JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY

SCHOOL OF MATHEMATICS AND ACTUARIAL SCIENCE

UNIVERSITY EXAMINATION FOR DEGREE OF BACHELOR OF SCIENCE ACTUARIAL

2ND YEAR 2ND SEMESTER 2018/2019 ACADEMIC YEAR

REGULAR (MAIN)

COURSE CODE: SAS 202

COURSE TITLE: PRINCIPLES OF STATISTICAL INFERENCE

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

DATE: 30/4/19 **EXAM SESSION: 12.00 – 2.00PM**

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 evaluate the following

   i) $P(-1.53 < Z < 1.31)$ (3 Marks)

   ii) The value of a such that $P(|Z| < a) = 0.92$ (3 Marks)

b) Prints from two types of film C and D have developing times which can be modelled by normal variables, C with mean 16.18s and standard deviation 0.11 s and D with mean 15.88 s and standard deviation 0.10 s.

   i. A type C print is developed and immediately afterwards a type D print is developed. What is the probability that the total time taken is greater than 32.5 s? (4 Marks)

   ii. What is the probability that a type C print will take longer to develop than a type D print? (4 Marks)

c) Generate a random sample of size 10 from the given probability distribution using the random numbers 3 ,7, 4, 7, 6, 5, 3, 3, 9, 0

X	0	1	2	3	
$P(X = x)$	0.1	0.2	0.4	0.3	

d) The mean of 50 observations of X, where $X - B(12,0.4)$, is $\bar{X}$ (5 Marks)

   i. State the approximate distribution of $\bar{X}$

   ii. Obtain $P(\bar{X} < 5)$ (6 Marks)

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 heights of students taking actuarial science were measured and found to be normally distributed with mean μ cm and standard deviation σ cm . On the basis of the results obtained from a random sample of 100 men from the actuarial science cohort, the 95% confidence interval for μ was calculated and found to be $(177.22cm - 179.18cm)$. Calculate

   i. The value of the sample mean

   ii. The value of σ

   iii. A symmetric 90% confidence interval for μ

   iv. $P(\bar{x} > 183\ cm)$ (12 Marks)

b) Use the sequence of random numbers 6789 3456 8976 9502 to take a random sample of size 8 from a $Bin\ (4, 0.6)$ population (8 Marks)

QUESTION THREE (20 MARKS)

a) Six graduates with Bsc. Actuarial Science 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

i) Find the Coefficient of Correlation between aptitude scores and productivity (10 Marks)

ii) Obtain the probable error and state its significance. (4 Marks)

b) Nineteen applicants for a job are subjected to an endurance test. The test checks the time in minutes that each applicant can concentrate on a task successfully without taking a break. The feedback was recorded as follows:
63, 229, 165, 77, 49, 74, 67, 59, 66, 102, 81, 72, 59, 74, 61, 82, 48, 70, 86. Identify any outliers in the data. (6 Marks)

QUESTION FOUR (20 MARKS)

a) Suppose $X \sim N(\mu_X, \sigma_X^2)$ and $Y \sim N(\mu_Y, \sigma_Y^2)$ are independent Normal random variables and a and b are constants, show that $aX - bY \sim N(a\mu_X - b\mu_Y, a^2\sigma_X^2 + b^2\sigma_Y^2)$ (8 Marks)

b) A soft drink manufacturer sells bottles of drinks in two sizes. A small bottle holds 252 milliliters with standard deviation 2millilitres while a large bottle holds 1012 milliliters with standard deviation 5 milliliters.

i. A bottle of each size is selected at random. Find the probability that the large bottle contains less than four times the amount in the small bottle (6 Marks)

ii. One large and four small bottles are selected at random. Find the probability that the amount in the large bottle is less than the total amount in the four small bottles. (6 marks)

QUESTION FIVE (20 MARKS)

a) Obtain the two lines of regression for the following data. (10 Marks)

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

b) An investigator wishes to study the effect of four different drugs on pain alleviation. He administered each drug at random to 12 patients with similar complaints and of the same age bracket. Each drug was randomly given to 3 of the twelve 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
D	29	26	25

By stating the hypothesis clearly, analyze the effect of drug on pain alleviation at 5% level of significance. (10 Marks)