MAE113 DISCRETE TECHNIQUES FOR COMPUTING

Coursework 4–to be handed in by noon, Wednesday 27/10/2010.
Write your name and student number at the top of your assignment before handing it in. You should attempt all questions because only one question will be marked.

1. Calculate the following sets:

   (a) $\{1, 2, 3, 4\} \cup \{1, 3, 5, 7\}$,

   (b) $\{1, 8, 6, 4\} \cap \{10, 4, 6, 8\}$,

   (c) $\{1, 4, 9\} \cup \emptyset$,

   (d) $\{5, 7, 1, 4\} \cap \{0, 2, 6\}$,

   (e) $\{1001, 5005, \text{ apple}\} \setminus \{1001, 50, \text{ pear}\}$,

   (f) $\{x : x \text{ is an integer divisible by } 2\} \cap \{x : x \text{ is an integer divisible by } 3\}$,

   (g) $\{1, 2, 3\} \times \{a, b, c\}$.

2. Let A, B and C be sets. Using the Venn diagram method from the lectures, prove that $A \setminus (B \cap C) = (A \setminus B) \cup (A \setminus C)$.

3. In a group of 30 people, it was found that

   - 18 enjoyed classical music,
   - 11 enjoyed pop music,
   - 18 enjoyed jazz,
   - 5 enjoyed pop music and classical music,
   - 7 enjoyed pop music and jazz,
   - 9 enjoyed classical music and jazz,
   - 2 enjoyed all three music types.

   (a) How many people enjoyed at least one of classical music and jazz?

   (b) How many people did not enjoy any of the three types of music?

   (c) How many people enjoyed classical music but not pop music or jazz?

4. Let A, B and C be sets. Suppose that $|A \cup B \cup C| = 64$, $|A \cup B| = 45$, $|B \cup C| = 51$, $|A \cup C| = 53$, $|A| = 28$, $|B| = 29$ and $|C| = 33$. Calculate:

   (a) $|B \cap C|$,

   (b) $|A \cap B \cap C|$.

   Hint: Rearrange the inclusion-exclusion formulae.

5. Let A, B and C be sets and suppose that $A \subseteq B$. Which of the following statements are always true and why? For each false statement, produce an example showing it is not true.

   (a) $A \cap C \subseteq B$,

   (b) $A \cup C \subseteq B$,

   (c) $A \setminus C \subseteq B$,

   (d) $A \subseteq B \setminus C$,

   (e) $A \subseteq B \times C$,

   (f) $A \times C \subseteq B \times C$.