NATIONAL SCHOOL OF BUSINESS MANAGEMENT

BSc. in Management Information Systems (Special) – 20.2

BSc. (Honours) in Software Engineering – 20.2

BSc. (Honours) in Computer Science – 20.2

BSc. (Honours) in Computer Networks – 20.2

Year 01 Semester 01 Examination

10 January 2021

MA101.3 – Mathematics for Computing

Instructions to Candidates

1) Answer all questions
2) Total Number of Pages is five (05)
3) Time allocated for the examination is three (03) hours and 30 minutes (Including downloading and uploading time)
4) Weightage of Examination: 60% out of final grade
5) Download the paper, provide answers to the selected questions in a word document.
6) Please upload the document with answers (Answer Script) to the submission link before the submission link expires
7) Answer script should be uploaded in PDF Format
8) Under any circumstances E-mail submissions would not be taken into consideration for marking. Incomplete attempt would be counted as a MISSED ATTEMPT.
9) The Naming convention of the answer script – Module Code_Subject name_Index No
10) You must adhere to the online examination guidelines when submitting the answer script to N-Learn.
11) Your answers will be subjected to Turnitin similarity check, hence, direct copying and pasting from internet sources, friend's answers etc. will be penalized.

Question 1 (Laws of Indices and Set Theory) **[20 marks]**

1. Simplify the following by using the laws of indices. (05 marks)
   i. $(b^4)^3 b^{-2}$
   ii. $(-3x)^2 + 3x^2$
   iii. $\left(\frac{x}{y}\right)^2 x^2 y$
   iv. $\frac{a^{-3}b^7}{a^5 b^3}$
   v. $\frac{4^{20}-4^{18}}{4^{18}}$

2. Fill in the blanks with $\in$, $\notin$, $\subseteq$, = or ≠. Note that each symbol can be used more than once. (05 marks)
   i. a ---------- {a, b, c, d}
   ii. {4, 5} ---------- {1, 2, 3, 4, 5}
   iii. {b, c} ---------- {a, {b, c}, d}
   iv. -4 ---------- {1, 2, 3, 4, 5}
   v. {1,-2/3} --------- { x|3x^2 -x -2=0 and x is a real number}

3. Given the universal set U= {1, 3, 5, 7, 9, 11}, A= {1, 3, 5}, B= {3, 5, 7}, C= {3, 7} Find the following:

   i. All subsets of C (02 marks)
   ii. A ∩ B (02 marks)
   iii. (A – C) ∪ B (02 marks)

4. X and Y are two sets. If $Y \subset X$, $|X| = 16$, $|Y| = 5$, $|X'| = 8$, find the following:
   i. $|Y'|$ (02 marks)
   ii. Number of elements in the universal set (02 marks)

Question 2 (Propositional Logic) **[20 marks]**

1. Given that p, q and r are propositions, construct truth tables and verify the following:
   i. $\sim(p \wedge q) = (\sim p) \vee (\sim q)$ (03 marks)
   ii. $\sim(p \vee q) \vee (\sim p \wedge q) = \sim p$ (04 marks)
   iii. $\sim(\sim(p \vee q) \vee \sim(p \vee r)) = p \vee (q \wedge r)$ (04 marks)

2. Determine whether the following compound propositions are tautologies, contradictions or contingent propositions?
   i. $p \vee (r \wedge \sim r)$ (03 marks)
   ii. $\sim (p \vee q) \Leftrightarrow \sim (q \vee p)$ (03 marks)
   iii. $(p \vee q) \Rightarrow (p \wedge q) \vee q$ (03 marks)

Question 3 (Matrix Algebra) **[20 marks]**

1. Let $A = \begin{bmatrix} 2 & a & 3 \\ -1 & b & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & -1 & a \\ 1 & b & 0 \end{bmatrix}$ and $P = \begin{bmatrix} 4 & 1 \\ 2 & 0 \end{bmatrix}$ where $a, b \in \mathbb{R}$. It is given that $AB^T = P$ where B^T denotes the transpose of matrix B.

   i. Find a and b (02 marks)
   ii. Find $B^T A$ (03 marks)
   iii. Write down P^{-1} and using it find the matrix Q such that $PQ = P^2 + 2I$ where I is the identity matrix of order 2. (05 marks)

2. Solve the following system of linear equations using matrix inversion. (10 marks)

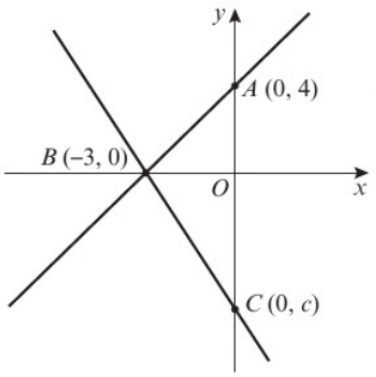
$$x - 3y + 2z = 9$$
$$3x + z - y = 8$$
$$-x + y - 4z = -1$$

Question 4 (Coordinate Geometry) **[20 marks]**

1. The general form of an equation of a straight line (L_1) is 6x+3y+12=0. Find the slope and the intercept? (02 marks)

2. The straight line L_2 passes through $(0, 6)$ and has the slope -2. It intersects the line with equation $5x - 8y - 15 = 0$ at point P. Find the coordinates of P. (04 marks)

3. The points A and C lie on the y-axis and the point B lies on the x-axis as shown in the diagram. The line line though points A and B is perpendicular to the line through points B and C.



i. Find the value of c (04 marks)

ii. Find the line equations of the the 3 sides of the triangle ABC (04 marks)

iii. Find the equation of the circle through the points A, B and C (04 marks)

iv. Hence find the radius and the center of the above circle (02 marks)

Question 5 (Statistics) **[20 marks]**

1. Briefly describe the 'Median' by giving an example. (02 marks)

2. The following data selected randomly, represent the daily temperature measurements (in Celsius degrees) of eleven days of a town.

   23, 27, 28, 19, 32, 28, 34, 20, 28, 18 and 25

   Find the interquartile range (03 marks)

3. Following table shows the mark distribution of students in a certain class for a Mathematics test. Note that frequencies of the mark ranges 20 – 40 and 60 – 80 are missing in the table. However, the mode and the median of the given grouped data are known as 48 and 50 respectively.

Range of Marks	Number of Students
00 – 20	14
20 – 40	f_1
40 – 60	27
60 – 80	f_2
80 – 100	15

Calculate the following:

i. f_1 and f_2 (03 marks)

ii. Mean (03 marks)

iii. Standard Deviation (04 marks)

4. The scores of two batsmen who played 5 consecutive 20 over matches in a tournament are shown in the table below. Identify which batsman is more consistent batsman? Justify your answer with appropriate calculations. (05 marks)

Batsman-1	41	38	40	42	39
Batsman-2	120	5	60	0	15

Note: Median, Mode and Variance for grouped data are calculated as follows:

$$Median = L + \frac{\left(\frac{n}{2}\right) - m}{f} \times c \qquad Mode = L + \frac{(f_1 - f_0)}{(f_1 - f_0) + (f_1 - f_2)} \times c \qquad s^2 = \frac{\sum f_i (x_i - \bar{x})^2}{n - 1}$$

End of Paper