The Management University of Africa

Sponsored by the Kenya Institute of Management

POST GRADUATE UNIVERSITY EXAMINATIONS

SCHOOL OF MANAGEMENT AND LEADERSHIP

DEGREE OF MASTER OF BUSINESS ADMINISTRATION/ DEGREE OF MANAGEMENT AND LEADERSHIP/ DEGREE OF MASTER OF ARTS IN DEVELOPMENT STUDIES

MBA 505/ MML 5102/MDE 517: SOCIAL STATISTICS/ QUANTITATIVE METHODS FOR BUSINESS / STATISTICAL DECISIONAL ANALYSIS

DATE: 3RD APRIL 2024

DURATION: 3 HOURS

MAXIMUM MARKS: 60

INSTRUCTIONS:

1. Write your registration number on the answer booklet.
2. **DO NOT** write on this question paper.
3. This paper contains **FOUR (4)** questions.
4. Question **ONE is compulsory.**
5. Answer any other **TWO** questions.
6. Question **ONE** carries **30 MARKS** and the rest carry **15 MARKS** each.
7. **Write all your answers in the Examination answer booklet provided**

QUESTION ONE

a) For each of the statements bellow, provide the description of the sentiments;

i. A researcher studies the factors that determine the number of children future couples decide to have. The variable 'number of children' is a _____ **(1 Mark)**

ii. In a 500m speed skating race, time results would be considered an example of which level of measurement _____ **(1 Mark)**

iii. IQ tests are standardized so that the mean score is 100 for the entire group of people who take the test. However, if you select a group of 50 who took the test, you probably would not get 100. What statistical concept explains the difference between the two means? _____ **(1 Mark)**

iv. A sports psychology was interested in the effects of a six-weeks imagery intervention on an athlete's ability to execute a sport-specific skills such as penalty taking in football. How might you define the imagery variable _____ **(1 Mark)**

v. A researcher is interested in the travel time or students from Kisaju market to the campus. A group of 50 students is interviewed. Their mean travel time was found to mean 15 minutes. For this study, the mean of 15 minutes is an example of _____ **(1 Mark)**

b) Two university examiners awarded the following marks in percentage on the research projects submitted for ten candidates:

CANDIDATES	A	B	C	D	E	F	G	H	I	J
Examiner 1	65	71	79	77	85	78	85	90	81	62
Examiner 2	65	74	82	64	87	78	61	65	79	69

Calculate the rank correlation coefficients. Interpret **(6 Marks)**

c) Explain giving examples four characteristics of a good estimator **(4 Marks)**

d) Suppose we are given the following data relating to the breakdown of a machine in a certain company during a given week, where x represents the number of breakdowns of the machine and $P(x)$ represents the probability value of x.

X	0	1	2	3	4
$P(x)$	0.12	0.20	0.25	0.30	0.13

Find the mean and the variance of the number of breakdowns per week for this machine **(6 Marks)**

e) Explain why Fisher's method of calculating index numbers is considered as ideal **(2 Marks)**

f) The manufacturer of a certain make of electric bulbs claims that his bulbs have a mean life of 25 months with a standard deviation of 5 months. Random samples of 6 such bulbs have the following value: Life of bulb in months: 24, 20, 30, 20, 20, 18. Can you regard the producer's claim to valid at 1% level of significance? **(4 Marks)**

g) When 16 cigarettes of a particular brand were tested in a laboratory for the amount of nicotine content, it was found that their mean content was 18.3 mg with S =1.8 mg. Set a 90 percent confidence interval for the mean nicotine content μ in the population of cigarettes of this brand. (Assume that the amount of nicotine in the cigarette is normally distributed). **(3 Marks)**

QUESTION TWO

a) The table below shows data on the profit earned by a travel company and the amount used in advertising for their company in millions of dollars, for each of six months.

Profit Earned	145	180	130	110	110	210	150	160
Advertising Expenditure	137	110	70	80	87	91	102	90

Required:

i. By identifying appropriate dependent and independent variables, find the least square regression line **(5 Marks)**

ii. Calculate the product moment correlation coefficient and the coefficient of determination. Interpret your answers **(2.5 Marks)**

iii. Test hypothesis that there is no relationship between number of tourism and the amount of money earned at 5% significant level **(2.5 Marks)**

b) Describe giving examples in each case, three probability methods of sampling **(3 Marks)**

c) Examine using an illustration the two conditions for a probability function **(2 Marks)**

QUESTION THREE

a) Suppose we have a formulated linear program model as:

Max, $Z = 2x_1 + 3x_2$

Subject to: $2x_1 + x_2 \leq 4$ .....R_1

$x_1 + 2x_2 \leq 5$ .....R_2

And $x_1, x_2 \geq 0$

Also suppose we are given optimal solution (after solving using simplex of graphical method) as: $x_1 = 1$ $x_2 = 2$ and $Z = 8$

