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(Knowledge for Development)

KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS 2020/2021 ACADEMIC YEAR

END OF SEMESTER EXAMINATIONS YEAR THREE SEMESTER TWO MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF EDUCATION AND BACHELOR OF SCIENCE

COURSE CODE : STA 321

COURSE TITLE : TEST OF HYPOTHESIS I

DATE: 5/10/2021

TIME: 9:00 A.M – 11:00 A.M

INSTRUCTIONS TO CANDIDATES

ANSWER QUESTIONS ONE AND ANY OTHER TWO.

QUESTION ONE (30 MARKS)

- a) Define the following terms. (4 marks)
- (i) Statistical hypothesis
 - (ii) Type II error
 - (iii) Significance level
 - (iv) Simple hypothesis
- b) An instructor gives a short quiz involving 10 true-false questions. To test the hypothesis that students are guessing, the instructor adopts the following decision rule. If 7 or more answers are correct, the student is not guessing and if less than 7 answers a correct, the student is guessing.
- i. Find the probability of rejecting hypothesis when its correct (6 marks)
 - ii. Find the probability of accepting the hypothesis $H_0 : P = \frac{1}{2}$ when $P = 0.7$ (4 marks)
- c) In a test given to two groups of students, the marks obtained are as follows
- | | | | | | | | | | |
|-----------------------|----|----|----|----|----|----|----|----|----|
| 1 st Group | 18 | 20 | 36 | 50 | 49 | 36 | 34 | 49 | 41 |
| 2 nd Group | 29 | 28 | 26 | 35 | 30 | 44 | 46 | | |
- At 5% level of significance, examine whether there significance of difference the arithmetic mean of the marks secured by the two groups students. (7 marks)
- d) A manufacturer suspects a difference in the quality of spare parts he receives from two suppliers. He obtains the following data on the service life of random samples of the parts from the two suppliers. For suppliers A, $n_1 = 50$, $x_1 = 150$ and $s_1 = 10$; for supplier B, $n_2 = 100$, $x_2 = 153$ and $s_2 = 5$. Test whether the difference between the 2 samples is statistically significant at the 1% level of significance. (4 marks)
- e) 1000 students at college level were graded according to their IQ and economic conditions of their homes. Test at 5% significance level whether there is an association between economic condition at home and IQ (5 marks)

Economic conditions at home	IQ		Total
	High	Low	
Rich	460	140	600
Poor	240	160	400
Total	700	300	1000

QUESTION TWO (20 MARKS)

- a) State and prove the Neyman- Pearson lemma. (10 Marks)
- b) Examine whether a B.C.R exists for testing $H_0: \theta = \theta_0$ against $H_1: \theta > \theta_0$ for the parameter θ of the distribution

$$f(x, \theta) = \frac{1+\theta}{(x+\theta)^2} ; 1 \leq x \leq \infty \quad (10 \text{ Marks})$$

QUESTION THREE (20 MARKS)

- a) State three assumptions made in determination of F-test (3 Marks)
- b) Two samples are drawn from normal population as shown below

Sample 1	60	65	71	74	76	82	85	87		
Sample 2	61	66	67	85	78	63	85	86	88	91

- c) The numbers of telephone calls arriving at an exchange in 6 minutes periods were recorded over a period of 8 hours with the following results. Can these results be modeled by a poisson distribution at $\alpha = 0.05$? (8 marks)

Number of cells	0	1	2	3	4	5	6	7	8
Frequency	8	19	26	13	7	5	1	1	0

Test whether the two samples have the same variance at 5% level of significance.

(9 Marks)

QUESTION FOUR (20 MARKS)

- a) Given the eight sample observations 31, 29, 26, 33, 40, 28, 30 and 25. Test at 1% level of significance whether the mean of sample observation is equal to 35. (6 Marks)
- b) A coin is tossed 6 times and the hypothesis $H_0: P = \frac{1}{2}$ is rejected if the number of heads is greater than 4. Compute the sizes of Type I and Type II errors if the alternative hypothesis is $H_1: P = \frac{3}{4}$. (5 marks)
- c) The mean score on a widely given freshman mathematics examination is 75. A mathematics teacher at a very large university wants to determine whether there is statistical evidence for claiming that this year's class is not average. Test for this at 5% level of significance using the following scores. (9 Marks)

94	69	89	49	88	89	85
95	55	93	86	62	83	96
48	51	69	74	83	71	89
58	89	81	79	52	73	
75	91	68	100	63	81	

QUESTION FIVE (20 MARKS)

- a) In an infantile paralysis epidemic 500 persons contacted the disease; 300 received no serum treatment and of these 75 became paralyzed. Was the serum treatment effective? Test at 5% significance level. (5 marks)
- b) Ten pairs of littermates were studied from birth. One animal of each pair was raised under stress conditions, the other under non stress conditions. After one year, all the littermates were given tests of motor ability, co-ordination and balance. Numerical scores are given to each subject; the scores are given below. Do the means of the non-stress and stress subjects differ significantly? Use 5% level of significance. (7 marks)

Littermate pair	A	B	C	D	E	F	G	H	I	J
Non-stress subject	50	46	50	64	54	70	58	74	58	66
Stress subject	34	42	46	46	50	54	58	58	62	70

c) A pharmaceutical firm has been conducting restricted studies on small groups of people to determine the effectiveness of a master vaccine. The following are the readings on antibody strength for five individuals injected with the vaccine.

1.2, 3.0, 2.5, 2.4, 1.9

- i) Use the data to test the hypothesis that the mean antibody strength for individuals vaccinated with the drugs is greater than 1.6 at $\alpha = 0.05$. (5 marks)
- ii) Using the above data estimate μ , the population means antibody strength for individuals vaccinated with the new drug. Use 95% confidence interval. (3 marks)