RONGO
UNIVERSITY COLLEGE

Goldmine of Knowledge and Innovation

(A Constituent College of Moi University)

OFFICE OF THE DEPUTY PRINCIPAL- ACADEMICS AND STUDENTS AFFAIRS

UNIVERSITY EXAMINATIONS

2013/2014 ACADEMIC YEAR

SECOND YEAR SECOND SEMESTER EXAMINATION

FOR

THE DEGREE

IN

BACHELOR OF SCIENCE (APPLIED STATISTICS)

COURSE CODE: STA 217

COURSE TITLE: PRINCIPLES OF STATISTICAL INFERENCE

DATE: 15/04/2013 **TIME: 09:00AM – 12.00NOON**

INSTRUCTIONS TO CANDIDATES

- Answer question **ONE** and any other **THREE** questions
- Marks are shown at the end of each question
- Show workings in the answer booklet for award of full marks
- Each question should begin on a fresh page
- Switch off your mobile phones
- Duration is 3 hours.

THIS PAPER CONSISTS (6) PRINTED PAGES

PLEASE TURN OVER

QUESTION ONE:

a) With specific examples explain "courses of action" and "uncertainty" as ingredients of decision problems in statistical decision theory. **(6mks)**

b) With specific illustrations explain sampling distribution? Briefly outline its role in statistical inference **(6mks)**

c) An electric firm manufactures light bulbs that have a length of life that is approximately normally distributed, with mean equal to 800 hours and a standard deviation of 40 hours. Find the probability that a random sample of 16 bulbs will have an average life less than 775 hours. **(4mks)**

d) With two examples in each case explain the differences between parametric and non-parametric statistics. **(6mks)**

e) Define the term "regression analysis". Explain its purpose in statistical analysis. **(3mks)**

QUESTION TWO:

a) State the central limit theorem of a sampling distribution of the difference between two means **(1mk)**

b) Two independent experiment experiments are being run in which two different types of paint are compared. Eighteen specimens are painted using type A and the drying time, in hours is recorded on each. The same is done with type B. the standard deviations are both known to be 1.0. Assuming that the mean drying time is equal for the two types of paint, find $P(\bar{X}_A - \bar{X}_B > 1.0)$, where $\bar{X}_A$ *and* $\bar{X}_B$ are average drying times for samples of size $n_A = n_B = 18$. **(7mks)**

c) Interpret the result in part (b) above. **(2mks)**

d) A random sample of 100 recorded deaths in the United States of America during the past year an average life span of 71.8 years. Assuming a population standard deviation of 8.9 years, does this seems to indicate that the mean life span today is greater than 70 years. Use a 0.05 level of significance. **(5mks)**

QUESTION THREE:

a) Explain what is meant by "posterior analysis" in statistical decision theory. **(2mks)**

b) A businessman wants to construct a hotel. He usually builds 25, 50, or 100 beds hotel, depending on whether anticipated demand is low, medium or high. The businessman has been able to find out net profits which are expressed in the table below and the prior distribution regarding the states of nature which in the next table.

PAYOFF TABLE

States of nature	Action		
	a_1 Build -25 beds hotel	a_2 Build -50 beds hotel	a_3 Build -100 beds hotel
θ_1= low demand	20,000	-10,000	-30,000
θ_2= medium demand	25,000	30,000	-5,000
θ_3= high demand	30,000	50,000	60,000

PRIOR DISTRIBUTION

States of nature=Demand	θ_1	θ_2	θ_3	Total
Prior probabilities, $g(\theta_i)$	0.2	0.3	0.5	1.00

The businessman engaged a research firm to collect additional information by conducting surveys which are used to obtain an estimate of either low demand (X1), medium demand (X2) or high demand (X3) depending on the result of the survey.The reliability of these estimates provided by the research firm are presented in the following table.

Conditional probabilities

State of nature	X_1	X_2	X_{13}	Total
θ_1	0.6	0.25	0.15	1.00
θ_2	0.15	0.60	0.100	1.00
θ_3	0.05	0.20	0.75	1.00

Using the information provided in the tablesabove, construct the following;

i) The Joint and marginal probabilities table. **(4mks)**
ii) The posterior probabilities table **(3mks)**
iii) The expected posterior payoff table **(3mks)**

c) State the actions to be taken at each level of outcome **(3mks)**

QUESTION FOUR:

Consider the experimental data given in the table below, which was obtained from 33 samples of chemically treated waste in the study conducted at the Virginia polytechnic. Readings on x, the percent reduction in total solids and y, the percent reduction in chemical oxygen demand for the 33 samples, were recorded.

Measures of solids and chemical oxygen demand

Solid Reduction, x (%)	Chemical oxygen, y(%)
3	5
7	11
11	21
15	16
18	16
27	28
29	27
30	25
30	35
31	30
31	40
32	32
33	34
33	32
34	34
36	37
36	38

(i) Using the general linear equation $y = a + bx$ fit the line using the above data. **(7mks)**

output. Five hourly production figures are observed at random from each machine and the results are given below.

Observations	A_1	A_2	A_3
1	25	31	24
2	30	39	30
3	36	38	28
4	38	42	25
5	31	35	28

Use analysis of variance to determine whether the machines are significantly different in their mean speed at 5% level of significance. **(10mks)**