1: For each of the following sets, determine whether 3 is an element of that set and also whether \{3\} is an element of that set.
(a) \{4, 3, \{4\}, 3\},
(b) \{4, \{3\}, \{4\}, \{\{3\}\}\},
(c) \{4, \{3, 4\}, \{4\}, \{3, \{3\}\}\},
(d) \{4, \{3, 3\}, \{4\}, 3, \{\{3\}\}\},
(e) \{4, \{\{3\}\}, \{4\}, \{\{3\}\}\}.

2: Determine whether each of the statements below is true or false.
(a) 0 ∈ \{\emptyset\};
(b) \{\emptyset\} = \emptyset;
(c) \emptyset ⊂ \{\emptyset\};
(d) \{\emptyset, \emptyset\} ⊆ \{\emptyset\};
(e) \{\{\emptyset\}\} ⊆ \{\emptyset, \{\emptyset\}\};
(f) \{\{\emptyset\}\} ∈ \{\emptyset, \{\emptyset\}\}.

3: Let \(A = \{x\}, B = \{1, 2, 3\}, \) and \(C = \{b, c\}\). Find
(a) \(B \times C\);
(b) \(A \times C \times B\);
(c) \(C \times B \times C\).

4: Translate each of the quantifications below into English and determine its truth value:
(a) \(\exists y \in \mathbb{R} \ (y + 2 > y)\)
(b) \(\forall x \in \mathbb{Z} \ \exists y \in \mathbb{R} \ (x - 1 > y)\)
(c) \(\exists y \in \mathbb{R} \ \forall x \in \mathbb{Z} \ (x - 1 > y)\)
(d) \(\exists y \in \mathbb{R} \ \forall x \in \mathbb{Z} \ (x^2 > y)\)

5: Let \(A, B, \) and \(C\) be sets. Show (in two ways: with the help of membership tables and by arguing like in Examples 10 and 12 from Chapter 2) that
(a) \(\overline{A - B - C} = \overline{A} \cup B \cup C\)
(b) \((A - B) \cup (B - A) = (A \cup B) - (A \cap B)\).
6: Let $A = \{2, 4, 6, 8, 10, 11\}$, $B = \{1, 2, 4, 8, 9\}$, and $C = \{1, 3, 6, 8, 9, 11\}$. Find
(a) $A \cap B \cap C$;
(b) $(A \cup B) - C$;
(c) $(A \cap B) \cup C$.
In each case write the corresponding bit string (characteristic vector) of length 11.