

THE OPEN UNIVERSITY OF SRI LANKA - CITES
 Department of Mathematics and Philosophy of Engineering
 Bachelor of Software Engineering Honours Study Programme
 Final Examination (2021/2022) Batch 3
 MHZ3459: Basic Mathematics for Computing



Date: 26th November 2022 (Saturday)

Time: 09:30 hrs. - 12:30 hrs.

Instructions:

- This paper consists of Five (5) questions in Two (2) pages.
- Answer to all the questions.
- Show all your workings.

1. (a) Let $A = \begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}$, $P = \begin{bmatrix} -1 & 1 \\ 1 & 1 \end{bmatrix}$. Then find PAP^{-1} . [25%]

(b) Answer to following questions using the value of $\det \begin{pmatrix} -1 & 3 & 1 \\ -3 & 4 & 1 \\ 2 & 2 & 1 \end{pmatrix}$.

- i. Are the points $A = (-1, 3)$, $B = (-3, 4)$, $C = (2, 2)$ co-linear? Justify your answer. [20%]
 - ii. If points A, B, C are not co-linear find the area of triangle ABC . [5%]
- (c) Solve the following system of linear equations by using the Cramer's rule. [50%]

$$\begin{aligned} -x + 3y + z &= 2 \\ -3x + 4y + z &= -1 \\ 2x + 2y + z &= 1. \end{aligned}$$

2. (a) Every five minutes, a scientist records the distance between two specific objects. In the first 20 minutes, the distances were as follows: 15mm, 12.5mm, 14mm, 16.5mm, and 17mm. Use Newton's backward difference interpolation to determine an approximation of the distance between the two objects at the first 18 minutes. [50%]
- (b) Use the method of False Position to find the value of $\sqrt{5}$ round to three decimal places.
 (Hint: Note that $2 \leq \sqrt{5} \leq 3$.) [50%]
3. (a) A sphere is expanding in such a way that its volume is changing in the rate of $r^3 - 5r^2 + 6r$ cubic meters per second when the radius is r meters.
 - i. Determine the rate at which surface area changes when the radius is 1 meter. [25%]
 - ii. Find the range of the radius r , that increases the surface area. [10%]

- (b) Let $f(x) = \frac{18}{9 - x^2}$.
- Sketch the graph of $y = f(x)$. Justify all the maxima/minima/inflection points and asymptotes of f if there are any. [35%]
 - Find the area bounded by curve $y = f(x)$, $x = 0$, $x = 1$ and, $y = 0$. [30%]
4. (a) How many terms of the sequence 28, 26, 24, ... should be taken so that their sum is zero. [30%]
- (b) According to a survey of a group of people, 55 of them liked tea, 35 liked coffee, and 45 liked milk. 10 liked coffee as well as tea, 20 liked milk as well as coffee, and 15 liked tea as well as milk. And 14 of them liked only milk. Assuming every participants like at least one of drink answer to following questions.
- Draw a complete Venn-Diagram according to given above details. [40%]
 - How many of them liked all three drinks? [8%]
 - How many of them liked coffee only? [7%]
 - How many of them liked only coffee and tea? [7%]
 - How many people participated in the survey? [8%]
5. (a) The time taken in minutes to install an anti-virus program on 25 computers are as follows.
- | | | | | | | | | | | | | |
|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 11 | 19 | 24 | 30 | 12 | 20 | 25 | 29 | 15 | 21 | 24 | 31 | 16 |
| 23 | 25 | 26 | 32 | 17 | 22 | 26 | 35 | 18 | 24 | 18 | 27 | |
- Construct a table displaying class intervals, frequencies, and relative frequencies by choosing the class size as 5. [25%]
 - Determine the central tendency measures (Mode, Median, Mean) for the sample data. [25%]
 - Draw the histogram for the above frequency distribution in part (a). [15%]
 - Describe about the shape of the distribution of above histogram. [10%]
- (b) A bus can accommodate four more passengers. Seven teenagers, two women, and one child, on other hand want to board. The bus driver chooses four of these people at random and allows them board. Determine the probability that
- four teenagers will be allowed to board. [10%]
 - two teenagers, one child, and one woman will be allowed to board. [15%]

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