Computer Science at The Dragon Academy
Term 1 : Test 1

Thu. October 11, 2018

40% Exercises and 60% Problems.

1 Exercises

1. (Ktica) State which of the following are propositions:
   (a) *Try to build a routine*
   (b) *Do not lie*
   (c) *It's cold out there*
   (d) *What do you mean?*
2. (KtiCa) Given $F = (\neg p \wedge \neg q) \vee (\neg r \wedge \neg s \wedge \neg t)$, which of the following represents the only correct expression for $\neg F$ (write down the derivation that justifies your answer):
   (a) $\neg F = \neg p \vee \neg q \vee \neg r \vee \neg s \vee \neg t$
   (b) $\neg F = \neg p \wedge \neg q \wedge \neg r \wedge \neg s \wedge \neg t$
   (c) $\neg F = (\neg p \wedge \neg q) \wedge (\neg r \wedge \neg s \wedge \neg t)$
   (d) $\neg F = (p \wedge q) \vee (r \wedge s \wedge t)$
   (e) $\neg F = (p \vee q) \wedge (r \vee s \vee t)$
3. (KtiCa) Express the following function $f(p, q, r, s) = (q \vee r \vee s) \wedge (p \vee r \vee s) \wedge (p \vee q \vee s)$ as a *disjunction* of terms, each of which consisting on a *conjunction* of atomic literals or negation of atomic literals.
4. (KtiCa) Express the following function $f(p, q, r) = [(p \vee q) \wedge r] \vee (p \wedge q \wedge r)$ as a *conjunction* of terms, each of which consisting on a *disjunction* of atomic literals or negation of atomic literals.

2 Problems

1. (ktiCA) A logical expression that consists in disjunctions of things that are conjunctions of literals is called a proposition in **Disjunctive Normal Form** (DNF). If it's written as a conjunction of disjunctions it's called **Conjunctive Normal Form** (CNF). Write $p \oplus q$ in (1) DNF and (2) in CNF.

2. (kTICa) Prove algebraically that $p \wedge (p \vee q) \leftrightarrow p$.

3. (KTICa) The following is a list of conditionals, i.e., logical statements with the pattern $p \to q$. For each of them, write the sentences corresponding to (I) $\neg q \to \neg p$, (II) $p \wedge \neg q$ and (III) $\neg p \to \neg q$:

   (a) *If it is January, then it is cold*

   (b) If $y + 5 \neq 7$ then $y < 0$