



MACHAKOS UNIVERSITY

University Examinations 2020/2021 Academic Year

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

THIRD YEAR SPECIAL /SUPPLEMENTARY EXAMINATION FOR

BACHELOR OF SCIENCE IN STATISTICS AND PROGRAMMING

SMA 367: EXPLORORY DATA ANALYSIS

DATE: 23/3/2021

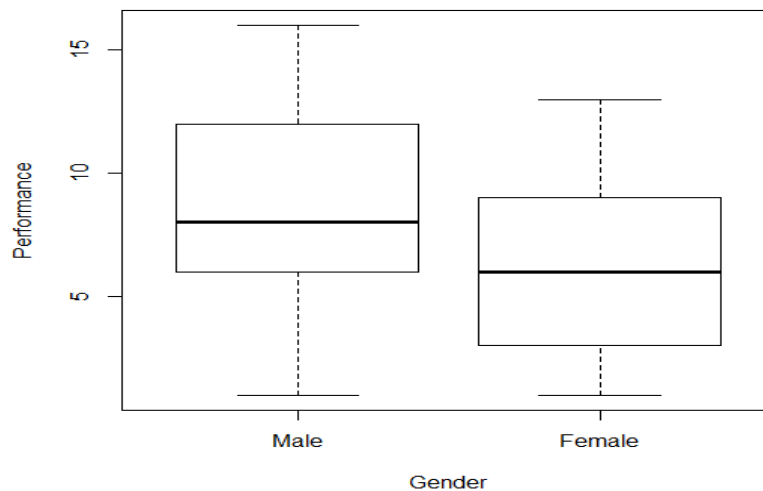
TIME: 2.00-4.00 PM

INSTRUCTIONS TO CANDIDATES

Answer Question **ONE** which is compulsory and any other **TWO** Questions

QUESTION ONE (30 MARKS)

- a) Distinguish the following terms as they apply in data analysis
- A variable and a case
 - Data mining and data screening
 - Descriptive statistics and inferential statistics
 - Parametric and Non-parametric test statistics (10 marks)
- b) A sample of 7 males and 13 females were assigned a task and their performance analyzed and summarized in figure below.



Using the figure estimate the; median and quartile deviation for each gender and commend on the gender with the higher dispersion. (6 marks)

- c) The following data represents the weight (KG) of newly born babies in Katu mission hospital, present it in a stem and leaf plot:

23, 35, 25, 22, 25, 43, 27, 54, 28, 55, 32, 36, 36, 45, 50 (6 marks)

- d) Distinguish the following terms as they apply in exploratory data analysis

- i. Exploratory data analysis (EDA) and response surface methodology (RSM)
- ii. Saturated and parsimonious model
- iii. Confounded variable and noise variable
- iv. Fixed and random models

(8 marks)

QUESTION TWO (20 MARKS)

- a) Distinguish between the terms

- i. prior and posterior probabilities (4 marks)
- ii. Show that the conjugate prior for poison likelihood is gamma distribution.

(6 marks)

- b) Discuss five ways of handling a missing data

(10 marks)

QUESTION THREE (20 MARKS)

- a) Complete the two- way ANOVA table by inserting the right figures in the spaces labeled in letter $p, q, r, s, t, u, v, w, x, y$ and z (10 marks)

Two- way ANOVA

Source of Variation	Degrees of Freedom	Sum of Squares	Mean sum of Squares	F – value	F – table
Factor A	3	42	v -	t	r
Factor B	2	w	16	q	s
AB	x	u	22.67	z	
Error	y	210	p		
Total	21	420			

Commend on the significance of the findings represented in the ANOVA table at $\alpha=5\%$

(2 marks)

- b) Based on the recent observations 3% of students of huang university has coronavirus. The university clinic laboratory can detect 90% of the virus when present. It also gives 13% false positive results. If a student from the university volunteers for the virus test in the university clinic laboratory, determine the following probabilities;
- That the test result will be positive
 - That, given a positive result, he has the virus
 - That, given a negative result, he has no virus
 - That he was misclassified
- (8 marks)

QUESTION FOUR (20 MARKS)

- a) Discuss four causes of asymmetry in data distribution structures (8 marks)
- b) Show that the conjugate prior for binomial likelihood is beta distribution (6 marks)
- c) A randomly sampled 13 students with a hearing impairment were given some test before and after being given a hearing aid. The test score for each student before and after were analyzed and the findings summarized in the output table below.

Table 1: Sample t-test output, for the test $H_0 : \mu_A = \mu_B$

	t	df	Sig.(2-tailed)	Mean difference	95% CI of the difference	Lower	Upper
Attendance	-0.5	1	0.6269	1.500	-5.443	3.443	
		2					

- State the hypothesis for the above scenario
- Based on the sample t-test output make statistical conclusion
- Interpret the 95% CI lower and upper difference values (6 marks)

QUESTION FIVE (20 MARKS)

- Highlight four methods of transforming a raw skewed data before analysis (4 marks)
- Discuss four non- parametric test statistics and highlight when appropriate to apply each one of them (8 marks)
- In an opinion survey regarding the BBI (Building Bridges Initiatives) 2500 individuals interviewed opined the initiative as summarized below.

Age in Years	Opposed	Undecided	In support	Total
Under 30	650	100	750	1500
Over 30	350	400	250	1000
Total	1000	500	1000	2500

Test the hypothesis that age difference did no influence the opinion $\alpha=5\%$ (8 marks)