Discrete Structures - Test 1 (Sample)
12:50-2:05, Oct 13, 2010 (Wednesday)

Name:_____

Answer all six questions.

Question 1 [4 points]

Let $A = \{1, 2, 3, 4, 5, 6, 7\}$. Give each of the following sets.

1. $B = \{n \in A : n \text{ is odd}\}$

2. $C = \{n + 4 : n \in A\}$

3. $D = B \cup C$

4. $E = B \cap C$

5. $F = B \setminus C$

6. $G = B \oplus C$

7. $P(E)$ - the power set of E

8. $E \times E$ - the Cartesian product of E and E

Question 2 [3 points]

Use Venn diagrams to prove the De Morgan law $(A \cap B)^c = A^c \cup B^c$.

Question 3 [3 points]

Consider the function f(x)=2x+3 from Z to Z.

1. Is f one-to-one?

2. Is f onto Z?

3. Is f invertible? If so, what is the inverse function?

4. What is f∘f?

Question 4 [3 points]

Build the truth tables for $(\neg p \vee \neg q)$ and $\neg(p \wedge q)$.

Question 5 [3 points]

Prove that the sum of three consecutive integers is divisible by 3.

Question 6 [4 points]

Here is a proof by contradiction for the following theorem: If $p \vee (q \to r)$, $q \vee r$, and $r \to p$, then p. For each step, supply an explanation.

1.	$p \vee (q \to r)$
2.	$q \vee r$
3.	$r \to p$
4.	$\neg p$
5.	$\neg r$
6.	$r \vee q$
7.	q
8.	$q \to r$
9.	r
10.	$r \wedge \neg r$
11.	contradiction