2. Use truth tables to prove that an implication is always equivalent to its contrapositive. **Give an example, in English,** where this is so.
3. Use truth tables to prove that an implication **may not** be equivalent to its converse. **Give an example, in English**, where this is so.
4. Use logic to write the negation of the sentence: All the participants of this course are IT majors **and** will graduate this semester. Don’t for get to use De Mogan”s law.
5. Determine whether (p q )  (p r) and p  (q  r) are logically equivalent.

1. Prove or disprove the following: If the integer n is divisible by 3 then n2 is divisible by 3. Don’t panic, just follow the examples given in the notes. Use the definition of divisible in the notes
2. Use the proof by contradiction method to prove:
   1. If x2 + 2x + 1 is an even integer then x is an odd integer.
   2. Prove: x is an odd integer **iff** x2 + 2x + 1 is an even integer. (Note this is an if and only if (iff) statement.
3. Let A = {1,3,7} and B = {3,5}. Compute
   1. A - B
   2. A X B
   3. A  B
   4. A  (B - A)

7. Let A, B, and C be any three sets and consider the sentence:

If A  B = A  C then B = C.

1. Prove in detail that this statement is false. (Hint. Give a counterexample)

(b)Write the converse of the above statement and show through an example that it is true.

8. What is the value of x after each of the following statements are encountered in a computer program, if x = 1 before the statement is reached.  **Explain fully.**

1. **if** 2 + 3 = 6 AND 3 + 4 = 7  **then** x:= x + 1
2. **if** 2 + 3 = 6 XOR 3 + 4 = 7  **then** x:= x + 1

9. A bit string is a string of bits (0’s and 1’s). The length of a bit string is the number of bits in the string. An example, of a bit string of length four is 0010. An example, of a bit string of length five is 11010. Use the **Rule of Products** to determine the following:

(a) How many bit strings are there of length eight? **Explain**

(b) How many bit strings are there of length eight which begin with two 1’s? **Explain**

For your information question 9 part a could have been stated the following way. Computers use bit strings of length 8, called bytes, to represent the characters (letters both upper case and lower case, punctuation symbols, [, {, the integers 0 through 9 etc) on a key board. The Extended ASCII code is one such coding system. Some examples of this code are: “a” is represented by 01100001, “A” is represented by 01000001 and “{“ is represented by 01111011 and the number 1 is represented by 00000001. How may such symbols can be described using a byte?