Quiz 2

Instructor: Sandy Irani

1. The domain of discourse in this problem is the set of students and teachers at a school. Define the following predicates:

   - E(x, y): x has sent an email message to y.
   - P(x): x is a student.
   - T(x): x is a teacher.

   Give a logical expression for each of the following sentences:

   (a) Someone has sent an email to everyone.

   (b) Everyone has sent an email to someone.

   (c) Every student has sent an email to at least one teacher.

   (d) There is a teacher who has received an email from every student.

2. The following is a logical argument that shows that the hypotheses

   - $\forall x(A(x) \to B(x))$
   - $\exists x(A(x) \land D(x))$

   lead to the conclusion that $\exists x(B(x) \land D(x))$. Fill in the missing peices of the argument.

1. $\exists x(A(x) \land D(x))$	Hypothesis
2.	Existential instantiation using (1)
3. A(c)	Simplification using (2)
4. D(c)	Simplification using (2)
5. $\forall x(A(x) \to B(x))$	Hypothesis
6. $A(c) \to B(c)$	Universal instantiation using (5)
7.	Modus Ponens using (3) and (6)
8.	Conjunction using (4) and (7)
9.	Existential Generalization using (8)