Supposing the 1st constrain (R_1) increases by 20% and 2nd constrain (R_2) increases by 10%, perform the sensitivity analysis to find the new solution and check whether it is feasible solution. **(5 Marks)**

b) An automobile manufacturing firm is bringing out a new model. In order to map out its advertising campaign, it wants to determine whether the model appeal depends on age group or not. The firm takes a random sample from persons attending a preview of the new model and obtained the results summarized below:

PERSONS WHO	AGE GROUPS			
	Under 20	**20 – 40**	**40 – 50**	**50 and over**
Liked the car	146	78	48	28
Disliked the car	54	52	32	62

At the 5% level of significance, test whether the model appeal and age groups are related. **(6 Marks)**

c) Using the examples explain the following terms as used in decision models:

i. Dominance principal **(2 Marks)**

ii. Saddle point **(2 Marks)**

QUESTION FOUR

a) An insurance company claims that it takes 2 weeks (14 days) on average to process an auto accident claim. The standard deviation is 6 days. To test the validity of this claim, an investigator randomly selected 36 people who recently filed claims. This sample revealed that it took the company an average of 16 days to process these claims.

   i) At the 1% level of significance, check if it takes the company more than 14 days on an average to process a claim **(6 Marks)**

   ii) Construct a 99% confidence interval for the average number of days taken to process a claim. **(2 Marks)**

b) A measure of a single value within a range of data can represent all the values in the series should have generally acceptable properties. Discuss **(5 Mark)**

c) Giving examples in each case, explain the two main ways of grouping the data in a frequency table **(2 Marks)**

FORMULAS

Mean $= \frac{\sum X}{n}$

Mean, $= \frac{\Sigma FX}{\Sigma F}$

Z-Formula $= \frac{\text{Mean_Value}}{\text{standard deviation}}$

Mode $= L + \frac{F1}{F1+F2} \times i$ or Mode $= L + \left(\frac{D_1}{D_1+D_2}\right).c$

Median $= L + \frac{i}{F}(m - c)$ or Median $= L + \left(\frac{\frac{N}{2} - F_{m-1}}{f_m}\right).c$

Variance $= \frac{\Sigma F(X - \text{mean})^2}{\Sigma F}$ or Variance, $S^2 = \frac{\sum fx^2}{\sum f} - \bar{x}^2$

$S = \sqrt{\frac{\Sigma F(x - mean)^2}{\Sigma F}}$ or $S \sqrt{\frac{\sum fx^2}{\sum f} - \bar{x}^2}$

$CV = \frac{SD}{Mean} \times 100$

$SKp = 3 \times \frac{(\text{mean - median})}{\text{Standard deviation}}$

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

$\bar{X}_{12} = \frac{N_1\bar{X}_1 + N_2\bar{X}_2}{N_1 + N_2}$

$\delta_{12} = \sqrt{\frac{N_1\delta_1^2 + N_2\delta_2^2 + N_1d_1^2 + N_2d_2^2}{N_1 + N_2}}$

$\mu = x_1p(x_1) + x_2p(x_2) + \ldots x_np(x_n) = \sum_{i=1}^{n} x_ip(x_i)$

$Var(X) = \sum_{i=1}^{n}(x_i - \mu)^2.p(x_i)$

$\bar{x} - z_{\alpha/2}\frac{\delta}{\sqrt{n}} < \mu < \bar{x} + z_{\alpha/2}\frac{\delta}{\sqrt{n}}$

$\bar{x} - t_{n-1,\alpha/2}\frac{S}{\sqrt{n}} < \mu < \bar{x} + t_{n-1,\alpha/2}\frac{S}{\sqrt{n}}$

$Z = \frac{\bar{x} - \mu_0}{\delta/\sqrt{n}}$

$\chi^2 = \sum_{i=1}^{6}\frac{(O_i - E_i)^2}{E_i}$

$F = \frac{MSB}{MSW}$

$T = \frac{\bar{x} - \mu_0}{S/\sqrt{n}}$

$$\text{MSB} = \frac{\text{SSB}}{\text{k-1}} \qquad \text{MSW} = \frac{\text{SSW}}{n-k} \qquad \text{SSB} = \sum_{\text{j=1}}^{\text{k}} \frac{\text{T}_\text{j}^2}{\text{n}_\text{j}} - \frac{T^2}{N}$$

$$\text{SSW} = \sum_{j=1}^{k}\sum_{i=1}^{n_j} X_{ij}^2 - \sum_{j=1}^{k} \frac{T_j^2}{n_j} \qquad r = \frac{n\sum XY - \sum X \sum Y}{\sqrt{\left[n\sum X^2 - \left(\sum X\right)^2\right]\left[n\sum Y^2 - \left(\sum Y\right)^2\right]}}$$

$$r = 1 - \frac{6\sum d^2}{n\left(n^2-1\right)} \qquad r\sqrt{\frac{n-2}{1-r^2}}.$$

$$\hat{b} = \frac{n\sum XY - \sum X \sum Y}{n\sum X^2 - \left(\sum X\right)^2} \qquad \hat{a} = \frac{1}{n}\left(\sum Y - \hat{b}\sum X\right) \quad = \quad \bar{Y} - \hat{b}\bar{X}$$