CSL 101- Discrete Mathematics
Indian Institute of Technology Bhilai
Tutorial Sheet 1

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1. Let A,B,C be arbitrary sets. Then Show that
   (a) $(A \setminus B) \setminus C = A \setminus (B \cup C)$
   (b) $(A \setminus B) \setminus C = (A \setminus C) \setminus B$
   (c) $(A \setminus B) \setminus C = (A \setminus C) \setminus (B \setminus C)$

2. Let A, B, C be sets. Under what condition is each of the following statements true?
   (a) $(A \setminus B) \cup (A \setminus C) = A$
   (b) $(A \setminus B) \cup (A \setminus C) = \varnothing$
   (c) $(A \setminus B) \cap (A \setminus C) = \varnothing$
   (d) $(A \setminus B) \oplus (A \setminus C) = \varnothing$

3. Let A denote the set of all automobiles that are manufactured domestically. Let B denote the set of all imported automobiles. Let C denote the set of all automobiles manufactured before 1977. Let D denote the set of all automobiles with a current market value of less than 2000. Let E denote the set of all automobiles owned by students at the university. Express the following statements in set-theoretic notation:
   (a) The automobiles owned by students at the university are either domestically manufactured or imported.
   (b) All domestic automobiles manufactured before 1977 have a market value of less than 2000.
   (c) All imported automobiles manufactured after 1977 have a market value of more than 2000.

4. Let A denote the set of all freshmen, B denote the set of all sophomores, C denote the set of all mathematics majors, D denote the set of all computer science majors, E denote the set of all students in the course Elements of Discrete Mathematics, F denote the set of all students who went to a rock concert on Monday night, G denote the set of all students who stayed up late Monday night. Express the following statements in set-theoretic notation:
   (a) All sophomores in computer science are in the course Elements of Discrete Mathematics.
   (b) Those and only those who are in the course Elements of Discrete Mathematics or who went to the rock concert stayed up late Monday night.
   (c) No student in the course Elements of Discrete Mathematics went to the rock concert Monday night.
   (d) The rock concert was only for freshmen and sophomores.
   (e) All sophomores who are neither mathematics nor computer science majors went to the rock concert.

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5. Determine whether each of the following statements is true or false.

   (a) $A \cup P(A) = A$
   (b) $A \cap P(A) = A$
   (c) $A \cup P(A) = P(A)$
   (d) $A \cap P(A) = A$
   (e) $A \setminus P(P(A)) = A$
   (f) $A \setminus \{A\} = P(A)$

6. Let A and B be two arbitrary sets.

   1. Show that $P(A \cap B) = P(A) \cap B$ or give a counterexample.
   2. Show that $(A \cup B) = P(A) \cup B$ or give a counterexample.

7. Show that at most a countably infinite number of books can ever be written in English. (We define a book to be a finite sequence of words, divided into sentences, paragraphs, and chapters.)