KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

FIRST SEMESTER, 2019/2020 ACADEMIC YEAR

EXAMINATION FOR THE DEGREE OF BACHELOR SCIENCE IN COMPUTER SCIENCE

COMP 213: DIGITAL CIRCUIT DESIGN

STREAM: Y2S1 **TIME:9:00-11:00PM**

EXAMINATION SESSION: DEC **DATE: 16/12/2019**

VENUE: AUDITORIUM **COPIES: 35**

INSTRUCTIONS TO CANDIDATES

1. **Answer Question 1 and any other two questions in the answer booklet provided.**
2. **Do not write on your question papers. All rough work should be done in your answer booklet.**
3. **Clearly indicate which question you are answering.**
4. **Write neatly and legibly.**
5. **Edit your work for language and grammar errors.**
6. **Follow all the instructions in the answer booklet**

QUESTION ONE (30 marks)

a) Explain the use of buffers in digital electronics (2mks)

b) What is the difference between decoder and a demultiplexer? (2mks)

c) What makes it appropriate for digital systems such as computers to work on binary variables in their operations? (2mks)

d) Explain any three disadvantages of analog signals over digital signal (3mks)

e) Explain the NAND gate giving its logic equation and all the possible outputs in a truth table. (5mks)

f) Explain the duality of De-Morgans Theorem (2mks)

g) Draw the block diagram of half adder giving the equations for the outputs with their truth table (5mks)

h) If a 3-input XNOR gate has eight input possibilities, show all the possibilities with their respective outputs (4mks)

i) Define Programmable Logic Devices (PLDs). Draw a Programmed Array Logic to implement the following equation. $Y=A'B'+A'B+AB$ (5Mks)

QUESTION TWO (20 marks)

a) Consider the following function $F=x'y'z+x'yz+xy'$

i) Minimize the function to give equivalent simpler function (3mks)

ii) Draw the logic gates before and after simplification. (4mks)

iii) How many gates do you save from this simplification (2mks)

b) Give any three applications of encoders (3mks)

c) Draw the block diagram for S-R latch using NAND gate.

What happens when all the inputs are '1'? (4mks)

d) Prove that $A(B+C) = (A B) + (A C)$ (4mks)

QUESTION THREE (20 marks)

a) Explain any three differences between combinational and sequential circuits (3mks)

b) What is the difference between an encoder and a multiplexer (2mks)

c) Use the Boolean algebra to reduce the following equation

F=(x'+y'+x'y'+xy)(x'+yz) (4mks)

d) Show that ***(a + b)(a + c)*** is logically equivalent to ***a + bc***. Draw the logic circuits for each (6mks)

e) What is the importance of a clock in a flip flop (2mks)

f) Draw the symbol and the equation for XOR gate (3mks)

QUESTION FOUR (20 marks)

a) Explain the use of exclusive-OR in the design of full adder (3mks)

b) To reduce the number of intergrated circuits, multiplexer is used. Explain how a 4-line to 1-line multiplexer works (4mks)

c) Simplify the following expression using a Karnaugh map:

$$A.\overline{B}.\overline{C} + \overline{A}.B.\overline{C} + A.\overline{B}.C + \overline{A}.B.C$$

(4mks)

d) Show the map by their equivalent decimal values in the respective cells in a 4 input variable K-map (3mks)

e) State any four postulates of Boolean algebra. (4mks)

f) What is the equivalence of 2-input XOR equation (2mks)

QUESTION FIVE (20 marks)

a) Explain the associative law of boolean algebra (2mks)

b) Explain the implementation of 3-8 decoder using AND gate (5mks)

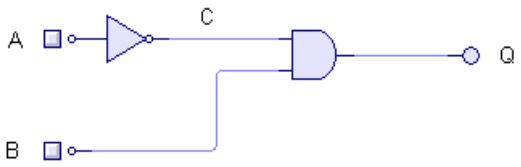
c) Use the Karnaugh map to solve the following function

$F1(x, y, z) = \Sigma(3, 4, 5, 6, 7)$ (4mks)

d) Differentiate between leading and trailing edge in clock used for memory elements (2mks)

e) Draw the half adder circuit and give the equations of the outputs of the sum and carry (3mks)

f) Study the following logic system carefully and then draw the truth table for it



(4mks)