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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

**FINAL EXAMINATION
SEMESTER II
SESSION 2018/2019**

COURSE NAME : DISCRETE STRUCTURE
COURSE CODE : BIT 11003
PROGRAMME CODE : BIT
EXAMINATION DATE : JUNE / JULY 2019
DURATION : 3 HOURS
INSTRUCTION : A) ANSWER ALL QUESTIONS
B) PLEASE WRITE YOUR
ANSWERS IN THIS QUESTION
BOOKLET
C) CALCULATOR IS NOT
ALLOWED

THIS QUESTION PAPER CONSISTS OF **NINE (9)** PAGES

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Q1 (a) Determine the truth value for the following propositions based on scenario in Figure **Q1(a)**.

Suppose that during the most recent fiscal year, the annual revenue of Acme Computer was 138 billion dollars and its net profit was 8 billion dollars, the annual revenue of Nadir Software was 87 billion dollars and its net profit was 5 billion dollars, and the annual revenue of Quixote Media was 111 billion dollars and its net profit was 13 billion dollars.

FIGURE Q1(a)

(i) Quixote Media had the largest annual revenue.
Answer : (1 mark)

(ii) Nadir Software had the lowest net profit and Acme Computer had the largest annual revenue.
Answer : (1 mark)

(iii) Acme Computer had the largest net profit or Quixote Media had the largest net profit.
Answer : (1 mark)

(iv) If Quixote Media had the smallest net profit, then Acme Computer had the largest annual revenue.
Answer : (1 mark)

(v) Nadir Software had the smallest net profit if and only if Acme Computer had the largest annual revenue.
Answer : (1 mark)

(b) Let p , q , and r be the propositions
 p : Grizzly bears have been seen in the area.
 q : Hiking is safe on the trail.
 r : Berries are ripe along the trail.

Write these propositions using p , q , and r and logical connectives (including negations).

(i) Berries are ripe along the trail, but grizzly bears have not been seen in the area.
Answer : (2 mark)



- (ii) Grizzly bears have not been seen in the area and hiking on the trail is safe, but berries are ripe along the trail.

Answer : (2 mark)

- (iii) If berries are ripe along the trail, hiking is safe if and only if grizzly bears have not been seen in the area.

Answer : (2 mark)

- (iv) It is not safe to hike on the trail, but grizzly bears have not been seen in the area and the berries along the trail are ripe.

Answer : (2 mark)

- (c) Let ψ be the formula

$$\psi = (\sim (p \rightarrow q)) \rightarrow (q \wedge \sim r)$$

Obtain a Disjunctive Normal Form (DNF) and Conjunctive Normal Form (CNF) for ψ .

(7 marks)

Answer:

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Q2 (a) Prove by definition that $A - (B \cap C) = (A - B) \cup (A - C)$.

(7 marks)

Answer:

(b) In a survey of 85 people it is found that 31 like to drink milk 43 like coffee and 39 like tea. Also 13 like both milk and tea, 15 like milk and coffee, 20 like tea and coffee and 12 like none of the three drinks. Find the number of people who like all the three drinks. Display the answer using Venn Diagram.

(8 marks)

Answer:

(c) If $A = \{1, 2, 3\}$, $B = \{2, 4, 6, 8\}$ and the universal set $U \in \mathbb{N}$

(i) $A - B$

(1 marks)

Answer :

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(ii) B^c (1 marks)

Answer :

(iii) $P(A)$, the power set of A (1 marks)

Answer :

(iv) $A \times A$ (2 marks)

Answer :

Q3 (a) Use mathematical induction to prove that $4^n - 1$ is divisible by 3 for integers $n \geq 1$ (10 marks)

Answer:

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Q4 (a) Find relation R , $\text{Domain}(R)$, $\text{Range}(R)$ for the following questions

(i) Let $A = \{2, 3, 4\}$ and $B = \{3, 4, 5, 6, 7\}$, given that aRb if and only if a divides b .

(3 marks)

Answer:

(ii) Let $A = \{1, 2, 3, 4\}$, given that aRb if and only if $a \leq b$.

(3 marks)

Answer:

(b) Determine whether the relation R on the set of all Web pages is reflexive, symmetric, anti-symmetric, and/or transitive, where $(a, b) \in R$ if and only if

(i) everyone who has visited Web page a has also visited Web page b .

(1 marks)

Answer:

(ii) there are no common links found on both Web page a and Web page b .

(1 marks)

Answer:

(iii) there is at least one common link on Web page a and Web page b .

(1 marks)

Answer:

(iv) there is a Web page that includes links to both Web page a and Web page b .

(1 marks)

Answer:

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- (c) Let $B = \{0, 1, 2, 3\}$ and a relation R on A be given by
 $R = \{(0, 0), (0, 1), (0, 3), (1, 0), (1, 1), (2, 2), (3, 0), (3, 3)\}$

- (i) Draw the digraph that illustrates the relation R (9 marks)

Answer:

- (ii) Is R an equivalence relation? Justify your answer (6 marks)

Answer:

- Q5** (a) Consider the algorithm shown in **Figure Q5**. This algorithm calculates the product of matrices $a[]$ and $b[]$, and stores the result in matrix $c[]$. Determine a time complexity $T(n)$ estimate for the execution time of the algorithm for matrix multiplication.

```

Procedure mmult(a[1 to n, 1 to n], b[1 to n, 1 to n]:real)
begin
  for i := 1 to n
    for j := 1 to n
      begin
        c[i, j] := 0
        for k := 1 to n
          c[i, j] := c[i, j] + a[i, k] * b[k, j]
        end
      end
    end
  end

```

Figure Q5

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(10 marks)

Answer:

(b) Consider the following algorithm:

```
Procedure sum(n: positive integer)
s := 0
for i := 1 to n
  for j := 1 to i
    s := s + j
  return s
```

(i) Suppose that procedure sum is started with input $n = 4$. Then what number is returned by the algorithm?

(2 marks)

Answer:

(ii) What is the worst-case time complexity of procedure sum?

(3 marks)

Answer:

- END OF QUESTIONS-

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