UTM
UNIVERSITI TEKNOLOGI MALAYSIA

ASSIGNMENT 2

SECI1013 – Discrete Structure

Semester 2024/2025-1

Instructions:

This is a group assignment. Each group should consist of no more than 3 members.

Please write all your answers by hand using a pen. Ensure that your answers are well-structured and that your handwriting is neat and easy to read. Submissions in printed form will not be accepted.

Please submit your assignment by **2/12/2024, 5:00 PM**, in room **N28-346-05**.

Question 1 **[22 marks]**

a. Let R is a relation on $A = \{2, 3, 5, 7, 11, 13, 17, 19\}$ where $(a, b) \in R$ if $a \geq b + 13$, and $a, b \in A$.

i. How many possible relations, R? [1 m]

ii. Write all relations, R. [2 m]

iii. Write domain and range of R. [2 m]

iv. Draw arrow diagram of R. [3 m]

v. Draw digraph of R. [3 m]

vi. Matrix of R. [3 m]

b. Determine whether the relation is defined on the following set of positive integers is reflexive, irreflexive, not reflexive, symmetric, asymmetric, antisymmetric, not antisymmetric, transitive, equivalence relation and/or partial order.

i. $(x, y) \in R$, if $x = 2y$ [1 m]

ii. $(x, y) \in R$, if $x = y$ [1 m]

iii. $(x, y) \in R$, if $x > y$ [1 m]

iv. $(x, y) \in R$, if $x < y$ [1 m]

v. Given $X = \{0, 1, 2, 3, 4, 5\}$, where (based on relation in (iv)) and $x, y \in X$. Write relation, R, and matrix of R. [4 m]

Question 2 **[16 marks]**

a. What is the different between Relation and Function? [2 m]

b. In the following cases, state whether the function is one-one, onto or bijective. Justify your answer.

i. $f = R \rightarrow R, f(x) = 1 - 2x$ [2 m]

ii. $f = R \rightarrow R, f(x) = 5x^2 - 1$ [2 m]

iii. $f = R \rightarrow R, f(x) = x^4$ [2 m]

iv. $f = R \rightarrow R, f(x) = \left(\frac{x-2}{x-3}\right)$ [2 m]

c. Given the following functions, find the function $f(g(x))$ and find the value of the function if $x = \{0, 1, 2, 3\}$

i. $f(x) = 3x-1; g(x) = x^2 - 1$ [2 m]

ii. $f(x) = x^2; g(x) = 5x - 6$ [2 m]

iii. $f(x) = x-1; g(x) = x^3 + 1$ [2 m]

Question 3 **[12 marks]**

a. Solve the recurrence relation given,

i. $a_n = 2a_{n-1} + 5a_{n-2}$; initial conditions $a_0 = 1$ *and* $a_1 = 6$ [2 m]

ii. $a_n = 4a_{n-1} - 7a_{n-2} + 3a_{n-3}$; initial conditions $a_0 = 2$, $a_1 = 5$ *and* $a_2 = 15$ [3 m]

iii. $a_n = -2a_{n-1} + 4a_{n-2} - a_{n-3}$; initial conditions $a_0 = 1$, $a_1 = -2$ *and* $a_2 = -1$ [3 m]

b. A sequence $a_1, a_2, a_3, a_4, ...$ is given by $a_{n+1} = 5a_{n-3}$; $a_1 = k$ where k is a non-zero constant.

i. Find the value of a_4 in terms of k. [2 m]

ii. Given that $a_4 = 7$, determine the value of k. [2 m]