INTERNATIONAL INSTITUTE OF INFORMATION TECHNOLOGY
HYDERABAD

Monsoon Semester (Aug-Nov), 2019
Discrete Structures (DS)

Tutorial II
August 24, 2019

Due: 24.08.19

Instructor: Dr. Pawan Kumar

INSTRUCTIONS:

Problems to be discussed in Tutorial in the week 26th Aug-31st Aug 2019.

1. **(Well formed formulas)** Which of the following formulas are well formed?
   (a) $(P \to (P \vee Q))$
   (b) $((P \to (\neg P)) \to \neg P)$
   (c) $((\neg Q \wedge P) \wedge Q$
   (d) $((\neg P \to Q) \to (Q \to P)))$

2. **(Implications)** Show the following implications **without** constructing the truth table.
   (a) $P \to Q \implies P \to (P \wedge Q)$
   (b) $(P \to Q) \to Q \implies P \vee Q$

3. **(Equivalences)** Show the following equivalences **without** constructing the truth table. Note in the following $\leftrightarrow$ stands for biconditional.
   (a) $P \to (Q \to P) \iff \neg P \to (P \to Q)$
   (b) $P \to (Q \vee R) \iff (P \to Q) \vee (P \to R)$
   (c) $\neg(P \leftrightarrow Q) \iff (P \wedge \neg Q) \vee (\neg P \wedge Q)$

4. **(Functionally complete connectives)**
   (i) Write formulas which are equivalent to the formulas given below, and which contain the connectives $\wedge$ and $\neg$ only.
      (a) $\neg(P \leftrightarrow (Q \to (R \vee P)))$
      (b) $((P \vee Q) \wedge R) \to (P \vee R)$
   (ii) Show that $\{\wedge, \vee\}$ is not functionally complete.

Student's name:

End of Tutorial