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KIRIRI WOMEN'S UNIVERSITY OF SCIENCE AND TECHNOLOGY
UNIVERSITY EXAMINATION, 2024/2025 ACADEMIC YEAR
THIRD YEAR, FIRST SEMESTER EXAMINATION
FOR THE BACHELOR OF BUSINESS AND INFORMATION TECHNOLOGY
KMA 2304 – MATHEMATICAL METHODS FOR MANAGERIAL DECISIONS

Date: 09TH December 2024
Time: 8:30AM – 10:30AM

INSTRUCTIONS TO CANDIDATES
ANSWER QUESTION ONE (COMPULSORY) AND ANY OTHER TWO QUESTIONS

QUESTION ONE (30 MARKS)

a) State and explain **four** factors that contribute to the increasing importance of quantitative approach to management decisions. (4 Marks)

b) Given the following weighted voting systems, classify each voter as a dictator, one with veto power, a dummy, or none of these.
   i) $[q: W_A, W_B, W_C] = [45: 46,42,2]$. (2 Marks)
   ii) $[q: W_A, W_B, W_C W_D] = [35: 26,16,10,4]$. (2 Marks)
   iii) $[q: W_A, W_B, W_C] = [23: 10,15,12]$. (2 Marks)

c) State **four** decision environments a manage may encounter in making a decision. (4 Marks)

d) Determine which **quantitative techniques** do the following characteristics relate to:
   i) This technique reduces waiting periods and the expenses they involve. (1 Mark)
   ii) The aim of this technique is to basically reduce wastage of time, energy and money in complex activities. (1 Mark)
   iii) This technique relies on probabilities instead of exact and accurate outcomes. (1 Mark)
   iv) Managers generally use this technique in situations of business rivalries or conflicts. (1 Mark)
   v) This technique basically helps in maximizing an objective under limited resources. (1 Mark)

e) Clearly explain the **seven** steps of Decision Making process. (3 Marks)

f) The mean duration of a construction project is 40 weeks, with a variance of 14.58 weeks.
   i) What is the probability that project will take 50 weeks to complete. (4 Marks)
   ii) What is the expected duration to complete 50% of the project. (4 Marks)

QUESTION TWO (20 MARKS)

An agricultural company wants to decide which commodity should stock to get maximum profit. It was supplied with the following information. The probability that the rains will be excess, normal and deficient is 0.40,0.30 and 0.30. The estimated profit or loss for the three commodities in respect of these different kinds of rain scenarios are as follows:

Profit per 1 ton			
Rains	**Excess**	**Normal**	**Deficient**
Rice	10,000	-4,000	15,000
Wheat	4,000	-3,000	8,000
Maize	4,000	1000	-1000

a) Determine the optimal decision under the following decision criteria
   i) Maximax. (3 Marks)

ii) Maximin. (3 Marks)
iii) Minimax. (3 Marks)
iv) Laplace. (3 Marks)
v) Hurwitz (α=0.8). (3 Marks)

b) The probability that the rains will be excess, normal and deficient are 0.2, 0.5 and 0.3 respectively. Find the expected profit for each commodity. (5 Marks)

QUESTION THREE (20 MARKS)

a) i) State the advantages and disadvantages of Linear Programming in decision making. (4 Marks)

ii) State three major steps in Linear Programing. (3 Marks)

iii) A factory manufactures two products A and B. To manufacture one unit of A, 1.5 machine hours and 2.5 labour hours are required. To manufacture product B, 2.5 machine hours and 1.5 labour hours are required. In a month, 300 machine hours and 240 labour hours are available.

Profit per unit for A is Ksh 75 and for B is Ksh 60.

Products	Resource/unit	
	Machine	Labour
A	1.5	2.5
B	2.5	1.5
Availability	300	240

Formulate as LPP using the following criteria:

i) Key decision. (2 Marks)
ii) Decision variables. (2 Marks)
iii) Objective function. (2 Marks)
iv) Constraints. (2 Marks)

b) State explain the importance of computer based decision in decision making. (5 Marks)

QUESTION FOUR (20 MARKS)

a) State the **steps** used in Monte Carlo simulation technique. (4 Marks)

b) A company manufactures two units of a certain product. Depending on availability of raw materials and other conditions, the daily production has been varying from 196 to 204 units and the probability distribution of production is given below:

Production	196	197	198	199	200	201	202	203	204
Probability	0.05	0.09	0.12	0.14	0.20	0.15	0.11	0.08	0.06

Consider the following sequence of random numbers (82, 89,78,24,53,61,18,45,04)

i) Simulate the units' production. (4 Marks)
ii) calculate the average demand per day. (4 Marks)

c) Voting is a game of determining the winner according to some defined rules. A company's advertising team is voting on five different advertising slogans called A, B, C, D, and E. The winning slogan must attain more than 50% of all casted votes. The votes were recorded as follows.

Use

i) Plurality with elimination method. (4 Marks)
ii) Pairwise Comparison Method to decide on the winning slogan. (4 Marks)

	3	4	4	6	2	1
1st choice	B	C	B	D	B	E
2nd choice	C	A	D	C	E	A
3rd choice	A	D	C	A	A	D
4th choice	D	B	A	E	C	B
5th choice	E	E	E	B	D	C

QUESTION FIVE (20 MARKS)

a) Network analysis is a critical technique in project management and decision making.

i) PERT/CPM contains two major components. With the help of a diagram, clearly explain the two components. (4 Marks)

ii) Draw a network for a house construction project and identify the critical path. The sequence of activities is given below.

Name of activity	Starting and finishing event	Description of activity	Predecessor	Time duration in days (days)
A	(1,2)	Prepare the house plan	---------	4
B	(2,3)	Construct the house	A	58
C	(3,4)	Fix doors/windows	B	2
D	(3,5)	Wiring	B	2
E	(4,6)	Paint the house	C	1
F	(5,6)	Polish doors/windows	D	1

(6 Marks)

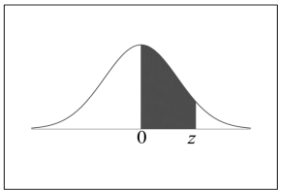
b) The following is the project data for a certain project.

Activity	1-2	1-3	2-4	3-5	4-6	5-6	5-7	6-8	7-8	8-9	9-10
Optimistic time	6	2	6	4	2	4	5	1	2	2	2
Most likely time	9	4	8	7	3	7	9	2	3	4	3
Pessimistic time	15	8	10	12	6	9	11	4	5	5	5

i) Draw a network diagram and identify the critical path. (5 Marks)

ii) Find the probability of completing the work in 33 weeks. (5 Marks)

Standard Normal Distribution Table



z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0753
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.2019	.2054	.2088	.2123	.2157	.2190	.2224
0.6	.2257	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2517	.2549
0.7	.2580	.2611	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2995	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998