



# MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya

Tel: +254(0) 799 529 958, +254(0) 799 529 959, + 254 (0) 712 524 293,

Website: [info@must.ac.ke](mailto:info@must.ac.ke) Email: [info@must.ac.ke](mailto:info@must.ac.ke)

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## University Examinations 2020/2021

SECOND YEAR THIRD SEMESTER SPECIAL/SUPPLEMENTARY EXAMINATION FOR  
THE DEGREE OF BACHELOR OF SCIENCE IN NURSING

**NND 3235: INTRODUCTION TO MEDICAL BIOSTATISTICS**

**DATE: MAY 2021**

**TIME: 2 HOURS**

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**INSTRUCTIONS:** Answer question *one* and any other *two* questions

### QUESTION ONE (20 MARKS)

(a) Explain the meaning of the following terms as used in biostatistics (4mks)

- (i) Type 1 and Type II errors
- (ii) Statistical experiment
- (iii) Sampling distribution
- (iv) Statistical hypothesis

(b) In the probability distribution below its known that  $E(x) = 3.2$

$X$	1	2	3	4	5
$\Pr(X = x)$	0.3		0.1	0.3	b

- i. Compute the values of a and b (4 mks)
- ii. Determine  $\text{Var}(2X)$  (4 mks)
- iii. Given that the variance of random variable  $X_i$  is given by  $\text{Var}(X_i) = \delta^2$ . Prove that the standard error (standard deviation of sampling mean  $\bar{X}$  is given by  $\text{s.e.} = \frac{\delta}{\sqrt{n}}$  (5 mks)

- (c) Explain the utility of fundamental statistical measures in conduction of medical research (4mks)
- (d) If 4% of drugs manufactured by a firm are in effective find the probability that in a sample of 200 pesticides
- i. At most 2 are in effective (2mks)
  - ii. At least 3 are ineffective (2mks)
- (e) The weight distribution of similar pests found in two counties Kisumu and Kakamega is shown in the following table.

County	Sample size	Mean weight (gms)	Standard deviation (gms)
Kisumu	120	50.25	0.9
Kakamega	110	50.45	0.5

- (i) Determine the combined mean (1mk)
- (ii) Determine which of the county has more variability in weight (4mks)

**QUESTION TWO (20 MARKS)**

- a) A medical research would like to test whether there is any difference in weights as a result of five different occupation sectors. He selects 56 workers in five sectors and tabulated their weights as below.

A	78.9	72.3	81.1	85.7			
B	63.5	74.1	75.5	80.8	71.3	79.4	
C	79.1	90.3	85.6	81.4	74.5	95.4	
D	87.0	91.2	75.3	79.4	80.7	82.8	89.6
E	75.9	77.2	81.5				

At 5% level of significance, test the null hypothesis that there is no significance difference in weights from the five occupation sectors. (14mks)

- b) Briefly describe the importance of predictions and hypothesis testing in medical research (6mks).

**QUESTION THREE (20 MARKS)**

- a) A researcher claimed that a certain female bacteria has less lifespan than the male bacteria. Challenged to support his claim, he recorded the lifespan of 10 female and 10 male bacteria in months.

Female	5.12	3.15	8.17	3.42	2.02	4.42	3.72	2.12	5.72	7.87
Male	5.83	6.49	4.45	5.12	9.02	9.73	5.42	6.43	8.79	8.89

Test the claim at 10% level of significance (12mks)

- b) The worms counts in children was found to have the following probability distribution function given below.

Worms Count (x)	50	100	150	200	250
P(x)	0.40	0.30	0.15	0.10	0.05

Determine

- (i) The expected worms count in children (3mks)
- (ii) The variance of worms count in children (3mks)
- c) Highlight two advantages of sampling over census (2mks)

**QUESTION FOUR (20 MARKS)**

- a) A sample of 200 people with a particular disease was selected .out of them, 100 were given a drug and the others were not given any drug. The results are as follows.

	Drug	No drug	Total
Cured	65	55	120
Not cured	35	45	80
Total	100	100	200

Test whether the drug is effective or not. (7 mks)

- b) A firm manufacturing vaccine coolant reported that on average its coolant will have a lifespan of 8 years with a standard deviation of 0.8 years. In a certain period they sold 3000 coolants and 600 of them were replaced for breaking down before the warrant period.
- (i) If the hospital buys a coolant from the firm, determine the probability that its lifespan will be,
- Less than 6.5 years (2mks)
  - Between 6 and 9 years. (3mks)
  - More than 8 years (1mk)
- (ii) Determine the firms warrant period for its vaccine coolants. (4mks)
- (iii) Determine the 95% confidence interval for the mean lifetime of the firm vaccine coolants. (3 mks)

**QUESTION FIVE (20MKS)**

- a) The weight gains in infants ( $y_i$ ) depends on the number of times they are dewormed ( $x_1$ ) and the number of times they are exposed to infections ( $x_2$ ). A research study has provided the following regression model and relevant information

$$y_i = 4.85 + 0.69x_1 - 0.52x_2$$

$$SE \quad (2.3), \quad (0.3) \quad (0.24)$$

$$r^2 = 0.76$$

- (i) Comment on the goodness of fit of the model (2mks)
- (ii) Test the significance of the three regression coefficients ( $\beta_s$ ) and comment on your results. (6 marks)
- b) Briefly explain the three principles experimental design giving examples how they can be applied in agricultural research. (6mks)
- c) The following data relates to yield in bags of four varieties of wheat each sown in three homogeneous plots. By completely randomized design technique, test the hypothesis of equal treatment means. (6 mks)

		<b>Varieties</b>			
		<b>A</b>	<b>B</b>	<b>C</b>	<b>D</b>
<b>Plots</b>	1	24	32	28	26
	2	19	17	20	21.5
	3	19	26	21	23