MATH 2112/CSCI 2112, Discrete Structures I
Winter 2007
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Homework Sheet 9
Due: Wednesday 28th March: 1:30 PM

Compulsory questions

1 Let $A = \{0, 1, 3, 5\}$, $B = \{x \in \mathbb{R} | 1 < x \leqslant 5\}$, and $C = \{x \in \mathbb{R} | x < 0.3 \vee x \geqslant 3\}$. Find:

(a) $A \cup B$

(b) $B \cap C$

(c) $A \setminus B$

(d) $A \cup (B \cap C)$

(e) $(A \cup B) \cap C$

(f) $P(A)$

2 The *symmetric difference* $A \triangle B$ of two sets A and B is given by $A \triangle B = (A \setminus B) \cup (B \setminus A)$.

(a) Show that $(A \triangle B)^c = (A^c \cap B^c) \cup (A \cap B)$.

(b) Show that symmetric difference is associative, i.e. that $(A \triangle B) \triangle C = A \triangle (B \triangle C)$.

3 Let $A_1, A_2, \ldots$ be an infinite collection of sets such that for any n, $A_1 \cap A_2 \cap \cdots \cap A_n \neq \emptyset$. Can these $A_1, A_2, \ldots$ be chosen so that $\bigcap_{i=1}^{\infty} A_i = \emptyset$?

4 Use the inclusion-exclusion principle to find the number of composite numbers from 1 to 100 inclusive. Show your working. [Hint: Any number less than 100 that is composite is divisible by one of 2,3,5 or 7 (Bonus question: Why?).]