

Student ID: _____

ICS 151 Quiz 1

Name : _____ , _____
(Last Name) (First Name)

Student ID : _____

Signature : _____

Instructions:

1. Please verify that your paper contains 8 **pages** including this cover.
2. Write down your Student-Id on the top of each page of this quiz.
3. This exam is **closed book**. No notes or other materials are permitted.
4. Total credits of this midterm are **45 points**.
5. To receive credit you must show your work clearly.
6. **No re-grades will be entertained if you use a pencil.**
7. Calculators are **NOT** allowed.

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Q1: [Data conversion]

9 points

(a)- Convert the following decimal number to binary using divide-by-2 method: (3 points)

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(b)- Convert the following binary number to decimal: (3 points)

1 0 1 0 1 1 0 1

(c)- Convert the following hexadecimal number to decimal: (3 points)

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Q2: [Boolean algebra]

10 points

(a) Prove the following boolean equation using boolean algebra: (5 points)

$$xyz' + x'yz' + xy'z' + x'y'z' + z = 1$$

(b) Use algebraic manipulation to convert the following equation to sum-of-product form: (5 points)

$$(a + b)'(cd)' + a(b+c)'d + (bc)d'$$

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Q3: [Combinational logic design]

4 points

There are three major courses X, Y and Z, and two minor courses A and B in a department. A student can graduate if he or she passes:

1- all the major courses from X to Z

or

2- two major courses and both minor courses

Write a Boolean equation to represent the graduation condition. Use the name of the courses as the variables of your equation.

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Q4: [Muxer/Decoder Application]

12 points

For function $F(x, y, z) = xy'z' + x'yz' + x'y'z$

(a) Create the truth table (3 points)

(b) Implement F by means of 8-to-1 Multiplexer (4 points)

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(c) Implement F by means of a 3-to-8 Decoder (5 points)

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Q5: [Combinational design]

10 points

We want to design a combinational circuit that computes the function $f(X) = 2X + 2$ for a 2-bit X :

(a) How many bits do we need for output? (2 points)

(b) Draw the truth table for this function. (4 points)

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(c) Using the truth table in (b), write the equations for representing the output function (no need for simplification). (4 points)