061006T4ICT

COMPUTER SCIENCE LEVEL 6

ICT/OS/CS/CR/03/6/A

UNDERSTAND MATHEMATICS FOR COMPUTER SCIENCE

NOV/DEC 2023

TVET CURRICULUM DEVELOPMENT, ASSESSMENT AND CERTIFICATION COUNCIL (TVET CDACC)

WRITTEN ASSESSMENT

TIME: 3 Hours

INSTRUCTIONS TO CANDIDATE

1. *The paper consists of **two** sections: **A** and **B***
2. *Answer **ALL** questions in Section **A** and any **Three** from section **B***
3. *Marks for each question are indicated in the brackets*
4. *A separate answer booklet will be provided*
5. *Do not write on the question paper*

Candidates should answer the questions in English

This paper consists of FOUR (4) printed pages

Candidates should check the question paper to ascertain that all pages are printed as indicated and that no questions are missing

SECTION A: (40 MARKS)

(Answer ALL the questions in this section)

1. Using examples, distinguish between row matrix and column matrix. (2 Marks)
2. Explain independent event as used in probability theory (2 Marks)
3. Simplify the given equation into a quadratic equation (2 Marks)

$$\frac{y+2}{5} = \frac{7}{y}$$

4. Explain the following terms: (4 Marks)
   (i) Linear interpolation
   (ii) Linear Extrapolation
5. Set B is formed by elements $x_1, x_2, \ldots x_n$. Where x_i is a positive integer greater than five (5). Represent set B using *set builder* notation (2 mark)
6. Convert the following numbers to the base indicated and show your workings: (4 Marks)
   (i) $20D_{16}$ to Decimal
   (ii) 1010011_2 to Octal
7. (a) Explain the following terms as used in matrices: (3 Marks)
   (i) Vector matrix
   (ii) Lower diagonal matrix
   (iii)Singular Matrix

   (b) Given matrix M and N, state the necessary conditions for the following operations: (4 Marks)
   (i) NM
   (ii) M+N
8. (a) Distinguish between injective function and subjective function (4 Marks)

   (b) Find the derivative of $f(x) = 6x^3 - 9x+4$ (2 Marks)
9. a) Explain the following terms: (4 Marks)
   (i) AND
   (ii) OR

   (b) If A={x, y, z} and B={p, q, r}. Explain the intersection of A and B. (1 mark)

   (c) Given set S={4,5,6,7}. Find the number of subsets of *P*(S). (1 mark)
10. Draw the logic gate that represent K = MN + PQ (3 Marks)
11. Represent $A \cup B = \{x \mid x \in A \vee x \in B\}$ using a Venn Diagram (2 Marks)

SECTION B: (60 MARKS)

(Answer any THREE questions in this section)

12. (a) Compute the power series representation for the function f(x) and determine the intervals of convergence. (5 Marks)

(b) Given that U = {a,b,c,d,e,f,g,h}, A = {a,c,e}, B={a,b,e,f} and C={f,g,h}

Determine; (6 Marks)

(i) $B^c \cap B$

(ii) $A \cup (B-C)$

(iii) $A \cup B \cap A \cap B$

(c) Given that function f() and g() are differentiatable at x, then proof that:

$(f+g)'(x) = f'(x) + g'(x)$ (4 Marks)

(d) Let p and q be the propositions such that;

p: is below freezing.

q: is snowing.

Write these propositions using p and q and logical connectives (5 Marks)

(i) It is below freezing, is necessary and sufficient for it to be snowing.

(ii) It is not below freezing and it is not snowing.

(iii)It is below freezing and snowing.

(iv)It is below freezing but not snowing.

(v) Either it is below freezing or it is snowing, but it is not snowing if it is below freezing

13. (a) Using crammers' method, solve (5 Marks)

$7x_1 - 8x_2 + 5x_3 = 5$

$-4x_1 + 5x_2 + 3x_3 = -3$

$x_1 - x_2 + x_3 = 0$

(b) Construct a combinatorial circuit using inverters, OR gates, and AND gates that produces the output $((\neg p \vee \neg r) \wedge \neg q) \vee (\neg p \wedge (q \vee r))$ from input bits p, q and r. (5 Marks)

(c) Given the data below, apply newton's forward difference formula to;

f(x)	1	0	1	10
x	0	1	2	3

(i) Generate the difference table (5 Marks)

(ii) Solve the inequality $4(x + 2) - 1 > 5 - 7(4 - x)$ (5 Marks)

14. a) Given the frequency table below, present the information on a: (5 Marks)

TV Preference	Yes	No	No response
Frequency	451	155	141

(i) Pie chart

(ii) Bar graph

(b) Evaluate: (5 Marks)

$$\int \left(4x^3 - 9x^2 + 7x + 3\right)e^{-x}\,dx$$

(c) Given that: (7 Marks)

$$\mathrm{K}=\begin{pmatrix}-1 & 2\\ 3 & 5\\ 8 & 3\end{pmatrix}\quad \mathrm{L}=\begin{pmatrix}9 & 3 & 4\\ 1 & 0 & 7\end{pmatrix}\quad \mathrm{M}=\begin{pmatrix}0 & 3 & -7\\ 2 & -1 & 8\end{pmatrix}$$

Find:

(i) (KL)M

(ii) (L+M) K

d) Let $f(x) = x^2 – 3x + 2$: (3 Marks)

Find f(x+3)

15. a) In observation on a certain highway, it was noted that 3 potholes existed for every 240 meters. A random length of 900 meters was selected from highway.

(i) Model this problem as Poisson Probability distribution (3 Marks)

(ii) Determine the probability of getting exactly 10 potholes on the selected length (2 Marks)

(iii) Determine the probability of getting between 4 and 6 potholes inclusive on the selected length of the highway (3 Marks)

(b) Using binomial expansion evaluate (1.002)3 to 4 decimal places (4 Marks)

(c) Using binomial theorem, expand the binomial expression (5 Marks)

(4x + 2y)5

(d) Find the equation of straight line that passes through P (-5, 4) and the gradient is 2 (3 Marks)

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