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CHRISTIAN SERVICE UNIVERSITY COLLEGE
KUMASI, GHANA
CSUC SCHOOL OF BUSINESS
DEPARTMENT OF ACCOUNTING AND FINANCE
MSC ACCOUNTING AND FINANCE
END OF FIRST SEMESTER EXAMINATIONS – 2021/22 ACADEMIC YEAR
LEVEL 500

MCSB 509: QUANTITATIVE METHODS

APRIL, 2022

100 MARKS

TIME ALLOWED: 3 HOURS

GENERAL INSTRUCTIONS TO CANDIDATES:

- Answer **any four** questions
- All questions carry equal marks of 25 each.
- Write your index number on top of the question paper and every page of the answer booklet used.

Examiner: Joyce Ama Quartey

Question 1

a. Foster Company Ltd., manufacturers of iron rods has factories producing iron rods in ten African countries. The personnel department of the company has records which show the following analysis of its 240 managers.

Age	Bachelor's Degree Only	Master's Degree	PhD	Total
Under 30	90	10	-	100
30 to 40	20	30	10	60
Over 40	<u>40</u>	<u>20</u>	<u>20</u>	<u>80</u>
Total	150	60	30	240

Required:

If one manager is selected at random from the company, find:

- (i) The probability that he has only a bachelor's degree. **2 marks**
- (ii) The probability that he has a master's degree, given that he is over 40. **3 marks**
- (iii) The probability that he has only a PhD degree. **2 marks**
- (iv) The probability that he is under 30, given that he has only a bachelor's degree. **3 marks**

b. A consignment of machine parts is offered to two firms, A and B, for GHC75,000. The following table shows the probabilities at which firms A and B will be able to sell the consignment at different prices.

Prices (in GHC) at which the Consignment can be sold	Probability	
	Firm A	Firm B
60,000	0.40	0.10
70,000	0.30	0.20
80,000	0.20	0.50
90,000	0.10	0.20

Which firm A or B will be more inclined towards the offer? **11 marks**

c). The usefulness of linear programming, as a tool for optimal decision-making on resource allocation, is based on its applicability to many diversified decision problems. Briefly explain two benefits of the LP model. **2 points explain will earn a maximum of 2 marks each.**

[Total = 25 marks]

Question 2

Floral Company produces pens of different kinds. Three machines, namely machine X, Y, Z produce the pens. A factory produces certain types of output by three machines. The daily

production quantities are: Machine X = 3500 units; Machine Y = 2000 units; and Machine C = 4500 units. Past records shows that 1 percent of the output produced by machine X is defective. The corresponding fractions of defectives for the other two machines are 1.2 and 2 percent respectively.

Required:

An item is drawn at random from the day’s production and is found to be defective. What is the probability that it comes from the output of (a) Machine X; (b) Machine Z? **10 marks**

b. A survey on Ghanaian Social Attitudes asked respondents if they had ever boycotted goods for ethical reasons. The survey found that 23% of the respondents have boycotted goods for ethical reasons.

Required:

- i. In a sample of six Ghanaian citizens, what is the probability that two have ever boycotted goods for ethical reasons? **4 marks**
- ii. In a sample of six Ghanaian citizens, what is the probability that at least two respondents have boycotted goods for ethical reasons? **7 marks**
- iii. In a sample of ten Ghanaian citizens, what is the probability that none have boycotted goods for ethical reasons? **4 marks**

[Totals = 25 marks]

Question 3

Mensah’s Bike shop is considering three options for his facility next year. He can expand his current shop, move to a larger facility or make no change. Mensah’s payoff table is given below.

Decision Alternatives	States of Nature (Market condition)		
	Favourable	Average	Unfavourable
Expand	GHC56,000	GHC21,000	-GHC29,000
Move	GHC70,000	GHC35,000	-GHC45,000
No Change	GHC30,000	GHC10,000	GHC5,000

Required:

- a). Which option should Mensah choose if he uses the persimistic (maximim) approach? **5 marks**
- b). What is the recommended decision using the minimax regret approach? **6 marks**
- c). If the probability of a favourable market is 25%, the probability of an average market is 45% and that of an unfavourable market is 30%. Using EMV, what option should Mensah choose and what is that optional expected value? **6 marks**
- d). Compute the expected value of perfect information (EVPI). Do you think it would be worth trying to obtain additional information concerning which scenario is likely to occur? **8 marks**

[Total = 25 marks]

Question 4

Shamah, Inc, is a small firm that produces a variety of chemical-based products. In a particular production process, three raw materials are used to produce two products: a fuel additive and a solvent base. The fuel additive is sold to oil companies and is used in the production of gasoline and related fuels. The solvent base is sold to a variety of chemical firms and is used in both home and industrial cleaning products. The three raw materials are blended to form the fuel additive and solvent base as indicated in the table below, which shows that a ton of fuel additive is a mixture of 0.4 tons of material 1 and 0.6 tons of material 3. A ton of solvent base is a mixture of 0.5 tons of material 1, 0.2 tons of material 2, and 0.3 tons of material 3.

