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**GARISSA UNIVERSITY**

**UNIVERSITY EXAMINATION 2018/2019 ACADEMIC YEAR ONE**

**SECOND SEMESTER EXAMINATION**

**SCHOOL OF INFORMATION SCIENCE AND TECHNOLOGY**

**FOR THE DEGREE OF BACHELOR OF INFORMATION SCIENCE**

**COURSE CODE: COM 113**

**COURSE TITLE: MATHEMATICS FOR COMPUTER SCIENCE 1**

**EXAMINATION DURATION: 2 HOURS**

**DATE: 12/02/2020 TIME: 09.00-11.00 AM**

**INSTRUCTION TO CANDIDATES**

* **The examination has FIVE (5) questions**
* **Question ONE (1) is COMPULSORY**
* **Choose any other TWO (2) questions from the remaining FOUR (4) 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 FOUR (4) printed pages *please turn over***

**QUESTION ONE (COMPULSORY)**

1. Define the following terms as used in logic
2. Proposition (1 mark)
3. Conjunction (1 mark)
4. Disjunction (1 mark)
5. Draw and complete the following truth table (5 marks)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| p | q | $$\~p$$ | $$\~q$$ | $$\~(p∨q)$$ | p$∨∽q$ | $$∽(p∨∽q)$$ |
| T | T |  |  |  |  |  |
| T | F |  |  |  |  |  |
| F | T |  |  |  |  |  |
| F | F |  |  |  |  |  |

1. Classify the following sets as either finite or infinite (4 marks)
2. $\left\{all positive divisors of 48\right\}$
3. $\left\{all human beings alive today\right\}$
4. $\left\{x:x is a prime number\right\}$
5. $\left\{all camels in Garissa, Wajir and Mandera\right\}$
6. Show that the function $f:R\rightarrow R$ given by $f\left(x\right)=3x-7$ and determine its inverse (5 marks)
7. Find the Boolean function of the circuit $C$ given by the table below
8. Using $O's$ (2 marks)
9. Using $I's$ (4 marks)

|  |  |  |
| --- | --- | --- |
| A | B | C |
| I | I | I |
| I | O | O |
| O | I | I |
| O | O | I |

1. Verify that if $M=\left[\begin{matrix}-5&10&8\\4&-7&-6\\-3&6&5\end{matrix}\right]$ and $N=\left[\begin{matrix}-1&2&4\\2&1&-2\\-3&0&5\end{matrix}\right]$

then $MN=NM=I\_{3}$ where $I\_{3}=3×3$ unit matrix and hence

solve the equation $\left[\begin{matrix}-5&10&8\\4&-7&-6\\-3&6&5\end{matrix}\right]\left[\begin{matrix}x\\y\\z\end{matrix}\right]=\left[\begin{matrix}-3\\3\\2\end{matrix}\right]$ (5 marks)

1. Let $f:R\rightarrow R$ and $g:R\rightarrow R$ be defined by

 $f\left(x\right)=5x-4$ and $g\left(x\right)=x+1 $. Find $g ο f$ (2 marks)

**QUESTION TWO**

1. Design a circuit, $C$, with two switches, $A$ and $B$ according to the information given in the table and show that the two expressions for C are equal.
2. Using the $I^{'}s$ (7 marks)
3. Using the $O's$ (7 marks)

|  |  |  |
| --- | --- | --- |
| A | B | C |
| I | I | 1 |
| I | O | O |
| O | I | O |
| O | O | I |

1. Use truth tables to show that $p∧(q∨r)$ and $(p∧q)∨(p∧r)$ are logically equivalent (6 marks)

**QUESTION THREE**

1. Chapatti Mix Limited conducted a survey to investigate customers’ loyalty to the company’s three brands of flour, namely: Ngano, Chapo and Super. The survey covered a total of 140 households. The following results were obtained:

53 households were loyal to Ngano

52 households were loyal to Chapo

54 households were loyal to Super

15 households were loyal to both Ngano and Chapo

10 households were loyal to both Ngano and Super

12 households were loyal to both Chapo and Super

13 households were not loyal to any of the three brands

**Required:**

1. Number of households that were loyal to all the three
2. Number of households that were loyal to exactly two brands
3. Number of households that were loyal to Ngano only
4. Number of households that were loyal to at most one brand
5. Number of households that were loyal to Ngano or Chapo but not to Super (15 marks)
6. Prove analytically that

$A-\left(B∩C\right)=(A-B∪\left(A-C\right) ∀ sets A,B,C$ (5 marks)

**QUESTION FOUR**

1. (i) Define an equivalence relation (2 marks) (ii) Let $A=R$ be the set of real numbers and define a relation $R on A$ by $x R y$ if and only if $x^{2}=y^{2}$ . Is this an equivalence relation?

 (4 marks)

1. Let $A=B=\{1,2,3,4,5,6\}$ and $R=\{\left(a,b\right):a divides b$} i.e. $a R b if and only if a divides b.$ Obtain the binary representation of $R $ on $A.$ (7 marks)
2. Three functions, $f, g, $and $h$ are defined by

$f: Z\rightarrow R f\left(x\right)=$ $\frac{2}{x+1}$

$$f: Z\rightarrow Z g\left(x\right)=x^{2}+3$$

$$h: R\rightarrow R h\left(x\right)=3x+2$$

Determine which of the following composition functions are defined

1. $g o f$ (ii) $f o g$ (iii) $h o f$ (iv) $f o h$ (v) $h o g$ (7 marks)

**QUESTION FIVE**

1. Prove that $(p∧q)∨(\overbar{p∨q)}$ $=p$ using Boolean Algebra (7 marks)
2. Show that the following two positions are logically equivalent using truth tables
3. If it rains tomorrow, then if I get paid, I will go to London
4. If it rains tomorrow and I get paid then I will go to London (13 marks)