CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATION

RESIT/SPECIAL EXAMINATIONS

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE IN

MATH 452: TEST OF HYPOTHESIS

STREAMS: **TIME: 2 HOURS**

DAY/DATE: TUESDAY 04/05/2021 **11.30 A.M – 1.30 P.M**

INSTRUCTIONS:

ANSWER ALL THE QUESTIONS

QUESTION ONE

(a) The Kasuku meat packaging company fears that the average mass of the shipments exceeds 30 kg. This is undesirable because anything over that requires additional shipping costs. To determine the average mass of their shipments,25 orders are selected at random. The sample mean is found to be 32.1 kg and the sample standard deviation is 3.1kg. State the hypotheses and test at 5% level of significance, whether the company's fears are justified. Assume that the distribution of the mass is normal [10marks]

(b) To find out whether the inhabitants of two islands may be regarded as having the same racial ancestry, an anthropologist determines the cephalic indices for six male adults from each island getting $\bar{X} = 77.4$, $\bar{Y} = 72.2$ and corresponding standard deviations, $S_1 = 3.3$ and $S_2 = 2.1$ respectively. Use 1% level of significance to check whether the difference between the two sample means can reasonably be considered to be negligible, stating any assumptions made. [10marks]

(c) Let $x_1, x_2, \ldots, x_n$ be random sample from a normal distribution$(X \sim N(0,\delta^2)$ Obtain a most powerful size α test for testing $H_O: \delta=1$ against $H_1: \delta=4$ and α=5%. [10marks]

QUESTION TWO

(a) The hemoglobin levels of two groups of children fed on two different diets are given below.

SN	1	2	3	4	5	6	7	8	9	10	11	12
GP 1	11.6	10.3	10.6	11.5	11.8	11.8	12.1	10.8	11.9	10.7	11.5	
GP 2	11.2	8.9	9.2	8.8	8.4	9.1	6.3	9.3	7.8	8.8	10.0	9.7

Test whether the means of these two groups differ significantly at 5% significance level.

[10 marks]

(b) The following table gives readings (^oC) taken by thermometers on the ground and sensors mounted in space satellites at 11 sites

Site	1	2	3	4	5	6	7	8	9	10	11
Therm	4.6	17.3	12.2	3.6	6.2	14.8	11.4	14.9	9.3	10.4	7.2
Sensors	4.7	19.5	12.5	4.2	6.0	15.4	14.9	17.8	9.7	10.5	7.4

Required

Investigate the hypothesis that satellite sensors give, on average, significantly higher readings than the ground thermometers at 5% significance level [10marks]

QUESTION THREE

(a) The light attenuation of an oak tree was repeatedly measured by two methods independently and results are shown below.

Photometric	85.6	86.1	86.5	85.1	86.8	87.3	
Photographic	82.4	84.7	86.1	87.2	82.4	85.8	84.3

Required

Test whether there is a difference in the variability of the two methods at 5% significance level.

[10marks]

(b) Suppose $X_1, X_2, \ldots . X_n$ form a random sample from a normal distribution with unknown mean, μ and a standard deviation 4. Consider the hypotheses

$$H_0: \mu = -1$$

$$H_1; \mu = 1$$

Given that $n = 25$, determine the minimum value of Pr(Type I error) + Pr(Type II error) that can be attained. Compare the values with the value obtained using the critical region $R = \{\bar{X}: \bar{X} > 18\}$ where $\bar{X}$ is the sample mean. Which of the two tests has a higher power?

[10marks]
