Set Theory: Tutorial Sheet

1. Draw a Venn Diagram to represent the universal set $\mathcal{U} = \{0, 1, 2, 3, 4, 5, 6\}$ with subsets:
   $A = \{2, 4, 5\}$
   $B = \{1, 4, 5, 6\}$

   Find each of the following

   (a) $A \cup B$
   (b) $A \cap B$
   (c) $A - B$
   (d) $B - A$
   (e) $A \otimes B$

2. (i) Let $S = \{w, x, y, z\}$. Describe briefly how the subsets of S can each be represented by a unique 4-bit binary string.
   (ii) Make a list of all 4-bit binary strings which have 1 as their first bit. Use this list to find all the subsets of S containing the element w.
   (iii) What is the total number of subsets of S?

3. Suppose we have the sets A and B defined as follows:

$$A = \{\sqrt{2}, \frac{3}{2}, 2\}$$

$$B = \{x \in R : X \notin Q\}$$

   (i) $A \cap Q$
   (ii) $A \cap B$
   (iii) $B \cup Q$

4. Consider the universal set U such that

$$U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$$

   and the sets

$$A = \{2, 5, 7, 9\}$$
$$B = \{2, 4, 6, 8, 9\}$$

   State the outcome for each of the following set operations:

   (a) $A - B$,
   (b) $A \oplus B$,
   (c) $A \cap B$,
   (d) $A \cup B$,
   (e) $A^C \cap B^C$,
   (f) $A^C \cup B^C$.