



(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FOURTH YEAR SECOND SEMESTER

SPECIAL/ SUPPLEMENTARY EXAMINATION

FOR THE DEGREE OF BACHELOR OF SCIENCE

MATHEMATICS

COURSE CODE: STA 425/STA 423

COURSE TITLE: CATEGORICAL ANALYSIS

DATE: 25/11/2022

TIME: 8 AM -10 AM

INSTRUCTIONS TO CANDIDATES

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 4 Printed Pages. Please Turn Over.

QUESTION 1:

- (a) Describe three ways of measuring the strength of the relationship between categorical variables (9 mks)
- (b) In the following cases, distinguish response and explanatory variables.
- i) Attitude towards Abortion on demand (favour, oppose); Gender (Male, Female) (1mk)
 - ii) Heart disease (Yes, No); Cholesterol level (1mk)
 - iii) Race (white, non-white); Gender (male, female); Vote for president (ODM, JAP, Other); Income
 - iv) Hospital (A, B); Treatment (T₁, T₂); Patient outcome (survive, die)
- (c) The data in the Table below is of records of accidents in 2015 compiled by the ministry of Transport in the Republic of Kenya.

Safety equipment in use	Injury	
	Fatal	Non Fatal
None	1601	162,527
Seat Belt	510	412,368

Work out the number of

- (i) Concordant pairs (4 mks)
- (ii) Discordant pairs and hence, (4 mks)
- (iii) Obtain the value of gamma, $\hat{\gamma}$ (6 mks)

Comment on the association between the safety equipment in use and the nature of injury (2mks)

QUESTION 2:

The number of licensor companies classified by the proportion of foreign profits derived from Licence agreements were as follows:

Proportion of profit	Licensor Type		Total
	Dominant Product	Diversified	
Less than 5%	1	6	7
5% or more	7	6	13
Total	8	12	20

- (a) Formulate a hypothesis to investigate whether the proportion of profit is independent of the Licensor types (4 marks)
- (b) Test the hypotheses in (a) above at 5% level of significance, taking into consideration, Yate's correction factor (12 marks)
- (c) Comment on the relationship between proportion of profit and licence types (4 marks)

QUESTION 3:

Consider the following data on the job status of students working within a university. The students are categorized as freshmen or sophomores and were required to confirm whether they had a job or not.

	Job Status	
	No	Yes
Freshmen	25	12
Sophomores	11	14

- a) For Freshmen, obtain the odds favouring not having a job (3 marks)
- b) For Sophomores, obtain the odds favouring not having a job (3 marks)
- c) Calculate the odds ratio, $\hat{\theta}$ (5 marks)
- d) Use the fact that $\frac{\ln(\hat{\theta}) - 0}{SE[\ln(\hat{\theta})]}$ has a distribution that is approximately standard normal for large values of n to ascertain whether there is an evidence of a strong association between job status and class category (9 marks)

QUESTION 4:

The following Table gives the effect of Measles immunizing vaccination on 12 months Care and cohort infants.

	Suffered from Measles, (A)	Did not suffer from Measles, (a)	Total
Vaccinated, (B)	6 (AB)	56 (aB)	62 (B)
Not- Vaccinated, (b)	84 (Ab)	18 (ab)	102 (b)
Total	90 (A)	74 (a)	164 (N)

- (i) Is the above data consistent?
Hint: Use ultimate class frequencies to investigate this. (4 marks)
- (ii) Evaluate the coefficient of association Q between vaccination and the suffering of patients from measles (12 marks)
- (iii) Comment on the effect of vaccination in terms of its ability to control measles (4 marks)

QUESTION 5:

In a certain cohort study, it was noted that per year, the proportion who died from lung Cancer was 0.0014 for cigarette smokers and 0.0001 for non-smokers. The proportion who died from coronary heart disease was 0.00669 for smokers and 0.00413 for Non-smokers.

- (a) Describe the association of smoking with each of lung cancer and heart disease using the relative risk. Interpret (5 marks)
- (b) Describe the associations using the difference of proportions. Interpret. (5 marks)
- (c) Describe the associations using the odds ratio. Interpret (7 marks)
- (d) Which response is more strongly related to cigarette smoking in terms of the reduction in the number of deaths that would occur with elimination of cigarettes (3 marks)