CS 1200 FS18 HW 03

Due Friday 10/05/18 at 11:59 PM

Please submit two files to Canvas (one is a PDF file and the other is the code .py file) :

1. A PDF file that contains all the answers to the individual questions, all pictures, all code, and all code output. This should all be well-organized. Points will be deducted for sloppy or disorganized work.

2. All the Python codes (.py file) (You may put all codes in one .py file).

If you need a program that helps you put PDF files together into a single PDF file, try http://www.pdfsam.org/. The program there is open source and available for free.

Note: Partial credit will be given on every problem.

1. (20pts) Show that $\rightarrow$ does not have the associative or commutative laws. In other words show that

   (a) $P \rightarrow (Q \rightarrow R)$ and $(P \rightarrow Q) \rightarrow R$ have different truth table.

   (b) $P \rightarrow Q$ and $Q \rightarrow P$ have different truth table.

2. (15pts) Verify the second DeMorgan's Law $\sim(P|Q) = \sim P \& \sim Q$ manually using truth table. Also verify the result by writing a program in Python. Submit a listing of the program.

3. (a) (8pts) Manually, construct a truth table for $\sim(P\& Q \rightarrow R\&S)$.
   (b) (7pts) Find the disjunctive normal form of $\sim(P\& Q \rightarrow R\&S)$.

4. (26pts) Let G(A,B,C) be the function:

$$B\&A|C\&C \leftarrow B\&B \rightarrow B! = A|C$$

   (a) Completely parenthesize the above expression for G. i.e, put parentheses in every correct location so the result can be evaluated correctly without using any precedence rules. (Note: the symbol != means Boolean operator xor.)
   (b) Create a truth table for G. You may simplify G if you wish. (Note: You are allowed to simplify the expression to make it easier to generate a

truth table.)

(c)Express G in disjunctive normal form.

(d)Draw a circuit that uses &, | and $\sim$ gates to compute G.

5. (12pts) Represent the function P!=(Q!=R) using NOT, AND and OR gates.

6. (12pts) Design a circuit for three switches that turns a light on only if at least two of the three switches are on.