



KENYATTA UNIVERSITY

UNIVERSITY EXAMINATIONS 2010/2011

INSTITUTIONAL BASED PROGRAMME (IBP) – AUGUST SESSION

EXAMINATION FOR THE DEGREE OF MASTER OF SCIENCE

SMA 674: CONTINGENCY TABLES ANALYSIS

DATE: MONDAY 2ND JANUARY 2012

TIME: 2.00 P.M – 5.00 P.M

INSTRUCTIONS: Answer Question ONE and any other TWO questions

QUESTION ONE (30 marks)

(a) What is a contingency table? (2 marks)

(b) What is an odds ratio? (2 marks)

(c) A cohort study to investigate the association between recent use of oral contraceptives and myocardial infarction gave the following results.

Recent oral contraceptive use	Myocardial infarction	Controls
Yes	29	135
No	205	1607

(i) Calculate the relative risk. (3 marks)

(ii) Calculate the 95% confidence interval for the relative risk and interpret

the results.

(3 marks)

- (d) To determine whether there is really a relationship between an employee's performance in the company's training program and his or her ultimate success in the job, the company took a sample of 400 cases from its very extensive files and obtained the results shown in the following table.

Success in job – Employee's rating	Performance in training program			
		Below average	Average	Above average
Poor		23	60	29
Average		28	79	60
Very good		9	49	63

Use the 0.01 level of significance to test the null hypothesis that performance in the training program and success in the job are independent.

(7 marks)

- (e) Show that the difference of the logistic transforms of $\frac{\pi_{01}}{\pi_{00} + \pi_{01}}$ and

$$\frac{\pi_{11}}{\pi_{10} + \pi_{11}} \text{ is } \log \left(\frac{\pi_{11}\pi_{00}}{\pi_{10}\pi_{01}} \right)$$

(4 marks)

- (f) In general sense psychiatric patients can be classified as psychotic or neurotic. To study the incidence of suicidal feelings, a random sample of 10 patients was taken from each group. Six patients displayed suicidal feelings in neurotic while only two displayed such feelings in the psychotic group. Construct an appropriate contingency table for displaying these results and use Fisher's exact test to test the hypothesis that the proportion of individuals with suicidal feelings is significantly higher for neurotics. Use $\alpha=0.01$ level of significance.

(9 marks)

QUESTION TWO (20 marks)

- (a) For a 4 – dimensional contingency table with r categories of variable 1, C categories of variable 2, V categories of variable 3 and W categories of variable 4, give an expression for a log linear model under the null hypothesis of mutual independence. Explain all the terms involved.

(6 marks)

- (b) For a 2 – dimensional contingency table with r rows and c columns, write down an expression for the natural logarithms of the estimated expected number of counts under the null hypothesis of independence of row and column characteristics, hence derive a log linear model for an $r \times c$ contingency table. (8 marks)

- (c) Using the results of (b) estimate the grand mean and the main effect parameters in the data below. (6 marks)

VARIABLE 1	VARIABLE 2				
		1	2	3	TOTAL
	1	20	56	24	100
	2	8	28	14	50
	3	2	16	2	20
	Total	30	100	40	170

QUESTION THREE (20 marks)

- (a) An experiment was conducted to determine whether seeding of clouds of a certain type causes them to produce radar echoes corresponding to the occurrence of rain. On each suitable day, a plane flew through 2 clouds that met certain criteria and one of the pair chosen at random was seeded and the other was not. For 24 flights, echoes occurred in both clouds 2 times, in unseeded clouds alone 3 times, in the seeded clouds 9 times and in neither cloud 10 times.
- (i) Set up an appropriate 2×2 contingency table and test at $\alpha = 0.1$ level of significance the null hypothesis that seeding has no effect against the alternative that seeding has effect. (3 marks)
- (ii) If the number of flights is 96 with same proportions in each classification, carry out an appropriate test for the hypothesis in (i). (3 marks)
- (b) The following results were obtained in a study to identify whether disease was associated with exposure to non treated water.

Untreated water	Case	Control
Yes	2	6
No	18	14

- (i) Calculate the odds ratio and discuss your results. (2 marks)
- (ii) Calculate the 95% confidence interval for the odds ratio. (5 marks)
- (c) An investigator is comparing two groups, a treatment and a control. He has picked two samples of size $n_1 = 10$ (Control) and size $n_2 = 5$ (treatment). He finds that he has 0 successes in 10 trials from the control group.
- (i) Form a 2×2 contingency table. (1 mark)
- (ii) If he wants to find out whether treatment is superior to the control, state the null and the alternative hypotheses. (1 mark)
- (iii) Find how many successes would be needed in the treatment group of size 5 to conclude that the treatment is superior to the control at 0.05 level of significance. (5 marks)

QUESTION FOUR (20 marks)

- (a) The table below shows data collected during an investigation into attempted suicides and show suicidal intent and a depression rating score for a sample of 91 cases.

		Depression rating(x)			
		19	21 - 29	30 - 39	> 39
Suicidal intent (y)	Did not want to die	10	14	8	2
	Unsure	2	4	7	2
	Wanted to die	5	9	11	17

Compute the Kendall's tau (τ) statistic and interpret it's meaning. (6 marks)

- (b) The table below shows some data concerning classroom behaviour of school children. Three variables are involved.

Variable 1: Teacher's rating of classroom behaviour into deviant or non – deviant

Variable 2: Risk index based on several items of home condition thought to be related to deviance.

Variable 3: Index of the adversity of school conditions based items.

Adversity of school conditions (k)							
		Low		Medium		High	
	Risk index (j)	Not at risk	At risk	Not at risk	At risk	Not at risk	At risk
Classroom behaviour (i)	Non - deviant	16	7	15	34	5	3
	Deviant	1	1	3	8	1	3

(i) At $\alpha = 0.05$ level of significance test the null hypothesis of mutual independence. (7 marks)

(ii) Collapse the data into a 2×3 two – dimensional contingency table and carry out the test again commenting on the result that you obtain. (7 marks)

END OF EXAMINATION

