Math 102
Project 1 Handout
Due: 2/09/2009

Instructions: This project is designed to give you an opportunity to explore some of the concepts from set theory. Complete as much of this project as you can by 4:00pm on the due date (Monday February 9th). You should write up your solutions neatly and all pertinent work leading up to your solution should be included as well. If you consult any references (books or online material), cite the relevant sources either in footnotes or at the end of your project.

1. (3 points each) Use Venn diagrams to decide whether or not the following statements are true.
   If a statement is false, give a **specific counterexample** that shows that it cannot be true.
   If a statement is true, give a **specific example** where the set equality holds.

   What I mean by a *specific example* is describing specific sets A, B, and C in roster notation and then showing the result of applying the set operations shown in each expression to these specific sets.

   (a) $(A \cap B) \cup (A \cap C) = (B \cup C) \cap A$
   (b) $C - [(A - B) \cup (B - A)] = [C - (A \cup B)] \cup (A \cap B \cap C)$

2. (4 points) Draw a Venn diagram showing all 16 possible regions for four sets, A, B, C, and D. Number each region in your diagram and then make a list indicating which of the four sets is represented in each region.

3. (5 points) Let $A = \{a, b, c, d, e, f, g, h, i\}$

   (a) Use Pascal's triangle to find the number of subsets of A with exactly 3 elements.
   (b) Use Pascal's triangle to find the number of subsets of A with exactly 6 elements.
   (c) Explain why the numbers you found in parts (a) and (b) are the same (your explanation should involve how subsets are chosen and not just a description of the computations used).