1. Let $F(x, y)$ be the statement "x can fool y" where the universe of discourse consists of all the people in the world. Use quantifiers to express each of these statements.

   (a) Everybody can fool Fred.

   (b) Evelyn can fool everybody

   (c) Everybody can fool somebody.

   (d) There is no one who can fool everybody.

   (e) No one can fool both Fred and Jerry.

   (f) No one can fool himself or herself.

2. Give the truth table for $(p \to q) \wedge ((\neg p) \leftrightarrow q)$.

3. Express that two sets are equal using logic and the subset ($\subseteq$) relation. Express that two sets are equal using logic and the set difference ($\setminus$) function.

4. Give an example of a function from $\mathbb{N}$ to $\mathbb{N}$ that is

   (a) one-to-one but not onto.

   (b) onto but not one-to-one.

   (c) both onto and one-to-one (but different from the identity function)

   (d) neither one-to-one nor onto.

   Justify your answers.

5. Find the least integer n such that $f(x)$ is $O(x^n)$ for each of the following functions

   (a) $f(x) = 5x^4 - 3x^2 \log x$

   (b) $f(x) = 3x^2 + (\log x)^4$

   (c) $f(x) = (x^5 + x^2 - 1)/(x^3 + 2)$

   (d) $f(x) = x + \sin(x) - x$

6. Derive, as a function of n, the O, Ω and Θ complexity of the following pseudo-code. Show your work.

```
procedure foo(n)
    y := 0;
    for i:=0 to n
        y := y + i*i

    for i:=1 to n
        y := y*(n-i)

    return y;
```