1. Section 1.5: #4 (a)-(h),

Solution:
We are given: \( A = \{b,c,d\}, B = \{a,b\} \). Some simpler sets that appear in the questions:
\[ A \times B = \{(b,a), (b,b), (c,a), (c,b), (d,a), (d,b)\} \]
\[ B \times B = \{(a,a), (a,b), (b,a), (b,b)\} \]
\[ A \cap B = \{b\} \]
\[ P(A) = \{\emptyset, \{b\}, \{c\}, \{d\}, \{b,c\}, \{b,d\}, \{c,d\}, \{b,c,d\}\} \]
\[ P(B) = \{\emptyset, \{a\}, \{b\}\{a,b\}\} \]
Now we have
(a) \((A \times B) \cap (B \times B) = \{(b,a), (b,b)\}\).
(b) \((A \times B) \cup (B \times B) = \{(b,a), (b,b), (c,a), (c,b), (d,a), (d,b), (a,a), (a,b)\}\).
(c) \((A \times B) - (B \times B) = \{(c,a), (c,b), (d,a), (d,b)\}\).
(d) \((A \cap B) \times A = \{(b,b), (b,c), (b,d)\}\).
(e) \((A \times B) \cap B = \emptyset\).
(f) \(P(A) \cap P(B) = \{\emptyset, \{b\}\}\).
(g) \(P(A) - P(B) = \{\{c\}, \{d\}, \{b,c\}, \{b,d\}, \{c,d\}, \{b,c,d\}\}\).
(h) \(P(A \cap B) = \{\emptyset, \{b\}\}\).

2. Section 1.6: Do problem #2, but use \( B = \{1,2,3,4\} \) instead of the set \( B \) listed in the problem (keep \( A \) and \( U \) the same).

Solution: (a) \( \overline{A} = \{1,3,5,7\} \)
(b) \( \overline{B} = \{0,5,6,7,8\} \)
(c) \( A \cap \overline{A} = \emptyset \)
(d) \( A \cup \overline{A} = U = \{0,1,...,8\} \)
(e) \( A - \overline{A} = A = \{0,2,4,6,8\} \)
(f) \( \overline{A} \cup \overline{B} = \{5,7\} \)
(g) \( \overline{A} \cap \overline{B} = \{5,7\} \)
(h) \( \overline{A} \cap \overline{B} = \{0,1,3,5,6,7,8\} \)
(i) \( \overline{A} \times \overline{B} = \{(1,1), (1,2), (1,3), (1,4), (3,1), (3,2), (3,3), (3,4), (5,1), (5,2), (5,3), (5,4), (7,1), (7,2), (7,3), (7,4)\} \)
3. Section 1.7: #12, #14

Solution: 

#12: \((A - B) \cup (C \cap B)\), or \((A \cup B) - (B - C)\)

#14: \((A - (B \cup C)) \cup (A \cap B \cap C)\)

Note: there are other possible correct answers for both problems.

4. Section 1.8: #4

Solution: (a) \(\bigcup_{i \in \mathbb{N}} A_i = \{\ldots, -6, -4, -2, 0, 2, 4, 6, \ldots\} = \{2n : n \in \mathbb{Z}\}\)

(b) \(\bigcap_{i \in \mathbb{N}} A_i = \{0\}\)

5. Section 1.8: #6

Solution: (a)

\[
\bigcup_{i \in \mathbb{N}} [0, i + 1] = \{x : x \in [0, i + 1], \text{for some } i \in \mathbb{N}\} = [0, \infty)
\]

(b)

\[
\bigcap_{i \in \mathbb{N}} [0, i + 1] = \{x : x \in [0, i + 1], \text{for every } i \in \mathbb{N}\} = [0, 2]
\]

6. Section 1.8: #8

Solution: For each \(\alpha \in \mathbb{R}\), the set \(\{\alpha\} \times [0, 1]\) is the vertical line segment connecting the points \((\alpha, 0)\) and \((\alpha, 1)\) in the plane \(\mathbb{R}^2\). For (a), the union of all these line segments is the horizontal strip:

\[
\bigcup_{\alpha \in \mathbb{R}} \{\alpha\} \times [0, 1] = \{(x, y) \in \mathbb{R}^2 : 0 \leq y \leq 1\} = \mathbb{R} \times [0, 1].
\]

For (b), the intersection of all these line segments is empty (even the intersection of two such line segments is already empty):

\[
\bigcap_{\alpha \in \mathbb{R}} \{\alpha\} \times [0, 1] = \emptyset.
\]