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UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
SEMESTER II
SESSION 2017/2018

COURSE NAME	:	DISCRETE MATHEMATICS
COURSE CODE	:	BWA 10603
PROGRAMME CODE	:	BWA/BWQ
EXAMINATION DATE	:	JUNE/JULY 2018
DURATION	:	3 HOURS
INSTRUCTION	:	ANSWER **ALL** QUESTIONS

THIS QUESTION PAPER CONSISTS OF **FOUR (4)** PAGES

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Q1 Complete and prove the De Morgan's Law:

$$(A \cap B)' =$$

(10 marks)

Q2 Without constructing the truth table, prove that this formula is a tautology.

$$(\sim p \land q) \rightarrow (\sim(q \rightarrow p))$$

(10 marks)

Q3 Identify the wrong definition and make correction:

(a) Let X be a set:

(i) If there exists a nonnegative integer k such that X has k elements, then X is called a finite set with k elements.

(1 mark)

(ii) X is called an infinite set if X is not a finite set.

(1 mark)

(iii) The number of distinct elements in a set X is called the cardinality of the set.

(1 mark)

(b) A set having single element is called a singleton set.

(1 mark)

(c) A set having two elements is called a pair set.

(1 mark)

(d) If p and q are propositions, the proposition if p then q is called a conditional proposition and is denoted $p \rightarrow q$. Here, q is called the antecedent.

(1 mark)

(e) Statement formula A is said to be a contradiction if the truth value of A is T for any assignment of the truth values T and F to the statement variables occurring in A.

(1 mark)

(f) A relation R from a set X to a set Y is a subset of the Cartesian product $X \times Y$.

(1 mark)

(g) Let X and Y be sets. Function $f: X \rightarrow Y$ is called injective if for all $x_1, x_2 \epsilon X$, $f(x_1) \neq f(x_2) \rightarrow x_1 \neq x_2$.

(1 mark)

Q4 Test whether the following argument is valid: If 24 is divisible by 12, then 24 is divisible by 3. If 24 is divisible by 3, then the sum of the digits of 24 is divisible by 3. Therefore, if 24 is divisible by 12, then the sum of the digits of 24 is divisible by 3.

(8 marks)

Q5 (a) Let a theorem in the form

For all $x_1, x_2, \dots, x_n$, if $p(x_1, x_2, \dots, x_n)$ then $q(x_1, x_2, \dots, x_n)$. .... (1)

List and explain several known techniques for constructing a proof of theorem (1).

(12 marks)

(b) Prove that if p is an integer and $3p + 2$ is odd then p is odd, by contrapositive and contradiction methods.

(8 marks)

(c) Prove that q is an integer and q is odd if and only if q^2 is odd, by direct and indirect methods.

(6 marks)

Q6 Fill in the blank to complete the following quotient-remainder theorem:

If ___1___ and ___2___ are integers and ___3___ > 0, there exist ___4___ called ___5___ and ___6___ called ___7___, satisfying ___8___, $0 \leq r < d$. Furthermore ___9___ and ___10___ are unique.

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(10 marks)

Q7 Solve a second-order linear homogeneous recurrence relation with constant coefficient

$$d_n = 4(d_{n-1} - d_{n-2})$$

subject to initial conditions $d_0 = d_1 = 1$.

(10 marks)

Q8 (a) Write an algorithm to swap two number of a list.

(4 marks)

(b) Use your own example to show the procedure in (a)

(4 marks)

Q9 Let f be a function from $X = \{0, 1, 2, 3, 4, 5\}$ to $Y = X$ is defined by $f(x) = x \bmod 6$.

a) Write f as a set of ordered pairs and draw the arrow diagram of f.

(2 marks)

b) Determine whether f is injective, surjective, bijection or non of these. Does the inverse function of f exist?

(2 marks)

c) Hence, write $f \circ f$ and $f \circ f \circ f$ as sets of ordered pairs. Shows that $f^n = f \circ f \circ \cdots \circ f$ to be n fold composition of f with itself. Then, find f^{36}.

(5 marks)

– END OF QUESTIONS –