GRETSA UNIVERSITY - THIKA

UNIVERSITY EXAMINATIONS

MAY - AUGUST 2018 SEMESTER

BACHELOR OF SCIENCE IN COMPUTER SCIENCE

COURSE CODE: BSCS 100

COURSE TITLE: DISCRETE STRUCTURES I

DATE: 6TH AUGUST 2018 **TIME: 8.00AM – 11.00AM**

INSTRUCTIONS TO CANDIDATES

1. SECTION A IS **COMPULSORY.**
2. SECTION B: ANSWER ANY OTHER **THREE** QUESTIONS.
3. **DO NOT** WRITE ANYTHING ON THIS QUESTION PAPER AS IT WILL BE AN EXAM IRREGULARITY.
4. ALL ROUGH WORK SHOULD BE AT THE BACK OF YOUR ANSWER BOOKLET AND CROSSED OUT.

CAUTION: *All exam rooms are under CCTV surveillance during the examination period.*

SECTION A: COMPULSORY

Question One

a) Define the principle of inclusion and exclusion of three sets **[4 marks]**

b) Show that the following functions are inverses of each other ; $f(x) = \frac{x+2}{x-3}$ and

$g(x) = \frac{3x+2}{x-1}$ **[6 marks]**

c) Define and list examples of the following terms

i. Containment of a set **[2 marks]**

ii. Proper subset **[2 marks]**

iii. Finite set **[2 marks]**

iv. Universal set **[2 marks]**

d) Proof using Venn diagrams and set notation.

i. $A - B = A \cap B'$ **[5 marks]**

ii. $(A \cap B)' = A' \cup B'$ **[5 marks]**

e) Describe the difference between Polynomial functions and Rational functions **[4 marks]**

f) State whether the following functions are propositions or not

i. *Four plus four equals eight* **[2 marks]**

ii. *(6,4,3)⊂(7,4,8,6,3,4)* **[2 marks]**

iii. *Do you speak Spanish?* **[2 marks]**

iv. *4-x=8* **[2 marks]**

SECTION B: ANSWER ANY THREE QUESTIONS

Question Two

a) Define a Compound Proposition **[3 marks]**

b) Given the functions $f()x = 3x + 2$ and $g(x) = 3x^2 + 4x$

Evaluate

i. $f(x) + g(x)$ **[2 marks]**

ii. $f(x)g(x)$ **[2 marks]**

iii. fog **[3 marks]**

iv. f^{-1} **[3 marks]**

c) Show that $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$ is a Tautology **[6 marks]**

Question three

a) Consider the following statements;

p:" You take a course in discrete mathematics"

q:"You understand logic"

r: "You get an A on the final exam"

Write as simple English statements as possible using;

i. $p \rightarrow q$ **[2 marks]**

ii. $p \vee q$ **[2 marks]**

iii. $(p \wedge \neg q) \rightarrow \neg r$ **[3 marks]**

iv. $\neg(p \vee q)$ **[3 marks]**

b) Construct a truth table for $\neg p \wedge (\neg q \rightarrow p)$ **[6 marks]**

c) State the type of functions shown below

i. $f : \mathrm{Z} \rightarrow \mathrm{Z}$

$f(x) = x^3$ **[2 marks]**

ii. $g : \Re \rightarrow \Re$

$g(x) = (3x + 1)$ **[2 marks]**

Question Four

a) Define a Logically equivalent statement **[2 marks]**

Given the sets below

$\xi = \{1,2,3,\ldots,20\}$

$A = \{5,10,15,20\}$

$B = \{2,4,6,8,10,12,14,18,20\}$

$C = \{3,6,9,12,15,18\}$

i. Construct a Venn diagram for the sets and fill in the elements. **[12marks]**

ii. Solve for $(A \cap B) \cap C$ and $((A \cup B) \cup C)'$ **[6marks]**

Question five

a) Show that contrapositive and conditional are logically equivalent [**4marks]**

b) Define the sets of numbers citing examples

i. Rational numbers **[1marks]**

ii. Natural numbers **[1marks]**

iii. Real numbers **[1marks]**

iv. Irrational numbers **[1marks]**

v. Imaginary numbers **[1marks]**

b) Given the statement

P: It rains

Q: The crops will grow

Write the down the following in as natural way as possible;

i. Implication [**1marks]**

ii. Converse, inverse and contrapositive of (i). [**3marks]**

c) Given the set

$A = \{1, c, f, 3, g, k, t\}$

$B = \{b, f, k, n, m\}$

$C = \{a, 3, t, z, x, k\}$

$\xi = \{1, a, c, 3, f, g, k, t, b, n.m, z, x, p, y\}$

Find

i. A' **[1marks]**

ii. $A' \cup B'$ **[2marks]**

iii. $(A \cup B)'$ **[2marks]**

iv. $(A \cap B)'$ **[2marks]**