Material	Product	
	Fuel Additive	Solvent Additive
Material 1	0.4	0.5
Material 2		0.2
Material 3	0.6	0.3

Shamah's production is constrained by a limited availability of the three raw materials. Material 1 has a limited amount of 20 tons available for production, material 2 has only 5 tons available for production, while material 3 has 21 tons available for production. The accounting department analyzed the production figures, assigned all relevant costs, and arrived at prices for both products that will result in a profit contribution of \$40 for every ton of fuel additive produced and \$30 for every ton of solvent base produced.

Required:

- (a) Formulate a linear programming model to determine the number of tons of fuel additive and the number of tons of solvent base to produce in order to maximize total profit contribution. **15 marks**
- (b) Solve the above problem using the graphical method. **10 marks**

[Total = 25 marks]

Question 5

Advertisement and sales are two important elements which are vital for the growth of an organization. Lakamuun incorporated is a company that specializes in the production of chromocoat papers. The weekly expenditure on adverts (x) and the weekly sales (y) are presented in the table below.

<i>Weekly sales (GH¢)</i>	<i>Weekly adverts (GH¢)</i>
5000	350
6000	413
3500	230
8000	631

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4500	285
6000	321
7000	431
8500	461
8100	313
8100	303

Required

(a) Compute

i. Covariance

8marks

ii. Coefficient of correlation

6marks

iii. Interpret your findings

1marks

(b) Estimate the least square line using least square method $\hat{y} = b_0 + b_1x$

5marks

(c) Using the regression line above estimate the following

(i) Weekly sales if an expenditure of GH¢2150 is spent on adverts.

2marks

(ii) How much should be spent on adverts if GH¢64500 was generated as sales.

2marks

(d) Base on the above estimations in C above, what recommendations would you make to Lakamuun Inc.

1mark

[Total = 25 marks]

Question 6

The data below consists of the demand values for the last 12 months of electrical gadgets of Lakamuun Inc. and their available future forecasts.

Month	Demand
January	240
February	251
March	304
April	284
May	352
June	300
July	241
August	284
September	312
October	289
November	385
December	256

Required

- i. Using exponential smoothing forecasting with an $\alpha = 0.2$ and a forecast of 270 for January, complete the table below and use it to calculate the **Mean Squared Error**

(t)	(Yt)	(Ft)	(Yt-Ft)	(Yt - Ft) ²
1	240	270		
2	251			
3	304			
4	284			
5	352			
6	300			
7	241			
8	284			
9	312			
10	289			
11	385			
12	256			

10 marks

Note Yt is Actual demand and Ft is forecast

- ii. Using a four month moving average calculate the Mean Squared Error. 10 marks
- iii. Which of these two forecasting methods is accurate? Justify your answer 2marks

- iv. State three benefits of forecasting to business organizations 3 marks

[Total = 25 marks}

Question 7

Blankson and Sons Company deals in plastic products. The company is currently engaged in stocking poly tanks and it spends GH¢60 on each poly tank. Annual holding costs are 20 per cent of unit cost for Interest Charges, 2 percent for insurance, 2.5 percent of allowances for obsolescence, GH¢4 for building overheads, GH¢1.80 for damage and loss, and GH¢5.5 miscellaneous costs. The annual demand for the item is constant at 1,000 units. Placing each order costs the company GH¢110.

Required:

- i. Calculate *EOQ* and the total costs associated with stocking the item. 6 marks
- ii. If the supplier of the item will only deliver batches of 300 units, how are the stock holding costs affected? 6 marks
- iii. If the supplier relaxes his order size requirement, but the company has limited warehouse space and can stock a maximum of 150 units at any time, what would be the associated costs? 6 mark
- c). Inventory is an important investment which cannot be eliminated. Examine four reasons for carrying inventory. 8 marks

[Total = 25 marks)