Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER I
SESSION 2018/2019

COURSE NAME	:	DISCRETE STRUCTURE
COURSE CODE	:	BIT 11003
PROGRAMME CODE	:	BIT
EXAMINATION DATE	:	DECEMBER 2018 / JANUARY 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 **TEN (10)** PAGES

Q1 (a) Determine whether the following set identity is true using Venn diagram. $(A - B) - C \subseteq A - C$

(6 marks)

Answer:

(b) By definition of Difference in set operations, demonstrate that $A - B = A \cap \bar{B}$ using a typical element argument.

(5 marks)

Answer:

(c) Let set $A = \{1, a, \{3, t\}, 4\}$.

(i) Find the cardinality of A (1 mark)

Answer:

(ii) Identify the truth value of the statement, $3 \in A$.

(1 mark)

Answer:

(iii) Provide the reason of your answer in c(ii). (2 marks)

Answer:

Q2 (a) If p is true, q is false, and r is true, what is the truth value of each statement?

(i) $(p \vee \sim q) \Rightarrow \sim q$ (2 marks)

Answer:

(ii) $(\sim p \wedge q) \Rightarrow \sim r$ (2 marks)

Answer:

(iii) $(p \vee \sim q) \Leftrightarrow \sim(p \wedge q)$ (2 marks)

Answer:

(b) A restaurant displays the sign "Good food is not cheap" and a competing restaurant displays the sign "Cheap food is not good". Use the truth table to verify whether the two restaurants saying the same thing.

(7 marks)

Answer:

(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:

Q3 (a) Prove by mathematical induction that $3 \mid n^3 - n$ for every positive integers n.

(10 marks)

Answer:

(b) Prove that $1 .2 + 2 .3 + 3 . 4 + \ldots\ldots\ldots\ldots + n(n+1) = \frac{n(n+1)(n+2)}{3}$ is true by using mathematical induction method.

(10 marks)

Answer:

Q4 (a) Define Euler circuit.

(2 marks)

Answer:

(b) Suppose that in a group of 5 people: A, B, C, D, and E, the following pairs of people are acquainted with each other.

- A and C
- A and D
- B and C
- C and D
- C and E

(i) Sketch a graph G to represent this situation.

(3 marks)

Answer:

(ii) Draw an adjacency matrix for G.

(5 marks)

Answer:

Q5 (a) Given $X = \{1, 2,3,4,5,6\}$ and a relation R on X is define as

$R = \{(1,2), (2,1), (2,3), (3,4), (4,5), (5,6)\}$. Describe

(i) If R is reflexive. Give the reason. (1 mark)

Answer:

(ii) If R is symmetric. Give the reason. (1 mark)

Answer:

(iii) If R is transitive. Give the reason. (1 mark)

Answer:

(b) Let $R = \{(1, u), (1, v), (2, w), (3, w)\}$ and

$S = \{(u, 1), (v, 2), (v, 3), (w, 3), (x, 4), (y, 1), (y, 4)\}$.

(i) Examine $S \circ R$ .Then find $S \circ R$.

(4 marks)

Answer:

(ii) Examine $R \circ S$ .Then find $R \circ S$

(3 marks)

Answer:

(c) (i) Draw the graphical representation for the relation

$\{(a, a), (a, b), (b, c), (c, b), (c, d), (d, a), (d, b)\}$

(2 marks)

Answer:

(ii) Suppose that $A = \{1, 2, 3\}$ and $B = \{1, 2\}$. Let R be the relation from A to B defined by aRb if $a \in A, b \in B$ and $a > b$. Represent relation R in matrix form.

(3 marks)

Answer:

Q6 (a) Consider the algorithm shown in **Figure Q6**. This algorithm calculates the product of matrices $a[\,]$ and $b[\,]$, and stores the result in matrix c[ ]. Determine a big-O estimate for the execution time of this algorithm.

```
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
```

Figure Q6: An algorithm for matrix multiplication.

(9 marks)

Answer:

(b) Analyze the following situation.

```
The bonus of an employee will be 100% of the basic salary
for outstanding performance, 70% of the basic salary for
good performance, 40% of the basic salary for average
performance and zero for all other cases.
```

Write an algorithm to calculate and print the total bonus amount to be distributed by the organization.

Solution: (11 marks)

Answer:

- END OF QUESTION -