

CHUKA



UNIVERSITY

UNIVERSITY EXAMINATIONS

FOURTH YEAR EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE ARTS AND EDUCATION

MATH 454: NON PARAMETRIC METHODS

STREAMS: B.Sc, B.ED, & B.A

TIME: 2 HOURS

DAY/DATE: THURSDAY 7/12/2017

2.30 P.M - 4.30 P.M.

INSTRUCTIONS:

- Answer Question ONE (Compulsory) and any other TWO Questions.

QUESTION ONE [30 MARKS]

- (a) The following measurement in centimeters of length of randomly selected pygmy sun fish.
5.0, 3.9, 5.2, 5.5, 2.8, 6.1, 6.4, 2.6, 1.7, 4.3

Can we conclude that the median length of pygmy sun fish differs significantly from 3.7 centimeters? (Use wilcoxon signed rank) [6 Marks]

- (b) The median age of the onset of diabetes is thought to be 45 years. The ages at onset of a random sample of 30 people with diabetes are:

35.5, 44.5, 39.8, 33.3, 51.4, 51.3, 30.5, 48.9, 42.1, 40.3,
46.8, 38.0, 40.1, 36.8, 39.3, 65.4, 42.6, 42.8, 59.8, 52.4,
26.2, 60.9, 45.6, 27.1, 47.3, 36.6, 55.6, 45.1, 52.2, 43.5,

Assuming the distribution of the age of the onset of diabetes is symmetric, is there evidence to conclude that the median age of the onset of diabetes differs significantly from 45 years? [$\alpha = 5\%$ level] [6 Marks]

- (c) A quality control chart has been maintained for the weight of paint cans tabbed from a conveyor belt at a fixed point in a production time. 16 weight obtained in order of time are as follows:

68.2, 71.6, 69.3, 71.6, 70.4, 65.0, 63.6, 64.7, 65.3, 64.2, 67.6, 68.6, 66.8, 68.9, 66.8, 70.1

Use the run test to determine whether the weight of the paint cans on the conveyor belt deviate from randomness. [6 Marks]

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(d) A chartered bush line has 48 passenger buses and 38 buses. With X and Y denoting the number of miles traveled per day for the 48 passengers and 38 passenger buses respectively, the bus company is interested in testing the equality of the two distribution. The company observed the following data on a random sample of

$$n_1 = 10 \text{ buses holding 48 passengers and}$$

$$n_2 = 11 \text{ buses holding 38 passengers}$$

X: 104 253 300 308 315 323 331 396 414 452
 Y: 184 196 197 248 260 279 355 386 393 432 450

Using the normal approximation to run test, conduct the hypothesis test at 5% significant level. [6 Marks]

(e) Recent studies of the private practices of physicians who saw no medical patients suggested that the median length of each patient visit was 22 minutes. It is believed that the median visit length in practice with a large Medicaid load is shorter than 22 minutes. A random sample of 20 visits in practices with a large Medicaid load yielded the following visit lengths.

9.4, 13.4, 15.6, 16.2, 16.4, 16.8, 18.1, 18.7, 18.9, 19.1,
 19.3, 20.1, 20.4, 21.6, 21.9, 23.4, 23.5, 24.8, 24.9, 26.8,

Based on these data, is there sufficient evidence to conclude that the median visit length in practice with a large Medicaid load is shorter than 22 minutes. (Use sign test at 5%) [6 Marks]

QUESTION TWO [20 MARKS]

A random sample of 395 people was surveyed. Each person was their interest in riding a bicycle (variable A) and their age (variable B). The table that resulted from the survey is summarized in the following table.

Variable A	Observed	Variable B				Total
		18-24	25-34	35-49	50-64	
Yes	60	54	46	41	201	
NO	40	44	53	57	194	
Total	100	98	99	98	395	

Is there evidence to conclude that the desire to ride a bicycle depends on age? (Chisquare test at $\alpha = 5\%$) [10 Marks]

(b) A sample of 26 offshore oil workers took part in a simulated escape exercise, resulting in the following data on time (in seconds) to complete the escape;

325, 325, 334, 339, 356, 356, 359, 359, 363, 304, 364, 366, 369, 370, 373, 373, 374, 373,
 389, 392, 393, 394, 397, 402, 403, 424

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Find the approximate confidence coefficient associated with the $[Y_8, Y_{18}]$ confidence interval for the median (m) [10 Marks]

QUESTION THREE [20 MARKS]

(a) The following is an arrangement of men M and women W hired up to purchase tickets for a trip from Nairobi to Mombasa via SGR.

M W M W M M M W M W M W W M M M
 W W M W M M M W M M M M W M M M
 W M W M M M M W W M M W W W M M

Test for randomness at $\alpha = 5\%$. [10 Marks]

(b) The following data are measurements for the number of customer services per shift at window of the SGR station in Nairobi (Sample (A)) and the SGR station in Mombasa [Sample (B)]

Sample A	120	136	107	109	129	117	125	110	124				
Sample B	131	144	116	111	103	122	141	139	130	133	132	135	148

Use the mann-Whitnery test to check to whether the two samples come from the same population at $\alpha = 5\%$ level. [10 Marks]

QUESTION FOUR [20 MARKS]

(a) The following are methods used in assessing drivers in Kenya.

A	20	31	24	33	23	24	28	16	19	26
B	29	18	29	19	20	21	34	33	30	23
C	19	31	16	26	31	33	28	28	25	30

Use the Kruskal-Wallis test to test whether there is a difference in the methods of assessing the drivers in Kenya [$\alpha = 5\%$ level] [10 Marks]

(b) Two judges at a college homecoming parade rank 8 floats in the following order

Float	1	2	3	4	5	6	7	8
Judge A	5	8	4	3	6	2	7	1
Judge B	7	5	4	2	8	1	6	3

Required:

- (i) Calculate the spearman's rank correlation. [5 Marks]
- (ii) Test the Null Hypothesis that $r = 0$ against alternative $r > 0$. [5 Marks]

QUESTION FIVE [20 MARKS]

(a) Let $Y_1, < Y_2 < Y_3 < \dots < Y_{28}$ denote the order statistics of a random sample of size 28 from a distribution of a continuous type.

Compute $P[Y_{20} < \pi_{0.75} < Y_{28}]$ [8 Marks]

(b) Using the kolmogorov-surrnove method, test the hypothesis that the following values from a random sample from a uniform distribution on the interval (0, 2)

1.77 1.43 0.33 1.59 0.03 0.81 1.15 0.45

1.51 0.83 1.81 1.33 0.17 0.65 0.19

Take $\alpha = 5\%$ level and $D_{15}^{0.05} = 0.34$ [12 Marks]

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