The Management University of Africa

MUA

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UNDERGRADUATE UNIVERSITY EXAMINATIONS

SCHOOL OF MANAGEMENT AND LEADERSHIP

DEGREE OF BACHELOR OF COMMERCE

BCM 222 : BUSINESS STATISTICS

DATE: 4TH APRIL 2025

DURATION: 2 HOURS

MAXIMUM MARKS: 70

INSTRUCTIONS:

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **SIX (6)** questions.
4. Question **ONE** is compulsory.
5. Answer any other **THREE** questions.
6. Question **ONE** carries **25 MARKS** and the rest carry **15 MARKS** each.
7. **Write all your answers in the Examination answer booklet provided.**

QUESTION ONE

a) Consider the pay off table which shows the results from the play of a game involving two competing companies; OliMax and SharoMax Company. The results per combination of a strategy applied by the companies are as shown below:

OliMax Company	SharoMax Company	
	Y1	Y2
X1	7	5
X2	3	12
X3	1	4

From the information given, advice each of the company on the optimum strategies to apply and the value of the game **(7 Marks)**

b) Haco Soap Manufacturing company makes Dove and Cerave brand in a factory that has two working area, mixing and shaping. The mixing area that requires five man-days on a Dove and four man-days on Cerave whereas Shaping area requires three man-days for a Dove and two man-days for a Cerave. Because of men and machine constraints, Mixing area has 1200 man-days per week available while Shaping area has 1800 man-days per week. The manufacturer incurs a cost of Ksh. 10,250 per Dove and KSh. 7,800 per Cerave.

Required:

i. Formulate a linear programming model **(4 Marks)**

ii. Obtain a dual program from the primal program **(4 Marks)**

c) Moran Car dealers' source for new cars from Japan and German with a capacity to supply 120 and 140 cars respectively per annum. Moran company sells their cars through four different car yards located in different towns across the Country. The distributing car yard has a demand of 80, 60, 75 and 50 respectively. Unit transportation costs between locations for source and destinations are as follows:

	DESTINATIONS			
SOURCES	Kisumu	Nairobi	Mombasa	Eldoret
Japan	41	13	17	26
German	10	14	15	25

Find the minimum cost schedule using Vogel's Approximation Method **(5 Marks)**

d) Giving examples in each case, differentiate between an activity and an event as used in the network analysis **(2 Marks)**

e) Explain any three decision making environments that a business leader is likely to face **(3 Marks)**

QUESTION TWO

a) At Isinya Juniour secondary school students' fees is collected by an Accountant who issue the receipt to students at a desk and then later take them to finance office which is at present staffed by one Bursar. The head teacher is concerned about the time spent by the accountant collecting fees from students and has recommended the employment of an intern accountant to assist the accountant. The information available is that at the finance office, a simple queue exists; The processing of fees cost Sh. 250 per hour; The accountant charges Sh. 200 per hour and can deal on average with 10 students per hour; Intern accountant could be employed at Sh. 175 per hour and the capacity of the fee collection wound be 12 per hour in terms of service and on average 8 students visit the desk each hour.

Required:

i. What percentage of the time is the accountant is idle before an intern accountant is employed? **(4 Marks)**

ii. How much time does a student spend in the desk after the intern is employed? **(2 Marks)**

iii. Determine whether it is worthwhile employing the intern accountant **(4 Marks)**

b) State three assumptions and two assumptions of Transportation models and game theory respectively **(5 Marks)**

QUESTION THREE

A construction project consists of 10 key activities which need to be completed as scheduled and within the estimated time in order for the project to be successful. The table below summarises the information:

Activity	Immediate predecessor	Duration (Weeks)		
		Optimistic time (0)	Most likely time (M)	Pessimistic time (P)
A	None	8	12	14
B	A	2	4	5
C	A	18	20	25
D	B	19	20	24
E	B	6	8	10
F	B	7	8	12
G	D,E	6	8	9
H	C	8	8	8
I	F,G,H	10	12	14
J	I	2	4	6

Based on the information above:

a) Present the above information in a network diagram **(4 Marks)**

b) Find critical activities and project completion time **(6 Marks)**

c) Find the probability of finishing the project within 61 weeks **(5 Marks)**

QUESTION FOUR

A company is considering investing in money market which can be classified as T-Bills, Certificates of Deposit, Repos and Commercial papers. The market conditions may be favorable, Indifference or unfavorable. The payoff matrix for this situation is as shown below:

Investment Opportunities	**MARKET CONDITIONS**		
	Favorable	**Indifference**	**Unfavorable**
T-Bills	5000	7000	3000
Certificates of Deposit	2000	10000	6000
Repos	4000	4000	4000
Commercial paper	1000	6000	5000

Determine the best investment opportunity using the following criteria

i. Maximin **(4 Marks)**
ii. Maximax **(3 Marks)**
iii. Minimax **(3 Marks)**
iv. Hurwicz (Alpha = 0.3) **(5 Marks)**

QUESTION FIVE

a) Assume that an economy has three different sectors: Agriculture, construction and education sectors. The three sectors are related to each other such that the production of one can be consumed by other sectors or consumed by itself of by final consumer. The data which shows their relationship in this respect is as shown below:

Inputs-output Coefficients			
Production	**Consumption**		
	Agriculture	**Construction**	**Education**
Agriculture	0.3	0.4	0.2
Construction	0.2	0.2	0.5
Education	0.1	0.3	0.1

The projected forecast demand for the three sectors is 100, 40 and 50 million shillings (the coefficients matrix is given in terms of money). Determine what gross outputs of the three sectors will meet the anticipated demand **(12 Marks)**

b) Givig clear examples, differentiate between Dominance principle and Saddle point **(3 Marks)**

QUESTION SIX

a) A new company has been set up in Nairobi and has hired four difference sales officers to distribute products into different locations across the Country. The sales recorded after some period of time is as indicated in the table below:

SALES OFFICERS	**REGIONS**				
	Eldoret	**Kajiado**	**Wajir**	**Kilifi**	**Mombasa**
Keffa	92	90	94	91	83
Nina	84	88	96	82	81
Tina	90	90	93	86	93
Zane	78	94	89	84	88

Required:

Assign the sales officers to regions in order to maximize the total ratings. Determine the total ratings **(10 Marks)**

b) Explain the following concepts as used in linear programming

i. Unique solution **(1 Mark)**

ii. Optimal solution **(1 Mark)**

iii. Infeasible region **(1 Mark)**

iv. Feasible region **(1 Mark)**

v. Basic solution **(1 Mark)**

BCM 222: BUSINESS STATISTICS – FORMULAS

$P = \frac{\lambda}{\mu}$ $\quad N_q = \frac{\lambda^2}{\mu(\mu-\lambda)}$ $\quad N_s = \frac{\lambda}{(\mu-\lambda)}$

$T_q = \frac{\lambda}{\mu(\mu-\lambda)}$ $\quad T_S = \frac{1}{(\mu-\lambda)}$

Activity variance $= \left[\frac{p-o}{6}\right]^2$

Expected Time $= \frac{O+4M+P}{6}$

Activity Standard Deviation $= \frac{P-O}{6}$

$Z = \frac{(x-Mean)}{project\ standard\ deviation}$

Input-Output Model, $X = (I_n - M)^{-1} \times d$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$