Ser. No. EDU 074/17

GARISSA UNIVERSITY

UNIVERSITY EXAMINATION 2017/2018 ACADEMIC YEAR ONE FIRST SEMESTER EXAMINATION

SCHOOL OF EDUCATION, ARTS AND SOCIAL SCIENCES

FOR THE DEGREE OF BACHELOR OF EDUCATION (ARTS)

COURSE CODE: COM 113

COURSE TITLE: MATHEMATICS FOR COMPUTER SCIENCE I

EXAMINATION DURATION: 3 HOURS

DATE: 13/12/17 **TIME: 09.00-12.00 PM**

INSTRUCTION TO CANDIDATES

- **The examination has SIX (6) questions**
- **Question ONE (1) is COMPULSORY**
- **Choose any other THREE (3) questions from the remaining FIVE (5) questions**
- **Use sketch diagrams to illustrate your answer whenever necessary**
- **Do not carry mobile phones or any other written materials in examination room**
- **Do not write on this paper**

This paper consists of THREE (3) printed pages ***please turn over***

QUESTION ONE (COMPULSORY)

(a) i)Distinguish the following sets:$\emptyset$, $\{0\}$ and $\{\emptyset\}$ **[1 Mark]**

ii) Let$U = \{1,2,3,\ldots,8,9\}$, $A = \{1,2,3,4\}$, $B = \{2,4,6,8\}$ and $C = \{3,4,5,6\}$.Find:

i. A^C

ii. $(A \cap C)^C$

iii. B\C **[4 Marks]**

(b) i)What is a *proposition?* Give an example. **[2 Marks]**

ii) Using a truth table, show that $\neg(A \vee B) \rightarrow \neg A$ is a tautology **[3 Marks]**

(c) Show that $2.4^n + 1$is divisible by 3 **[5 Marks]**

(d) Given two functions $f(x) = 5x - 3$ and $g(x) = (2x + 3)/(3x - 5)$

i) Show that $(f_{\circ}g)(x) \neq (g_{\circ}f)(x)$ **[4 Marks]**

ii) Find $(f_{\circ}g)^{-1}(x)$ and hence $(f_{\circ}g)^{-1}(2)$ **[3 Marks]**

(e) A mixed hockey team containing 5 men and 6 women is to be chosen from 7men and 9 women. In how many ways can this be done **[3 Marks]**

QUESTION TWO

(a) For each of the following, draw a Venn diagram and shade the region corresponding to the indicated set.

i. $A - (B \cap C)$ ii) $(A - B) \cup (A - C)$ **[4 Marks]**

(b) Prove analytically that $A - (B \cap C) = (A - B) \cup (A - C)$ for all sets A,B and C **[5 Marks]**

(c) Let $A = \{1,2,3,\}, B = \{2,4,\}$ and $C = \{3,4,5\}$.Find $A \times B \times C$(3Marks).

(d) Find the number of partitions of $X = \{a, b, c, d\}$ **[3 Marks]**

QUESTION THREE

(a) i) Define *recursion* as used in structures **[1 Mark]**

ii) Give a recursive definition ofα^n, where α is a nonzero real number and n is a nonnegative integer **[3 Marks]**

(b) Give the definition of Fibonacci numbers,$f_{0,}f_{1,\ldots}$ $and\ use\ your\ definition\ to\ find$ $f_2, f_3, f_4, f_5\ and f_6$ **[4 Marks]**

(c) A playoff between two teams consists of at most five games. The first team that wins three games wins the playoffs. In how many different ways can the playoff occur?[Hint: use a tree diagram]. **[7 Marks]**

QUESTION FOUR

(a) i) Prove that if n and r are integers with $0 \leq r \leq n$, then $P(n, r) = {}^{n!}/_{(n-r)!}$ **[3 Marks]**

ii)How many ways are there to select a first prize winner, a second prize winner and a third prize winner from 100 different people who have entered a contest **[3 Marks]**

(b) i) Use the Binomial theorem to expand $(x + y)^4$ **[3 Marks]**

ii) Obtain the coefficient of $x^{12}y^{13}$ in the expansion $(2x - 3y)^{25}$ **[2 Marks]**

(c) Let f_n denote the nth Fibonacci number. Prove by mathematical induction that $f_n < 2^n$ **[4 Marks]**

QUESTION FIVE

(a) i)Define an equivalence relation **[1 Mark]**

ii) Let $A = \mathbb{R}$, the set of real numbers and define a relation R on A by xRy if and only if $x^2 = y^2$ .Is this equation an equivalence relation? **[3 Marks]**

(b) Let $A = B = \{1,2,3,4,5,6\}$ and $R = \{(a, b): a \text{ } divides \text{ } b\}$ ie aRb if and only if a divides b.Obtain the binary matrix representation of R on A **[5 Marks]**

(c) Three functions f, g and h are defined by $f: \mathbb{Z}^+ \to \mathbb{R}$, $f(x) = \frac{2}{x+1}$, $g: \mathbb{Z} \to \mathbb{Z}$, $g(x) = x^2 + 3$ and $h: \mathbb{R} \to \mathbb{R}$, $h(x) = 3x + 2$ .Determine which of the following composition functions are defined:

(i)$(g_\circ f)$ (ii)$(f_\circ g)$ (iii)$(h_\circ f)$ (iv)$(f_\circ h)$ (v)$(f_\circ g)$ (vi)$(h_\circ g)$ **[6 Marks]**

QUESTION SIX

(a) Prove that $(\bar{p} \wedge q) \vee \overline{(p \vee q)} \equiv \bar{p}$ using Boolean algebra. **[4 Marks]**

(b) Show that the following two positions are logically equivalent using a truth table:

i. If it rains tomorrow then, if I get paid, I'll go to Paris.

ii. If it rains tomorrow and I get paid then I'll go to Paris. **[11 Marks]**