CS 1200 FS18 HW 05

Due Wednesday 11/07/18 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.

HW5 Problems:

1. (20 pts) Assuming P and Q are defined for the same universe use truth trees to determine whether the argument

$$\frac{\forall \text{x P(x)} \mid \forall \text{x Q(x)}}{\forall \text{x (P(x)} \mid \text{Q(x))}}$$

   is valid. If it is not valid construct a counterexample.

2. (20 pts) Draw a Venn diagram to show the relationships among the sets: $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}, A = \{2, 4, 6, 7, 9\}, B = \{1, 3, 6, 7, 9\}$, and $C = \{2, 3, 6, 8\}$. List the elements of the 8 sets in Figure 11.7 (in textbook). In other words manually calculate:
   $A \cap B \cap C$, $A \cap B \cap C'$, $A \cap B' \cap C$,$A' \cap B \cap C$,$A' \cap B \cap C'$,$A' \cap B' \cap C$, $A \cap B' \cap C'$,$A' \cap B' \cap C'$.

3. (10pts) Write a Python program to verify your answers. Submit a listing and the output of this program.

4. (10pts) Simplify the expression $(A \cup ((B \cap C)' \cup (A' \cap C')')')'$ using the laws of Boolean algebra.

5. (10 pts) Write down the set $\{x, y\} \times \{f, h\} \times \{9, 3, 6\}$.

6. (a)(10 pts) List all the elements of $2^{\{0,1,2\}}$ and $2^{\{a,b,c,d\}}$.
   (b) (10pts) Write a Python program to verify your answers in (a). Submit a listing and output of this program.

7. (10 pts) Draw a Venn diagram of (A#B)∩(B#C).

8. (Bonus point:10pts) Assuming P, Q and R are defined for the same universe use truth trees to decide if the following argument is valid. If it is not valid show all the counterexamples that can be found using the truth tree.

$$\frac{\begin{array}{l}\forall x\ (P(x)\ !=\ Q(x))\\ \forall x\ (Q(x)\ !=\ R(x))\end{array}}{\forall x\ (P(x)\ =\ R(x))}$$