



*(Knowledge for Development)*

**KIBABII UNIVERSITY**  
**UNIVERSITY EXAMINATIONS**  
**2019/2020 ACADEMIC YEAR**  
**FOURTH YEAR SECOND SEMESTER**  
**MAIN EXAMINATION**  
**FOR THE DEGREE OF BACHELOR OF SCIENCE**  
**(MATHEMATICS)**

**COURSE CODE: STA 452**

**COURSE TITLE: CATEGORICAL DATA ANALYSIS**

**DATE: 10/11/2020      TIME: 9 AM - 11 AM**

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**INSTRUCTIONS TO CANDIDATES**

Answer Question One and Any other TWO Questions

TIME: 2 Hours

This Paper Consists of 5 Printed Pages. Please Turn Over.

**QUESTION 1:**

A clinical trial was conducted to ascertain the use of aspirin to prevent heart attack. Approximately equal number of subjects were recruited into the study where 11,034 were assigned to a placebo and 11,037 were assigned to aspirin. The details of the study are as indicated in the table below.

Aspirin Use	Heart Attack	
	Yes	No
Placebo ( no aspirin used)	189	10,845
Aspirin	104	10,933

- (a) Obtain the sample odds of Heart attack for;
- (i) the placebo group ( 2 marks )
  - (ii) the Aspirin group ( 2 marks )
- (b) Calculate the odds ratio,  $\hat{\theta}$  and give an interpretation to your findings. State some three properties of the odds ratio. ( 8 marks )
- (c) Assuming the sampling distribution of  $\hat{\theta}$  to be close to normal, construct the confidence intervals for  $\ln \hat{\theta}$  and then exponentiate endpoints to get confidence intervals for  $\hat{\theta}$ . ( 12 marks )
- (d) Suppose the odds ratio were equal to one, what would that imply in terms of the dependence of Heart attack on Aspirin use? ( 3 marks )
- (e) List three ways we would use to measure the strength of association between categorical variables. ( 3 marks )

**QUESTION 2:**

- (a) Explain how you would use the Concordant and Discordant pairs to measure the Strength of Association between two Categorical variables ( 6 marks )
- (b) In a certain General Social Survey, the following data pertaining to job satisfaction and income was recorded

INCOME (Us \$)	JOB SATISFACTION			
	Very <u>dissatisfied</u>	Little <u>dissatisfied</u>	<u>Moderately satisfied</u>	<u>Very satisfied</u>
< 6	20	24	80	82
6 - 15	22	38	104	125
15 – 25	13	28	81	113
>25	7	18	54	92

Obtain,

- i) The total number of concordant pairs, C ( 3 marks )
- ii) The total number of Discordant pairs, D ( 3 marks )

From the values of C and D, comment on the status of income and job satisfaction ( 3 marks )

Calculate the value of gamma,  $\hat{\gamma}$  and use it to conclude about the nature of association between the categorical variables ( 5 marks )

### QUESTION 3:

A case-control study of oral contraceptives use and Heart attack was performed. 58 female heart attack victims were identified and each of these “cases” was matched to three “control” subjects of similar age, etc who had not suffered heart attacks. The data are recorded as below.

Contraceptive Use	Heart Attack	
	Yes	No
Yes	23	34
No	35	132

- (a) Estimate probabilities of contraceptive use given presence or absence of heart attack, hence obtain the odds ratio. Comment on the result so obtained. ( 9 marks )
- (b) Calculate the Relative risk of attack in this case. How does it compare to the odds ratio?



( 6 marks )

- (c) Use the chi-square test to verify that there is indeed an association between Contraceptives use and Heart attacks ( 5 marks )

**QUESTION 4:**

Opinion about promotions, too dependent on published work by persons interested in teaching or research was taken and displayed as below

<b>Interest</b>	<b>Promotion dependent on published work</b>		<b>Total</b>
	Agree	Disagree	
Teaching	90	10	100
Research	70	30	100
<b>Total</b>	160	40	200

- (a) Test the null hypothesis that promotion dependent on published work is independent of the field of interest at 5% level of significance. ( 10 marks )
- (b) Discuss the strength of association between promotion dependent on published work and ones field of interest at 1% level of significance ( 10 marks )

**QUESTION 5:**

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 )