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(Knowledge for Development)

KIBABII UNIVERSITY
UNIVERSITY EXAMINATIONS
2017/2018 ACADEMIC YEAR
THIRD YEAR SECOND SEMESTER
MAIN EXAMINATION

**FOR THE DEGREE OF BACHELOR OF EDUCATION AND
BACHELOR OF SCIENCE**

COURSE CODE: STA 342

COURSE TITLE: TEST OF HYPOTHESIS I

DATE: 01/08/18

TIME: 2 PM -4 PM

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: (30 Marks)

- (a) Define a statistical Hypothesis (2 marks)
- (b) Distinguish a simple from a composite Hypothesis (3 marks)
- (c) State and explain two types of errors encountered in statistical testing of Hypotheses (4 marks)
- (d) Suppose that it is required that the mean operating life of size D batteries be 22 hours. Suppose also that the operating life of the batteries is normally distributed. It is known that the standard deviation of the operating life of all such batteries produced is 3 hours. If a sample of 9 batteries has a mean operating life of 20 hours, can we then conclude that the mean operating life of size D batteries is not 22 hours? Use the level of significance 5% to perform this test. (6 marks)
- (e) State the Neyman-Pearson's Lemma (2 marks)
- (f) A random sample of size n from a normal population with $\sigma^2=1$ is to be used to test the null hypothesis $\mu=\mu_0$ against the alternative hypothesis $\mu=\mu_1$, where $\mu_1>\mu_0$. Use the of Neyman-Pearson's Lemma to find the most powerful critical region of size α . (7 marks)
- (g) Use the data shown in the following table below to test at 0.01 level of significance whether a person's ability in pure mathematics is independent of his or her interest in statistics

Ability in pure mathematics

Interest in Statistics

	Low	Average	High
Low	6	42	15
Average	58	61	31
High	14	47	29

(6 marks)

QUESTION 2: (20 Marks)

- (a) Prove the Neyman-Pearson's Lemma stated in Question 1(e) above. (10 marks)
- (b) Examine whether a Best critical region (B.C.R) exists for testing $H_0: \vartheta = \vartheta_0$ against $H_1: \vartheta > \vartheta_0$ for the parameter ϑ of the distribution (10 marks)

QUESTION 3: (20 Marks)

An experiment is performed to determine whether the average nicotine content of one kind of cigarette exceeds that of another kind by 0.20 milligram. If $n_1=50$ cigarettes of the first kind had an average nicotine content of $\bar{x}_1=2.61$ milligrams with a standard deviation of $s_1=0.12$ milligram, whereas $n_2=40$ cigarettes of the other kind had an average nicotine content of $\bar{x}_2=2.38$ milligrams with a standard deviation of $s_2=0.14$ milligram, test the null hypothesis $\mu_1 - \mu_2 = 0.20$ against the alternative hypothesis $\mu_1 - \mu_2 \neq 0.20$ at 0.05 level of significance. Base the decision on the;

- (i) P-value corresponding to the value of the appropriate test statistic
- (ii) Critical values at the stated level of significance

(20 marks)

QUESTION 4: (20 Marks)

- (a) State three uses of the chi-square test. (3 marks)
- (b) Suppose that the thickness of a part used in a semiconductor is its critical dimension and that measurements of the thickness of a random sample of 18 such parts have the variance of 0.68, where the measurements are in thousandths of an inch. The process is considered to be under control if the variation of the thickness is given by a variance not greater than 0.36. Assuming that the measurements constitute a random sample from a normal population, test the null that the variance is equal to 0.36 against the alternative hypothesis that it is greater than 0.36, at 0.05 level of significance. Is the process under control? (10 marks)
- (c) In comparing the variability of the tensile strength of two kinds of structural steel, an experiment yielded the following results; $n_1=13, S_1^2=19.2, n_2=16$ and $S_2^2=3.5$, where the measurements are in kilograms per square metre. Assuming the measurements constitute independent random samples from two normal populations, test

$$H_0: \sigma_1^2 = \sigma_2^2 \quad \text{versus}$$

$$H_1: \sigma_1^2 \neq \sigma_2^2$$

at 0.02 level of significance

(7 marks)

QUESTION 5: (20 Marks)

In a small clinical trial to assess the value of a new tranquillizer on psychoneurotic patients, each patient was given a week's treatment with the drug and a week's treatment with a placebo, the modes in which the two sets of treatments were given being determined at random. At the end of each week the patient had to complete a questionnaire on the basis of which he or she was given an 'anxiety score' (with possible values from 1 to 30), high scores corresponding to states of anxiety.

The results are given in the following table:

Patient	Anxiety Score		Difference
	<u>Drug</u>	<u>Placebo</u>	<u>D - P</u>
1	19	22	-3
2	11	18	-7
3	14	17	-3
4	17	19	-2
5	23	22	1
6	11	12	-1
7	15	14	1
8	19	11	8
9	11	19	-8
10	<u>8</u>	<u>7</u>	<u>1</u>
Mean	14.8	16.1	-1.3

Is there enough evidence in these data to decide that the drug really reduces anxiety on patients? Formulate suitable hypotheses and perform the test at 5% level of significance assuming the data are normally distributed. (20 marks)