Exercise Sheet 1

Discrete Mathematics, 2020.9.15

1. (P13, Ex.11, [R]) Let p and q be the propositions:

   p : It is below freezing.

   q : It is snowing.

   Write these propositions using p and q and logical connectives (including negations).

   - It is below freezing and snowing.
   - It is below freezing but not snowing.
   - It is not below freezing and it is not snowing.
   - It is either snowing or below freezing (or both).

2. Construct a truth table for each of these compound propositions and answer which of them are logically equivalent with each other.

   a) $(\neg p \vee q) \wedge (\neg q \vee p)$
   b) $(\neg p \vee q) \vee (\neg q \vee p)$
   c) $p \wedge (q \vee r)$
   d) $(p \wedge q) \vee (p \wedge r)$
   e) $\neg(p \wedge q)$
   f) $\neg p \vee \neg q$
   g) $(p \wedge q) \vee (\neg p \wedge \neg q)$

3. Prove that the following propositions are satisfiable.

   a) $(p \vee \neg q) \wedge (q \vee \neg r) \wedge (r \vee \neg p)$
   b) $\neg((p \vee \neg q) \wedge (q \vee \neg r) \wedge (r \vee \neg p))$