COM320

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OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2019 /2020 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATION

FOR THE DEGREE OF BACHELOR OF COMPUTER SCIENCE

MAIN EXAMINATION

COURSE CODE: COM 320

COURSE TITLE: DIGITAL SYSTEM DESIGN

DATE: 2ND NOVEMBER, 2020 **TIME: 9.00 AM – 12.00 NOON**

INSTRUCTION TO CANDIDATES

- SEE INSIDE

THIS PAPER CONSISTS OF PRINTED PAGES **PLEASE TURN OVER**

REGULAR EXAMINATION

COM 320: DIGITAL SYSTEM DESIGN

STREAM: BSc (Computer Science) **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

i. *Answer **ALL** questions from section A and any **THREE** from section B.*

ii. *Maps and diagrams should be used whenever they serve to illustrate the answer.*

iii. *Do not write on the question paper.*

SECTION A (24 MARKS) COMPULSORY

QUESTION ONE [12 MARKS]

a. Describe the function of a digital integrated circuit. [2 Marks]

b. Define the following terms:

i. Maxterm [2 Marks]

ii. Instruction set with respect to microprocessor [2 Marks]

c. Convert the boolean expression $f = x.\bar{y}.\bar{z} + x.\bar{y}.z + x.y.\bar{z}$ into its equivalent product of sums form. [3 Marks]

d. List the different categories of counters. [3 Marks]

QUESTION TWO [12 MARKS]

a. What is the function of a Karnaugh map. [2 marks]

b. Simplify the boolean expression a. $\bar{b}$ + a. $(\overline{b+c})$ + b. $(\overline{b+c})$ [3 Marks]

c. List the three main units which make up a microprocessor. [3 Marks]

d. Contrast between microprocessor and microcomputer. [4 Marks]

SECTION B [36 MARRKS]

QUESTION THREE [12 MARKS]

a. A sales company intends to begin paying its sales people based on their work experience, number of days they have worked, number of sales they have made and cost of items they have sold. You have been hired to come up with an automatic logic circuit to analyze the amount of pay each of them will get on a monthly basis. Outline different steps you will adopt in the design of a suitable combinational logic circuit to implement the hardware required to analyze the pay. [6 marks]

b. With the aid of illustrations, outline the three main ways of specifying the function of a combinational logic circuit. [6 Marks]

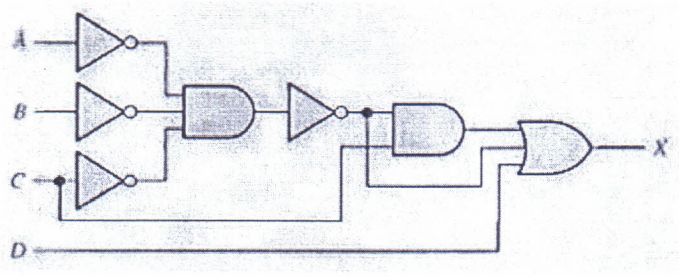
QUESTION FOUR [12 MARKS]

a. Contrast between a flip flop and a latch [2 Marks]

b. Apply boolean theorems to simplify the boolean equation: (A + B)(A + C)

[4 Marks]

c. Consider the combinational logic circuit:



i. Generate the expression for the output of the circuit [3 Marks]

ii. Reduce the equation to its minimum form [3 Marks]

QUESTION FIVE [12 MARKS]

a. List the different memory "sub-systems" found in a microprocessor-based system. [3 Marks]

b. Consider the boolean expression Q = $(\overline{A.B})$. $(\overline{A+B})$. C. Generate its equivalent logic diagram and truth table. [4 Marks]

c. Simplify the boolean expression (a. b. (c + $\overline{b.d}$) + $\overline{a.b}$) $c.d$ [5 Marks]

QUESTION SIX [12 MARKS]

a. With the aid of a diagram, explain how the microprocessor functions. [4 Marks]

b. With the aid of architectural configurations, explain the differences between RISC processors and CISC processors [8 Marks]

QUESTION SEVEN [12 MARKS]

a. Consider the function Y = (A.B) + $(\overline{A.C})$ $\bar{B}$

i. Draw a combinational logic circuit that implements this function. [2 Marks]

ii. Draw a truth table for this function. [2 Marks]

iii. Generate a sum-of-products representation of Y from the truth table. [2 Marks]

iv. With the aid of De Morgan's law, generate a product-of-sums representation of Y. [2 Marks]

b. Consider the boolean expression given by A.B.C.D +$\overline{A.B}$.C.D + $\bar{A}$.B. Determine if there are any 'don't care' entries hence give the simplified version of the expression. [4 Marks]