

Exercise A.1.15, 19, 21.

Let  $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$  be the universal set, and let  $A = \{1, 3, 4, 5, 9\}$ ,  $B = \{2, 4, 6, 7, 8\}$ , and  $C = \{1, 3, 4, 6\}$ .

A.1.15 Find  $(A \cup B) \cap C$ .

Solution

We deal with  $A \cup B$  first since this is in parentheses. Now  $A \cup B$  is the set consisting of elements that belong to either  $A$  or  $B$ , so

$$A \cup B = \{1, 3, 4, 5, 9\} \cup \{2, 4, 6, 7, 8\}$$

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

Now  $(A \cup B) \cap C$  is the set consisting of elements that belong to both  $A \cup B$  and  $C$ , so

$$(A \cup B) \cap C = \{1, 2, 3, 4, 5, 6, 7, 8, 9\} \cap \{1, 3, 4, 6\} \text{ or}$$

$$(A \cup B) \cap C = \{2, 3, 4, 6\} \quad \square$$

A.1.19 Find  $\overline{A \cap B}$ .

Solution

First,  $A \cap B$  is the set consisting of elements that belong to both  $A$  and  $B$ , so

$$A \cap B = \{1, 3, 4, 5, 9\} \cap \{2, 4, 6, 7, 8\} = \{4\}.$$

The complement  $\overline{A \cap B}$  is the set consisting of all elements in the universal set that are not in  $A \cap B$ .

$$\boxed{A \cap B = \{0, 1, 2, 3, 5, 6, 7, 8, 9\}} \quad \square$$

A.1.21 Find  $\overline{A \cup B}$ .

Solution

The complement  $\overline{A}$  is the set consisting of all elements in the universal set that are not in  $A$ , so

$$\overline{A} = \overline{\{0, 1, 2, 3, 5, 6, 7, 8, 9\}} = \{0, 2, 6, 7, 8\}.$$

Similarly,

$$\overline{B} = \overline{\{1, 3, 5, 9\}} = \{2, 4, 6, 7, 8\}.$$

The union  $\overline{A \cup B}$  is the set consisting of elements that belong to either  $\overline{A}$  or  $\overline{B}$ ,

so  $\overline{A \cup B} = \{0, 2, 6, 7, 8\} \cup \{1, 3, 5, 9\}$  or

$$\boxed{\overline{A \cup B} = \{0, 1, 2, 3, 5, 6, 7, 8, 9\}} \quad \square$$