Faculty of Health, Applied Sciences and Natural Resources

Department of Health Sciences

QUALIFICATION : BACHELOR OF MEDICAL LABORATORY SCIENCES; BACHELOR OF HUMAN NUTRITION; BACHELOR OF SCIENCE IN HEALTH INFORMATION SYSTEMS MANAGEMENT; BACHELOR OF ENVIRONMENTAL HEALTH SCIENCES	
QUALIFICATION CODE: 08BMLS; 08BOHN; 08BOHS; 07BSHM	**LEVEL:** 5
COURSE CODE: HSS511S	**COURSE NAME:** HEALTH SCIENCE STATISTICS
SESSION: JUNE 2022	**PAPER:** THEORY
DURATION: 3 HOURS	**MARKS:** 100

FIRST OPPORTUNITY QUESTION PAPER	
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MODERATOR:	Dr Laria Aku-Akai

INSTRUCTIONS	
1.	Answer ALL the questions.
2.	**Part I** of this question paper entails multiple choice questions. Write down the letter corresponding to the best option for each question.
3.	For **Part II**, you are required to write only your final solution on the answer sheet.
4.	For **Part III**, you are required to show clearly all the steps used in the calculations.
5.	Write clearly and neatly.
6.	Number the answers clearly.

PERMISSIBLE MATERIALS

Nonprogrammable scientific calculator

THIS QUESTION PAPER CONSISTS OF 6 PAGES (Including this front page)

PART I: Write down the letter corresponding to the best option for each question.

QUESTION 1 [12 marks]

1.1. What is a sample space? **[2]**

    A. The sample from a national survey
    B. The space between events A and B
    C. The set of all possible outcomes of an experiment
    D. None of the above

1.2. Which of the following is not a correct statement about a probability? **[2]**

    A. It must have a value between 0 and 1
    B. It can be reported as a decimal or a fraction
    C. A value near 0 means that the event is not likely to occur/happens
    D. It is the collection of several experiments.

1.3. If you calculate the probability of an event and it turns out to be 0.7, you know that **[2]**

    A. the event is certainly going to happen.
    B. the event is probably not going to happen.
    C. the probability of it not happening is 0.3.
    D. you made a mistake.

1.4. Which of the following methods are used in presenting categorical (qualitative) data? **[2]**
    A. Bar charts, pie charts and Histogram
    B. Bar charts, pie charts and frequency distribution tables
    C. Mean, Median and Mode
    D. Variance, Standard deviation and Coefficient of Variation

1.5. A Nutritionist plans to have annual survey of nutritional content of child food at different retailors store. If each month has an equal chance of being selected, find the probability that the survey will be in a month that begins with letter J or A. **[2]**

    A. 5/12   B. 1/4
    C. 1/6   D. 5/2

1.6. At a hospital with 200 patients, 32 was diagnosed with HIV/AIDS, 18 diagnosed with TB and 8 with both HIV/AIDS and TB. If a patient is chosen at random, find the probability that a patient is HIV/AIDS positive or TB patient. **[2]**

    A. 4/25   B. 1/4
    C. 21/1000   D. 21/100

Part II [26 MARKS]: Short answer questions. You are required to write down only your final answer on your answer sheet.

QUESTION 2 [26 MARKS]

2.1. Classify each random variable as either discrete or continuous. **[3]**

    2.1.1. The number of arrivals at an emergency room between midnight and 6:00 am.

    2.1.2. The weight of new-born baby in kg.

    2.1.3. The number of accident-free days in one month at a factory.

2.2. The mean and median weight of 10 tetracycline capsules x_1, x_2, x_3, x_4,.., x_{10} are known to be 20 g and 24 g. The weight of new set of capsules is $y_i = 2x_i + 3$ g, where $i = 1, 2, …, 10$. Answer the following questions based on this information.

    2.2.1. $\sum_{i=1}^{10} x_i =$ _____ **[2]**

    2.2.2. $\sum_{i=1}^{10} y_i =$ _____ **[2]**

    2.2.3. $\bar{Y} =$ _____ **[2]**

    2.2.4. Median weight of the new set of capsules: ____ **[2]**

    2.2.5. Solve the following equations for x and provided your final answer on your answer sheet

        a) $\left(\frac{1}{3}\right)^{x-1} = 27$ **[2]**

        b) $25^{x^2} = 5^{3x+2}$ **[4]**

        c) $\frac{x+3}{2} + \frac{x-5}{4} = \frac{3}{8}$ **[2]**

        d) 2.4.4. $\frac{4}{x-1} > \frac{12}{2x+5}$ **[2]**

2.3. Let A and B be two events associated with an experiment and suppose that P(A)=0.2 while P(AUB)=0.6. Let P(B)=P

    2.3.1. For what choice of P are A and B mutually exclusive? **[2]**

    2.3.2. For what choice of P are A and B independent? **[3]**

Part III [62 MARKS]: show clearly all the steps used in the calculations

QUESTION 3 [15 MARKS]

