CROSS RIVER UNIVERSITY OF TECHNOLOGY, CALABAR
DEPARTMENT OF COMPUTER SCIENCE
FIRST SEMESTER EXAMINATION 2016/2017
COURSE CODE: CSC 2204 – SWITCHING ALGEBRA AND DISCRETE STRUCTURES
3 CREDITS, TIME 3 HOURS

ANSWER ANY FOUR QUESTIONS

1(a) Explain the terms collection, universal set, and define sets. Explain the terms natural languages and formal languages. Comment why formal languages were introduced.

(b) Explain what is membership relation. Give interpretation of the symbols $\epsilon, \forall, \exists$ and write the statements below in natural language: (1) $\forall \times \epsilon$ {apples} $\exists\ y\ \epsilon$ {plate} to eat from; $\exists$x ϵ { subjects } $\forall\ y\ \epsilon$ {students } to study;

(c) What are defined symbols? Give two examples. Define subset and equality relations of sets.

2(a) Define ordered pairs, define Cartesian products. Define the subset relation, and define relations and binary relations.

(b) Define reflexive, symmetric and transitive binary relations. Give examples for two of them.

(c) Define equivalence relation and state the partition theorem about equivalence classes generated by an equivalence relation.

3(a) Define order relations, partially ordered sets and complete ordering. Show examples of complete and partial ordering.

(b) Define upper and lower bounds of a subset of an ordered set. Define sup and inf of a subset of an ordered set. Define maximum and minimum of a subset of an ordered set.

(c) Show an example of a subset of an ordered set which has infimum and does not have a minimum. Hence or otherwise define well-ordered sets.

4(a) Define lattices. Show that operations a∧b:= inf{a, b} and avb := sup {a, b} may not fulfill the distributive rule lattices. Give condition for a lattice to be a distributive lattice.

(b) Define a distributive lattice with unit elements. What is involution? Define a Boolean algebra. Give an example of a Boolean algebra.

(c) Define the language symbols of a formal language. Define truth values and truth tables (and, or and not).

5(a) Define what is a graph. Define undirected, directed and oriented graphs. Explain the difference between directed and oriented graphs.

(b) Define a path, when are two nodes of a graph are connected by a path. Analyze the relation x~y if x is connected to y, x, where x, y∈ G.

(c) When does the relation ~ represent an equivalence relation? What are the equivalence classes in a graph?

6(a) Define adjacency matrices. How will the adjacency matrix of a graph look like when ~ is equivalence relation.

(b) Define loops in a graph. Compare loops in undirected, oriented and directed graph.

(c) Explain that any adjacency matrix can be written in the form of a sum of a symmetric and an as = symmetric adjacency matrix. Interpret it.

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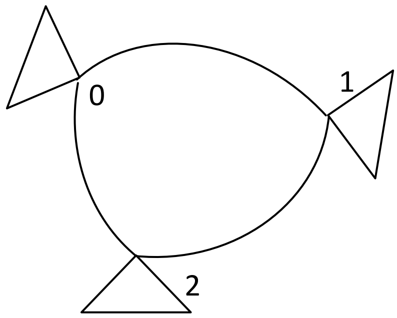
COURSE TITLE: SWITCHING ALGEBRA AND DISCRETE STRUCTURES
INSTRUCTION: ANSWER ANY FOUR (4) QUESTIONS DATE: 22/10/19 TIME: 2 HOURS

1a. (i) What is an equivalent relation? (ii) Let R be a relation on the set of ordered pairs of positive integers such that ((a,b), (c,d))$\in$ R if only if ad=bc. Proof that R is an equivalent relation?

b. The diagraph below suggests a relation. Proof that there exist;

i. An equivalence relation
ii. A partial order relation



c. (i) What is partitioning as relates to switching algebra? (ii) State the properties of partitioning

2a. (i) Let X = {12,13,14} and A = {x,y,z} be two distinct sets, identify the partitions in these sets (ii) if PI= {12,13}, show that the partition is mutually disjointed.

b. With a truth table, compare the logical functions of the 2-input logic gates.

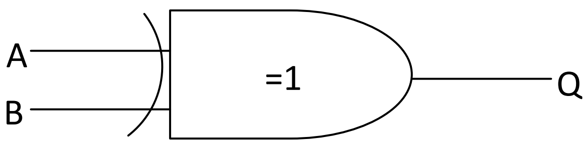
c. The distributive law in Boolean Algebra is made up of two operators, AND and OR. Proof that the values of A. (B + C) and A. B + A.C is equal.

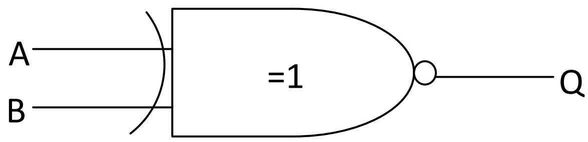
3a. What is a truth table with respect to Boolean Algebra? (ii) Draw a truth table for *A+BC*.

b. With the logic levels, show the input combinations for a 4-input logic circuit.

c. (i) What is an equivalent class? (ii) Given a set S with an equivalence relation ~ define [[X]] = {y/x ~y}. Consider S = {1,2,3,4}, identify the equivalent classes.

4a. Explain the logic gates below and further show the truth tables.





b. The variables A, B or C can represent a single variable or combination of variables. With this background, state the 12 rules of Boolean Algebra you were thought in class.

c. What is a set? (ii) State how a set is specified.

5a. Differentiate between an equivalent relation and a partial order relation.

b. Let A = {1, 2, 3, 4, 5, 6} and B = {2, 4, 6, 8}. What is the cardinality of B, A$\cup$B, A $\cap$B?

c. (i) What is relation in switching algebra? (ii) If A = {2, 4, 5, 8} and B = {2, 4, 6, 9, 15, 16, 25, 64}, and the relation R between A and B is defined as 'is a positive square root of'. Identify the ordered pair in the relation R.