kasneb

DICT LEVEL I

COMPUTER MATHEMATICS

MONDAY: 17 May 2021. **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a) Perform the following octal operations:

(i) $1_8 + 4_8 + 2_8$. (1 mark)

(ii) $1_8 + 5_8 + 6_8$. (1 mark)

(iii) $7346_8 + 5263_8$. (2 marks)

(b) Convert the hexadecimal number $39.B8_{16}$ to its decimal equivalent. (3 marks)

(c) Convert 0.3123_4 to decimal form. (2 marks)

(d) Perform the following hexadecimal operations:

(i) $83A7F4_{16} + B5B63_{16}$. (2 marks)

(ii) $4C.3E_{16} + 2.5D8_{16}$. (2 marks)

(e) Suppose that a computer uses 6–bit BCD code, with odd parity. Explain how the computer could store the following names:

(i) MARC. (2 marks)

(ii) ERIK. (2 marks)

(f) Perform the following binary operations:

(i) 110110 x 101. (2 marks)

(ii) Determine the two's complements of the binary number 11100111. (1 mark)

(Total: 20 marks)

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QUESTION TWO

(a) An inverter in logic systems has a single input and a single output.

Highlight three applications of an inverter in logic systems. (3 marks)

(b) A tautology is a statement or formula that is always true.

Demonstrate that the proportion: $PV\sim(p\wedge q)$ is a tautology. (5 marks)

(c) Construct a truth table for the formula:

$\neg P \wedge (P \rightarrow Q)$

(4 marks)

(d) Two dice are tossed once. Let "A" be the probability that the product of the outcomes is even and let "B" be the probability that the product of the outcomes is odd.

Required:

(i) A contingency table showing all elements of the sample space. (4 marks)

(ii) P(A) from the sample space. (2 marks)

(iii) P(B) from the sample space. (2 marks)

(Total: 20 marks)

QUESTION THREE

(a) An apartment building has 45 apartments with the following numbers of tenants:

2,	1,	3,	5,	2,	2,	2,	1,	4,	2,	6,	2,	4,	3,	1,
2,	4,	3,	1,	4,	4,	2,	4,	4,	2,	2,	3,	1,	4,	2,
3,	1,	5,	2,	4,	1,	3,	2,	4,	4,	2,	5,	1,	3,	4

Required:

(i) Represent this data in a histogram. (4 marks)

(ii) Calculate the mean number of tenants. (3 marks)

(iii) Calculate the standard deviation of the tenants. (5 marks)

(b) Solve the following simultaneous equations:

(i)
$$47x + 33y = 75$$
$$33x + 47y = 5$$
(2 marks)

(ii)
$$4/x + 5y = 7$$
$$3/x + 4y = 5$$
(2 marks)

(c) Two years ago, a father was five times as old as his son. Two years from today, his age will be 8 years more than 3 times the age of the son.

Required:

Find the present ages of father and son. (4 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Define each of the following terms as used in matrices:

(i) Singular matrix. (2 marks)

(ii) Diagonal matrix. (2 marks)

(iii) Equality of a matrix. (2 marks)

(b) Given that $A = \begin{pmatrix} 3 & 2 \\ 2 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 2 \\ 4 & -1 \end{pmatrix}$

Show that:

$\det(A) \times \det(B) = \det(AB)$. (5 marks)

(c) Using matrices, calculate the values of x and y for the following simultaneous equations:

$$2x - 2y - 3 = 0$$
$$8y = 7x + 2$$

(4 marks)

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(d) A group of 40 high school students were surveyed about the science courses that they had enrolled to study out of the following:

Chemistry - C
Physics - P
Biology - B

The result of the survey was as follows:

- 22 students study chemistry.
- 18 students study physics.
- 14 students study biology.
- 9 students study both chemistry and physics.
- 7 students study both chemistry and biology.
- 5 students study both physics and biology.
- 2 students study all the three courses.

Required:

(i) A venn diagram to illustrate the data above. (4 marks)

(ii) The number of students not taking any of the courses above. (1 mark)

(Total: 20 marks)

QUESTION FIVE

(a) Let: $A = \{a, b, c, d, e\}$ and
$B = \{a, b, c, d, e, f, g, h\}$

Find:

(i) $A \cup B$. (1 mark)

(ii) $A \cap B$. (1 mark)

(iii) $A - B$. (1 mark)

(b) The length of a rectangular field is 25 metres more than its width. The perimeter of the field is 450 metres.

Required:

(i) The actual width and length of the field. (2 marks)

(ii) The area of the field. (2 marks)

(c) Three horses A, B and C are in a race. A is twice as likely to win as B, and B is twice as likely to win as C.

Required:

(i) Find their respective probabilities of winning denoted by P(A), P(B) and P(C). (4 marks)

(ii) Find the probability that B or C wins. (3 marks)

(d) A survey of men (M), women (W) and children (C) concerning their preference of beef (B), chicken (CH) and fish (F); yielded the following results:

	Beef (B)	Chicken (CH)	Fish (F)
Men (M)	440	310	275
Women (W)	390	280	325
Children (C)	140	410	40

Required:

Using the data provided above, find each of the following:

(i) $n(W \cap CH)$. (2 marks)

(ii) $n(B \cap C')$. (2 marks)

(iii) $n(M \cap (B \cup F))$. (2 marks)

(Total: 20 marks)

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