Helwan University
Faculty of Computers and Information

MidTerm Exam
Spring 2016
Closed Book

Department of Computer Science
Discrete Mathematics
MA112

Solve the following problems.

8 marks

1. Consider the following propositions then answer the following questions:

   p : "you miss the practical exam".

   q : "you miss the final exam".

   r : "you will pass".

   (a) Express in English the logical statement: $(p \to \neg r) \wedge (q \to \neg r)$.

   (b) Express in English the logical statement: $(p \vee q) \to \neg r$.

   (c) Are the two statements equivalent? (answer using truth table).

   (d) Are the two statements equivalent? (answer algebraically).

8 marks

2. Suppose that the domain of x consists ONLY of -3, -1, 1, 3. Then for any predicate $p(x)$ express the following using ONLY $\wedge$, $\vee$, $\neg$.

   (a) $\exists x\ p(x)$.

   (b) $\forall x\ p(x)$.

   (c) $\forall x\ \big((x \neq 1) \to p(x)\big)$.

   (d) $\exists x\ \big((x \geq 0) \wedge p(x)\big)$.

9 marks

3. Consider the following statements:

$$\exists x \forall y\ (y \neq 0 \to xy = 1).$$
$$\forall x \exists y\ \big((x + y = 2) \wedge (2x - y = 1)\big).$$

   (a) Express each statement in English.

   (b) Which statement is true and which is false? (why?)

   (c) For the false statement, give a counterexample.