# DISCRETE MATHEMATICS 1 (MS4111): TUTORIAL 2

1. Let $p$ and $q$ be two propositions. Write the truth tables of the following compound propositions.

   (a) $(p \Rightarrow q) \wedge (q \Rightarrow p)$
   (b) $(p \Rightarrow q) \vee (q \Rightarrow p)$

2. Let $p$ and $q$ be two propositions. Write the truth tables of the following compound propositions.

   (a) $(p \Rightarrow q) \wedge (\overline{q} \Rightarrow \overline{p})$ ; $(p \Rightarrow q) \vee (\overline{q} \Rightarrow \overline{p})$
   (b) $(p \Rightarrow q) \wedge (\overline{p} \vee q)$ ; $(p \Rightarrow q) \vee (\overline{p} \vee q)$
   (c) $\overline{(p \Rightarrow q)} \wedge (p \wedge \overline{q})$ ; $\overline{(p \Rightarrow q)} \vee (p \wedge \overline{q})$

   What can you say about them?

3. Give the definition of **logically equivalent** propositions.

4. Are the following pairs of propositions logically equivalent? Justify your answer.

   (a) $p \Leftrightarrow q$ ; $\overline{p} \Leftrightarrow \overline{q}$
   (b) $p \wedge q$ ; $\overline{\overline{p \wedge q}}$
   (c) $p \wedge q$ ; $\overline{p \wedge q}$

5. Give the definition of **tautology** and **contradiction**.

6. Check whether the following propositions are tautologies or contradictions. Justify your answer.

   (a) $(p \Rightarrow q) \vee (q \Rightarrow p)$
   (b) $(p \Rightarrow q) \Leftrightarrow \overline{\overline{p \Rightarrow q}}$
   (c) $(p \Rightarrow q) \wedge \overline{p \Rightarrow q}$
   (d) $(p \Rightarrow q) \Leftrightarrow \overline{p \Rightarrow q}$
   (e) $(\overline{p} \vee q) \wedge (p \wedge \overline{q})$
   (f) $(\overline{p} \vee q) \Leftrightarrow (p \wedge \overline{q})$