.99752	0.99760	0.99767	0.99774	0.99781	0.99788	0.99795	0.99801	0.9980
2.9	0.99813	0.99819	0.99825	0.99831	0.99836	0.99841	0.99846	0.99851	0.99856	0.9986
3.0	0.99865	0.99869	0.99874	0.99878	0.99882	0.99886	0.99889	0.99893	0.99896	0.9990
3.1	0.99903	0.99906	0.99910	0.99913	0.99916	0.99918	0.99921	0.99924	0.99926	0.9992
3.2	0.99931	0.99934	0.99936	0.99938	0.99940	0.99942	0.99944	0.99946	0.99948	0.9995
3.3	0.99952	0.99953	0.99955	0.99957	0.99958	0.99960	0.99961	0.99962	0.99964	0.9996
3.4	0.99966	0.99968	0.99969	0.99970	0.99971	0.99972	0.99973	0.99974	0.99975	0.9997
3.5	0.99977	0.99978	0.99978	0.99979	0.99980	0.99981	0.99981	0.99982	0.99983	0.9998
3.6	0.99984	0.99985	0.99985	0.99986	0.99986	0.99987	0.99987	0.99988	0.99988	0.9998
3.7	0.99989	0.99990	0.99990	0.99990	0.99991	0.99991	0.99992	0.99992	0.99992	0.9999
3.8	0.99993	0.99993	0.99993	0.99994	0.99994	0.99994	0.99994	0.99995	0.99995	0.9999
3.9	0.99995	0.99995	0.99996	0.99996	0.99996	0.99996	0.99996	0.99996	0.99997	0.9999

Negative Z-Score Table

Z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.9	0.00005	0.00005	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00003	0.00003
-3.8	0.00007	0.00007	0.00007	0.00006	0.00006	0.00006	0.00006	0.00005	0.00005	0.00005
-3.7	0.00011	0.00010	0.00010	0.00010	0.00009	0.00009	0.00008	0.00008	0.00008	0.00008
-3.6	0.00016	0.00015	0.00015	0.00014	0.00014	0.00013	0.00013	0.00012	0.00012	0.00011
-3.5	0.00023	0.00022	0.00022	0.00021	0.00020	0.00019	0.00019	0.00018	0.00017	0.00017
-3.4	0.00034	0.00032	0.00031	0.00030	0.00029	0.00028	0.00027	0.00026	0.00025	0.00024
-3.3	0.00048	0.00047	0.00045	0.00043	0.00042	0.00040	0.00039	0.00038	0.00036	0.00035
-3.2	0.00069	0.00066	0.00064	0.00062	0.00060	0.00058	0.00056	0.00054	0.00052	0.00050
-3.1	0.00097	0.00094	0.00090	0.00087	0.00084	0.00082	0.00079	0.00076	0.00074	0.00071
-3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00104	0.00100
-2.9	0.00187	0.00181	0.00175	0.00169	0.00164	0.00159	0.00154	0.00149	0.00144	0.00139
-2.8	0.00256	0.00248	0.00240	0.00233	0.00226	0.00219	0.00212	0.00205	0.00199	0.00193
-2.7	0.00347	0.00336	0.00326	0.00317	0.00307	0.00298	0.00289	0.00280	0.00272	0.00264
-2.6	0.00466	0.00453	0.00440	0.00427	0.00415	0.00402	0.00391	0.00379	0.00368	0.00357
-2.5	0.00621	0.00604	0.00587	0.00570	0.00554	0.00539	0.00523	0.00508	0.00494	0.00480
-2.4	0.00820	0.00798	0.00776	0.00755	0.00734	0.00714	0.00695	0.00676	0.00657	0.00639
-2.3	0.01072	0.01044	0.01017	0.00990	0.00964	0.00939	0.00914	0.00889	0.00866	0.00842
-2.2	0.01390	0.01355	0.01321	0.01287	0.01255	0.01222	0.01191	0.01160	0.01130	0.01101
-2.1	0.01786	0.01743	0.01700	0.01659	0.01618	0.01578	0.01539	0.01500	0.01463	0.01426
-2.0	0.02275	0.02222	0.02169	0.02118	0.02068	0.02018	0.01970	0.01923	0.01876	0.01831
-1.9	0.02872	0.02807	0.02743	0.02680	0.02619	0.02559	0.02500	0.02442	0.02385	0.02330
-1.8	0.03593	0.03515	0.03438	0.03362	0.03288	0.03216	0.03144	0.03074	0.03005	0.02938
-1.7	0.04457	0.04363	0.04272	0.04182	0.04093	0.04006	0.03920	0.03836	0.03754	0.03673
-1.6	0.05480	0.05370	0.05262	0.05155	0.05050	0.04947	0.04846	0.04746	0.04648	0.04551
-1.5	0.06681	0.06552	0.06426	0.06301	0.06178	0.06057	0.05938	0.05821	0.05705	0.05592
-1.4	0.08076	0.07927	0.07780	0.07636	0.07493	0.07353	0.07215	0.07078	0.06944	0.06811
-1.3	0.09680	0.09510	0.09342	0.09176	0.09012	0.08851	0.08691	0.08534	0.08379	0.08226
-1.2	0.11507	0.11314	0.11123	0.10935	0.10749	0.10565	0.10383	0.10204	0.10027	0.09853
-1.1	0.13567	0.13350	0.13136	0.12924	0.12714	0.12507	0.12302	0.12100	0.11900	0.11702
-1.0	0.15866	0.15625	0.15386	0.15151	0.14917	0.14686	0.14457	0.14231	0.14007	0.13786
-0.9	0.18406	0.18141	0.17879	0.17619	0.17361	0.17106	0.16853	0.16602	0.16354	0.16109
-0.8	0.21186	0.20897	0.20611	0.20327	0.20045	0.19766	0.19489	0.19215	0.18943	0.18673
-0.7	0.24196	0.23885	0.23576	0.23270	0.22965	0.22663	0.22363	0.22065	0.21770	0.21476
-0.6	0.27425	0.27093	0.26763	0.26435	0.26109	0.25785	0.25463	0.25143	0.24825	0.24510
-0.5	0.30854	0.30503	0.30153	0.29806	0.29460	0.29116	0.28774	0.28434	0.28096	0.27760
-0.4	0.34458	0.34090	0.33724	0.33360	0.32997	0.32636	0.32276	0.31918	0.31561	0.31207
-0.3	0.38209	0.37828	0.37448	0.37070	0.36693	0.36317	0.35942	0.35569	0.35197	0.34827
-0.2	0.42074	0.41683	0.41294	0.40905	0.40517	0.40129	0.39743	0.39358	0.38974	0.38591
-0.1	0.46017	0.45620	0.45224	0.44828	0.44433	0.44038	0.43644	0.43251	0.42858	0.42465
0.0	0.50000	0.49601	0.49202	0.48803	0.48405	0.48006	0.47608	0.47210	0.46812	0.46414