3.1. A meteorologist interested in the consistency of temperatures in three cities during a given week collected the following data. The temperatures for the five days of the week in the three cities were summarized as follows. Which city have the most consistent temperature, based on this information? **[4]**

City	Average temperature	Standard deviation
City 1	26	40
City 2	27	50
City 3	30	60

3.2. At a ministry of health meeting on COVID-19 protection and control, there were 15 men and 24 women. Eight of the men and 10 of the women were selected to be a member of national task force. If a person is chosen at random, what is the probability that the person is a female or is a member of national task force. **[3]**

3.3. A company buys microchips from three suppliers A, B, and C. Supplier B has a record of providing microchips that contain 5% defectives; supplier A has a deflective rate of 10%; and supplier C has a defective rate of 2%. Suppose 20%, 35%, and 45% of the current supply came from Suppliers A, B, and C, respectively.

   3.3.1. If a microchip is selected at random from this supply, what is the probability that it is defective? **[5]**

   3.3.2. If a randomly selected microchip is defective, what is the chance it came from supplier B? **[3]**

QUESTION 4 [32 MARKS]

4.1. Table below relates the weights and heights of a group of individuals participating in an observational study.

Weight/height	Tall (T)	Medium (M)	Short (S)	Totals
Obese (O)	18	28	14	--
Normal (N)	20	51	28	--
Underweight (U)	12	25	9	--
Totals	--	--	--	--

   4.1.1. Find the probability that a randomly chosen individual from this group is Tall. **[2]**

   4.1.2. Find the probability that a randomly chosen individual from this group is Obese and Tall. **[2]**

   4.1.3. Are the events Obese and Tall independent? **[3]**

   4.1.4. Find the probability that a randomly chosen individual from this group is Obese given that the individual is Tall. **[2]**

4.2. The weights of children in pediatric ward at Katutura State Hospital are known to be normally distributed with a mean of 70 kg and a standard deviation of 13 kg.

   4.2.1. Find the percentage of children in a pediatric ward with weight below 90 kg. **[3]**

   4.2.2. Find the percentage of children in a paediatric ward with weights between 60 kg and 90 kg. **[5]**

4.3. The element titanium has five stable occurring isotopes, differing from each other in the number of neutrons an atom contains. If X is the number of neutrons in a randomly chosen titanium atom, the probability mass function of X is given as follows:

x	24	25	26	27	28
$p(x)$	0.2	0.3	0.25	0.1	0.15

4.3.1. Find probability that X is at least 26 **[2]**

4.3.2. Find the expected value of X. **[3]**

4.3.3. Variance and standard deviation of X **[5]**

4.3.4. If $Y = 2X + 4$, find the expected value and variance of Y **[5]**

QUESTION 5 [15 MARKS]

5. The daily calorie intake of patients suffering from obesity is summarised in the following table.

Calorie intake (kcal/day)	Number of patients
3800	12
4100	13
4400	28
4900	14
5200	15
5500	12
6000	6

5.1. Find daily average calorie intake of these patients **[4]**

5.2. Compute the variance and standard deviation of daily median calorie intake **[6]**

5.3. Find daily median calorie intake of these patients **[3]**

5.4. Find the model daily calorie intake of these patients **[2]**

BONUS QUESTION [5 Marks]

6. Measles is a highly contagious, serious disease caused by a virus. Previously known to result in major epidemics and millions of deaths each and every year, there was a sharp decline in measles-related deaths with the introduction of the measles vaccine in 1963. However, despite the availability of this effective vaccine, the disease still remains one of the leading causes of death among young children globally. Both vaccine efficacy and a critical vaccination coverage is needed to prevent large outbreaks. The measles vaccine is highly effective in preventing disease but vaccination coverage is insufficient in some areas. The World Health Assembly recommends that 90% of individuals in an area be vaccinated in order to achieve herd immunity, a form of indirect protection from infectious disease that occurs when a large percentage of a population has become immune to an infection and, consequently, individuals that are not immune are still partially protected from disease. In a particular area, 99.8% of individuals were either vaccinated or female, 44.7% of individuals were females who vaccinate, and 51.1% of individuals were female. Based on this information, has the critical vaccination level of 90% been achieved? What percentage of the individuals in this area were vaccinated?

============End of question paper==========