JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF BIOLOGICAL, PHYSICAL MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE ACTUARIAL

EXAMINATIONS 2022/2023

REGULAR (MAIN)

COURSE CODE: WAB 2214

COURSE TITLE: PRINCIPLES OF STATISTICAL INFERENCE

EXAM VENUE: **STREAM: (Bsc. ACTUARIAL SCIENCE)**

DATE: 19/12/2022   **EXAM SESSION: 9.00-11.00AM**

TIME: 2.00 HOURS

Instructions:

1. **Answer question 1 (Compulsory) and ANY other 2 questions**
2. **Candidates are advised not to write on the question paper.**
3. **Candidates must hand in their answer booklets to the invigilator while in the examination room.**

QUESTION ONE (30 MARKS)

a) Use the standard normal table to evaluate the following
   - i) $P(-2.56 < Z < 1.815)$ [3 Marks]
   - ii) The value of a such that $P(Z > a) = 0.097$ [4 Marks]

b) The mass of a certain grade of apple is Normally distributed with mean mass 120g and standard deviation 10g.
   - i. An apple of this grade is selected at random. Find the probability that the mass lies between 100.5g and 124g.   [4 Marks]
   - ii. Four apples of this grade are selected at random. Find the probability that their total mass exceeds 505g?   [4 Marks]

c) The mean of 50 observations of X where $X \sim Bin\ (12,0.4)$ is $\bar{X}$
   - **i.** State the sampling distribution of $\bar{X}$ [2 Marks]
   - **ii.** Obtain $P(\bar{X} < 5)$ [4 Marks]

d) The random variable X is Normally distributed as $X \sim N(105,25)$. A single random sample may be taken from this distribution based on the random number 912. Obtain the possible random number.   [4Marks]

e) A sample of n independent observations is taken from a normal population with mean 74 and standard deviation 6. The sample mean is denoted by $\bar{X}$. Find n if $P(\bar{X} > 75) = 0.282$.   [5 Marks]

QUESTION TWO (20 MARKS)

a) The masses of packets of sugar are normally distributed. In a large consignment of packets of sugar, it is found that 5% of them have a mass greater than 510g and 2% have a mass greater than 515g.
   - i. Estimate the mean and the standard deviation of this distribution.   [9Marks]
   - ii. Obtain the proportion of packets with masses less than 495g   [4 Marks]

b) The discrete random variable X is such that $\sim B(5,0.4)$. Take a random sample of size 7 from this distribution using the random numbers 308, 423, 112, 901, 355, 283, 002   [7 Marks]

QUESTION THREE (20 MARKS)

a) Six graduates with Bsc. Actuarial Science who appeared for an interview were subjected to two tests. Each had to take an aptitude test out of 25 and a productivity test whose index was measured within 2 weeks of internship out of 50 before the company would finally make a decision for permanent employment. The results were tabulated as follows:

Aptitude score (X)	9	18	18	20	20	23
Productivity Index (Y)	33	23	33	42	29	32

Find the Coefficient of Correlation between aptitude scores and productivity. [10 Marks]

b) Ina sack of mixed seeds, the probability that a seed is spotted is 0.35. Using the Normal approximation to the Binomial, find the probability that in a random sample of 400 seeds from the sack.

   i. Less than 120 are spotted. [3 Marks]

   ii. Between 120 and 150 inclusive are spotted [4 Marks]

   iii. More than 160 are spotted [3 Marks]

QUESTION FOUR (20 MARKS)

a) An investigator wishes to study the effect of three different drugs on pain alleviation. He administered each drug at random to 9 patients with similar complaints and of the same age bracket. Each drug was randomly given to 3 of the 9 patients and the response to pain alleviation recorded as shown in minutes.

Drug	Observation		
A	30	25	20
B	28	26	31
C	35	32	30

By stating the hypothesis clearly, analyze the effect of drug on pain alleviation at 5% level of significance. [8 Marks)

b) You are provided with the random digits 509 978 take a random sample of size two from each of the following continuous distributions.

   i. $f(x) = \frac{3}{8}x^2 \ for \ 0 < x < 2$ [6 Marks]

   ii. $X \sim N(55,16)$ [6 Marks]

QUESTION FIVE (20 MARKS)

You are provided with the following data.

X	1	2	3	4	5
Y	3	6	9	12	15

Use the data

    a. To obtain regression equations of X on Y and Y on X respectively.   **[16 Marks]**

    b. Use the equations obtained above to predict

        i.   The value of X when $Y = 50$ **[2 Marks]**

        ii.   The value of Y when $X = 12$ **[2 Marks]**