MAT 115: Finite Math for Computer Science

Problem Set 1

Due: 09/16/2019

- **Instructions:** I leave plenty of space on each page for your computation. If you need more sheet, please attach your work right behind the corresponding problem. If your answer is incorrect but you show the computation process, then partial credits will be given. Please staple your solution and use the space wisely.

- **Group Details**: A group can have a maximum of 3 people. Kindly provide your batch or group details and any kind of changes are not accepted once fixed.

- **Late Assignment Rules:**
  1-2 days delay: - 20 % of total score

  3-5 days delay: - 30 % of total score

  >5 days delay: - 50 % of total score

  > 2 weeks delay: 0 points

First Name:

Last Name:

Group ID:

Score: /100

Problem 1 Proof: Algebraic Rules for Boolean Functions [2 points]

Which of the following function is equivalent to $p \vee (q \wedge r)$ =?

(Note: Use algebraic rules and provide the answer)

a) $(p \wedge q) \wedge (p \vee r)$
b) $(p \vee q) \wedge (p \vee r)$
c) $(p \vee q) \vee (p \vee r)$
d) $(p \vee q) \vee (p \wedge r)$

Problem 2 Truth Table [15 points]

(Note: Provide the truth table clearly)

Make a truth table for ~ (p ∨~q) ∨ (~p ∧ ~ q) and for ~p and compare their results.

Problem 3 Proof: Algebraic Rules: 15 pts

Is the function $(r \vee p) \wedge (\sim r \vee (p \wedge q)) \wedge (r \vee q)$ equal to the function $p \wedge q$

Problem 4 Truth Table: 15 pts

(Note: Provide the truth table clearly)

Make a truth table for $(\sim (\sim (p \wedge q) \wedge (\sim p \vee r))) \wedge \sim (q \vee \sim r \vee p)$

Problem 5 Base Change: 20pts

a) Convert $(7A.1)_{16}$ into binary format

b) Convert the binary number $(1111010.0001)_2$ to base 8

c) BA0A (hex number into decimal form)

d) 2081 (base 9 number to decimal number)

Problem 6 Circuit Design: 10 + 5pts

1) Please design the circuit for the XOR gate by using AND, NOT and OR gate (Please try to come up with one that is different from what is given in class).

2) Please verify your circuit with the four possible inputs by showing the outputs after each gate and then the final output.

Problem 7 Circuit Design: 10 + 5pts

a) Please generate the circuit for the following Boolean expression f where x y z are binary variables as gate inputs

$$f = (X \wedge \sim Y \wedge \sim Z) \vee (X \wedge Y \wedge Z)?$$

b) Show that any Boolean expression can be represented by NAND-gates alone.

Problem 8 Proof: Algebraic Rules for Boolean Functions [3 points]

~ (p V ~q) V (~p ^ ~q) is equivalent to which of the following?

(Note: Use algebraic rules and provide the answer)

a) p
b) ~p
c) q
d) ~q