1. Exercise set 5.1

3: $\{0,1,2\} = \{x \in \mathbf{Z} \ : \ -1 < x < 3\}$.

†6:

a. $3 \in \{1,2,3\}$.	b. $1 \not\subseteq \{1\}$.	c. $\{2\} \notin \{1,2\}$.
d. $\{3\} \in \{1,\{2\},\{3\}\}$.	e. $1 \in \{1\}$.	f. $\{2\} \not\subseteq \{1,\{2\},\{3\}\}$.
g. $\{1\} \subseteq \{1,2\}$.	h. $1 \notin \{\{1\},2\}$.	i. $\{1\} \subseteq \{1,\{2\}\}$.
j. $\{1\} \subseteq \{1\}$.		

9:

a. $\{x \in \mathbf{R} \ : \ -2 \le x < 3\}$.	b. $\{x \in \mathbf{R} \ : \ -1 < x \le 1\}$.
c. $\{x \in \mathbf{R} \ : \ x < -2 \ \vee \ 1 < x\}$.	d. $\{x \in \mathbf{R} \ : \ x \le -1 \ \vee \ 3 \le x\}$.
e. $\{x \in \mathbf{R} \ : \ x < -2 \ \vee \ 3 \le x\}$.	f. $\{x \in \mathbf{R} \ : \ x \le -1 \ \vee \ 1 < x\}$.
g. $\{x \in \mathbf{R} \ : \ x \le -1 \ \vee \ 1 < x\}$.	h. $\{x \in \mathbf{R} \ : \ x < -2 \ \vee \ 3 \le x\}$.

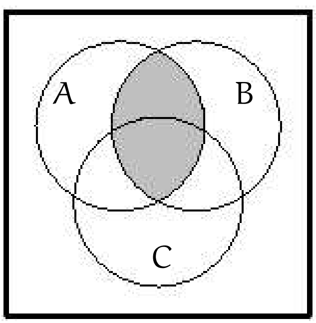
†14:

a. $A \cup (B \cap C) = (A \cup B) \cap (A \cup C) = \{a,b,c\} \neq (A \cup B) \cap C = \{b,c\}$.

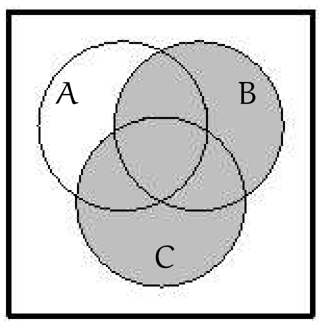
b. $A \cap (B \cup C) = (A \cap B) \cup (A \cap C) = \{b,c\} \neq (A \cap B) \cup C = \{b,c,e\}$.

c. $(A - B) - C = \{a\} \neq A - (B - C) = \{a,b,c\}$.

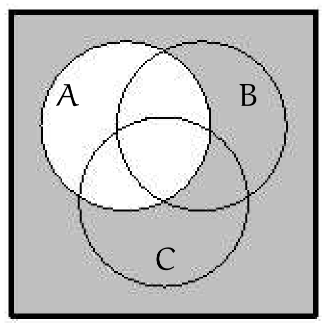
†15:



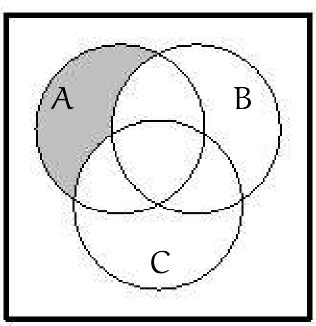
a. $A \cap B$



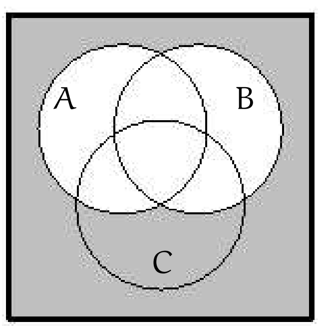
b. $B \cup C$



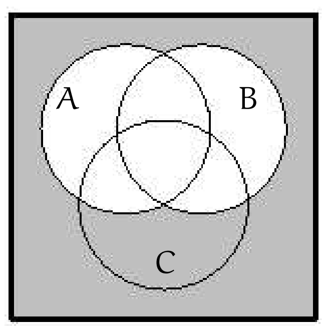
c. A^c



d. $A - (B \cup C)$



e. $(A \cup B)^c$



f. $A^c \cap B^c$

18: a. $A \times (B \times C) = \{(1,(u,m)),(1,(u,n)),(1,(v,m)),(1,(v,n)), (2,(u,m)),(2,(u,n)),(2,(v,m)),(2,(v,n)), (3,(u,m)),(3,(u,n)),(3,(v,m)),(3,(v,n))\}$

b. $(A \times B) \times C) = \{((1,u),m),((1,u),n),((1,v),m),((1,v),n), ((2,u),m),((2,u),n),((2,v),m),((2,v),n), ((3,u),m),((3,u),n),((3,v),m),((3,v),n)\}$

c. $A \times B \times C = \{(1,u,m),(1,u,n),(1,v,m),(1,v,n), (2,u,m),(2,u,n),(2,v,m),(2,v,n), (3,u,m),(3,u,n),(3,v,m),(3,v,n)\}$

2. Exercise set 5.2

4: *Proof.* Suppose A and B are any sets and $A \subseteq B$. *[We must show that* $\underline{A \cup B \subseteq B}$.*]* Let $x \in \underline{A \cup B}$. *[We must show that* $\underline{x \in B}$.*]* By definition of union, $x \in \underline{A}$ <u>or</u> $x \in \underline{B}$. In case $x \in \underline{A}$, then since $A \subseteq B$, $x \in \underline{B}$. In case $x \in B$, then clearly $x \in B$. So in either case, $x \in \underline{B}$ *[as was to be shown]*. □

†11: True. *Proof:*

$$\begin{aligned} x \in (A-B)\cap(C-B) &\Leftrightarrow x \in (A-B) \wedge x \in (C-B) \\ &\Leftrightarrow (x \in A \wedge x \notin B) \wedge (x \in C \wedge x \notin B) \\ &\Leftrightarrow (x \in A \wedge x \in C) \wedge x \notin B \\ &\Leftrightarrow x \in A \cap C \wedge x \notin B \\ &\Leftrightarrow x \in (A \cap C) - B. \end{aligned}$$
□

†12: False. E.g. for $A = \{1\}, B = \{\}, C = \{\}$.

31: (References to Theorem 5.2.2)

$$(A-B)-C \overset{(10)}{=} (A \cap B^c) \cap C^c \overset{(2)}{=} A \cap (B^c \cap C^c)$$
$$(A-C)-B \overset{(10)}{=} (A \cap C^c) \cap B^c \overset{(2)}{=} A \cap (C^c \cap B^c),$$

and the two are equal by (1). □

†34: (References to Theorem 5.2.2)

$$(A - B) - C \stackrel{(10)}{=} (A \cap B^c) \cap C^c \stackrel{(2)}{=} A \cap (B^c \cap C^c)$$

$$A - (B \cup C) \stackrel{(10)}{=} A \cap (B \cup C)^c \stackrel{(7)}{=} A \cap (B^c \cap C^c). \qquad \square$$

36: (References to Theorem 5.2.2)

$$(B^c \cup (B^c - A))^c \stackrel{(10)}{=} (B^c \cup (B^c \cap A^c))^c \stackrel{(9)}{=} (B^c)^c \stackrel{(5)}{=} B. \qquad \square$$