The Open University of Sri Lanka

Faculty of Natural Sciences

Diploma in Food Science
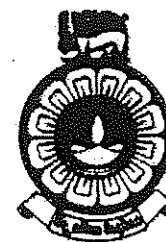
Department	: Chemistry
Level	: 3
Name of the Examination	: Final Examination
Course Title and Code	: Basic Mathematics & Statistics for Food Science (ADD3200)
Academic Year	: 2021-2022
Date	: 24th of September 2022
Time	: 9.30 a.m. – 11.30 a.m.
Duration	: Two hours

General Instructions

1. Read all instructions carefully before answering the questions.

2. This question paper consists of **04 questions. Answer all questions.**

3. The use of a non-programmable electronic calculator is permitted.

4. Write down all **relevant steps** and simplify your answer/s.

5. Use a pen not a pencil. Use the given book to write down answers.

6. Use blue or black ink to answer the questions.

7. Clearly state your **index number in your answer script.**

8. Involvement in any activity that is considered as an exam offence will lead to **punishment according to examination regulations.**

1) Simplify each of the following and determine whether each is rational or irrational. (Without proof, you may take $\sqrt{2}$ and $\sqrt{3}$ as irrational numbers.)

   a) $\frac{2}{2-\sqrt{3}} + 3\sqrt{3}$ c) $\sqrt{2}\left(\left(1+\sqrt{2}\right)^2 - \left(1-\sqrt{2}\right)^2\right)$

   b) $\left(\sqrt{2}+\sqrt{3}\right)^3 - \left(\sqrt{2}-\sqrt{3}\right)^3$ d) $\frac{(1-\sqrt{3})}{\sqrt{3}}$

(20 marks)

ii) Let $x = \frac{1}{2-\sqrt{3}}$. Find positive integers a and b such that $x = a + \sqrt{b}$.

   a) Simplify $\sqrt{2x}$ and show that $x - \sqrt{2x} = 1$.
   b) Show that x satisfies the equation $x^3 - 2x^2 - 7x + 2 = 0$.

(40 marks)

iii) Write down each of the following real numbers in the Scientific notation.
   a) 0.0000478   b) 203.14001   c) 2999.0032   d) -908

(20 marks)

iv) Find the number of digits in each of the following and approximate each value to the second decimal place.
   a) 3002.10347   b) 0.090716   c) -1000.876901   d) -102.00923

(20 marks)

2) i) Find the prime factorizations of 300 and 250.
Using the prime factorization or otherwise, calculate the least common multiple of 300 and 250.
Based on the prime factorization or otherwise, state whether each of the following statements is true or false. In each case, give reasons for your answer.

   a) The number $\frac{250}{300}$ is a rational number in the standard form.
   b) The number $\frac{250}{300}$ is a proper fraction.
   c) The numbers 300 and 250 are relatively prime numbers.
   d) The number 250 is a square number.

(40 marks)

ii) In packaging a certain food item, one inner wrapping sheet and one outer wrapping sheet is used, for each packet. The inner wrapping sheets are received in bundles of 300 sheets in each and the outer wrapping sheets are received in bundles of 250 sheets in each. Using the results from part (i) or otherwise, calculate the minimum numbers of inner and outer wrapping paper bundles needed, if both types of wrapping sheets are to be used with no left over from each type. Also calculate the number of packets of food that can be packeted using the calculated numbers of wrapping paper bundles.

(20 marks)

iii) If $\log_2 3 = m$, $\log_2 5 = n$, find the values of each of the following, in terms of m and n:
   a) $\log_3 2$ b) $\log_2 75$ c) $\log_3\left(\frac{2}{3}\right)$ d) $\log_5\left(\frac{5}{2}\right)$

Substituting $\log_2 x = t$, find x that satisfy the equation $\log_2 x - 2\log_x 2 - 1 = 0$.

(40 marks)

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3) The variables V_1, V_2, V_3, V_4 and V_5 described below, were selected from a questionnaire used in a study on consumer satisfaction with regards to a certain brand of cereal bars

V_1: Opinion on the size (weight) of the cereal bar
   1: prefer to be smaller; 2: just right; 3: prefer to be bigger

V_2: Most concerned factor when purchasing cereal bars
   1: price; 2: taste; 3: nutritional value; 4: artificially added flavours; 5: other

V_3: Number of months you have been consuming this brand of cereal bars
   1: less than 6; 2: 6 - 12; 3: 13 - 18; 4: more than 18

V_4: Number of members in the family

V_5: Total amount of bill (to the nearest rupee), per visit

i) Classify each variable as qualitative or quantitative.

(10 marks)

ii) Classify the quantitative variables as discrete or continuous.

(10 marks)

iii) Classify the data as nominal, ordinal, interval, or ratio.

(15 marks)

iv) The following frequency table summarises the data collected on V_5 of a sample of consumers at a particular sales outlet.

Total bill (rupees)	Number of consumers
100 - 499	16
500 - 999	24
1000 – 1499	32
1500 - 1999	41
2000 - 2499	17

a) What is the sample size used for the data presented in the above frequency table?

(10 marks)

b) Estimate the expected bill amount of a randomly chosen consumer from this sales outlet.

(30 marks)

c) Calculate the relative cumulative frequency corresponding to the third class interval and clearly explain what it measures in relation to this study.

(15 marks)

d) Suggest a suitable graph that can be used to examine whether the data has a symmetric distribution or not. **You need not construct the graph.**

(10 marks)

4) The following summary statistics were computed from the temperatures ($^\circ C$) measured on 200 food samples, five weeks after adding a known amount of a food preservative to each sample.

Description	Mean	Median	Mode	5% trimmed mean	First quartile	Third quartile	Standard deviation
temperature	32.61	32	34	32.5	30	35	3.98

i) Name three measures of central tendency that can be calculated from the summary table given above and give the values of each.

(20 marks)

ii) Name three measures of dispersion that can be calculated based on the summary table given above and give the values of each.

(20 marks)

iii) Based on the values given in the table, a student made the following conclusions. In each case, giving reasons, state whether you agree with the conclusion made by the student or not. If the given information is not adequate to draw the conclusion, state that the information is not adequate.

a) Since the values of mean and median are close, the data set cannot have extreme observations.

(15 marks)

b) Since the values of 5% trimmed mean and median are close, the data are likely to follow a symmetric distribution.

(15 marks)

c) Since the median has nearly the same deviation from the first and the third quartile, the data are likely to follow a symmetric distribution.

(15 marks)

d) **Suppose food samples with temperature greater than 40 are considered as spoiled.** Percentage of spoiled samples among the inspected samples is less than 25%.

(15 marks)

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