4CCS1ELA – Elementary Logic with Applications

Small Group Tutorial 2 (week 4)

Propositional Logic II

1. [HARD, 15 mins] A professor of logic meets 10 of his former students. Albert, Alice, Bob, Bertha, Clifford, Connie, David, Dora, Edgar, Edith who have become five married couples. When asked about their husbands, the ladies gave the following answers:

Alice: My husband is Clifford, and Bob has married Dora.

Bertha: My husband is Albert, and Bob has married Connie.

Connie: Clifford is my husband, Bertha's husband is Edgar.

Dora: My husband is Bob, and David has married Edith.

Edith: Yes, David is my husband. And Albert's wife is Alice.

Additional true information coming from the men was that every lady gave one correct and one wrong answer. This was sufficient to find out the truth. Reproduce the professor's argument.

(from the "Logic for Artificial Intelligence and Information Technology book)

2. [EASY, 10 mins] Rewrite the formulas below into equivalent formulas in CNF and DNF.

1. $P \to (Q \wedge R)$
2. $S \vee (P \to \neg Q)$
3. $P \leftrightarrow Q$
4. $P \vee Q$

3. [MEDIUM, 8 mins] Use the equivalence rules to push all occurrences of the negation symbol $\neg$ next to the atoms in the formulas below:

- $\neg((P \to Q) \vee ((P \to R) \wedge \neg P))$

- $(\neg(P \wedge \neg Q)) \rightarrow P$

4. [MEDIUM, 8 mins] Check the validity of the following arguments by using truth-tables.

- $(P \vee Q) \rightarrow R$, Q. Therefore R.
- $P \rightarrow (Q \vee R)$, P. Therefore R.