REFORMED CHURCH UNIVERSITY

FACULTY OF EDUCATION AND SOCIAL SCIENCES

BACHELOR OF SCIENCE HONOURS DEGREE IN INFORMATION TECHNOLOGY

Mathematics for Computing

HICT 108

Part 1 Semester 2 Examination

Total Marks [100]

Date: July 2022

Time: 3 Hours

INSTRUCTIONS

1. This paper has ***six (6)*** questions
2. Answer any ***four (4)*** questions
3. Each question carries ***25 marks***
4. Start each question on a new page

Question 1

(a) Translate the following statements:

(i) 'Jack and Jill went up the hill 'into symbolic form using conjunction (4)

(ii) 'The crop will be destroyed if there is a flood' into symbolic form using conditional connective. (4)

(b) Let p and q denote the statements:

p: You drive over 70 km per hour.

q: You get a speeding ticket.

Write the following statements into symbolic forms.

(i) You will get a speeding ticket if you drive over 70 km per hour. (3)

(ii) Driving over 70 km per hour is sufficient for getting a speeding ticket. (3)

(iii) If you do not drive over 70 km per hour then you will not get a speeding ticket. (3)

(iv) Whenever you get a speeding ticket, you drive over 70 km per hour. (3)

(c) Construct the truth table for $(p \rightarrow q) \wedge (q \rightarrow p)$ (5)

Question 2

Prove (a) $P \vee Q \Leftrightarrow \neg (\neg P \wedge \neg Q)$. (15)

(b) $(P \rightarrow Q) \Leftrightarrow (\neg P \vee Q)$. (10)

Question 3

(a) Let $A = \{1, 2, 3, 4\}$ and $B = \{b1, b2, b3\}$. Consider the relation $R = \{(1, b2), (1, b3), (3, b2), (4, b1), (4, b3)\}$. Determine the matrix of the relation. (12)

(b) Let $X = \{1, 2, 3, 4\}$ and $R= \{(x, y) \mid x > y\}$. Draw the graph of R and also give its matrix. (13)

Question 4

(a) Let S = {a, b, c} and consider the following collections of subsets of S.

A = {{a, b}, {b, c}}, B = {{a}, {b, c}}, C = {{a, b, c}}, D = {{a}, {b}, {c}}, and E= {{a}, {a, c}}.

Which of the above sets are covering? (6)

(b) Let $X = \{1, 2, 3, 4\}$ and $R == \{(1, 1), (1, 4), (4, 1), (4, 4), (2, 2), (2, 3), (3, 2), (3, 3)\}$.

Prove that R is an equivalence relation. (13)

(c) If the function f is defined by f(x)=x2 + 1 on the set {−2, −1, 0, 1, 2}, find the range of f. (6)

Question 5

(a) Determine whether f: Z → Z given by $f(x) = x^2$, x ∈ Z is a one-to-One function. (5)

(b) Show that a mapping $f: R \to R$ defined by $f(x) = 2x + 1$ for $x \in R$ is a bijective map from R to R. (6)

(c) Let $X = \{1, 2, 3\}$ and f, g, h and s be the functions from X to X given by

$f = \{(1, 2), (2, 3), (3, 1)\}$

$g = \{(1, 2), (2, 1), (3, 3)\}$

$h = \{(1, 1), (2, 2), (3, 1)\}$

$s = \{(1, 1), (2, 2), (3, 3)\}$

Find

(i) $f \circ f$; (2)

(ii) $g \circ f$; (2)

(iii) $f \circ h \circ g$; (2)

(iv) $s \circ g$; (2)

(v) $g \circ s$; (2)

(vi) $s \circ s$; (2)

(vii) $f \circ s$. (2)

Question 6

Prove that

(i) the sum of two odd integers is an even integer. (12)

(ii) a group consisting of three elements is an abelian group? (13)