Exercises 2: Set Operations

Exercises

1. Using an appropriate Venn Diagram in each case indicate the following sets.

   (a) $(A \cap B) \cup B^c$
   (b) $A \setminus (A \setminus B)$
   (c) $A \cap (B \setminus A)$
   (d) $A \cup (B \cap C)$
   (e) $(A \cup B) \cap C$
   (f) $(A \cup B) \cap (A \cup C)$
   (g) $A^c \cup B^c \cup C^c$
   (h) $A^c \cap (B \setminus C^c)$

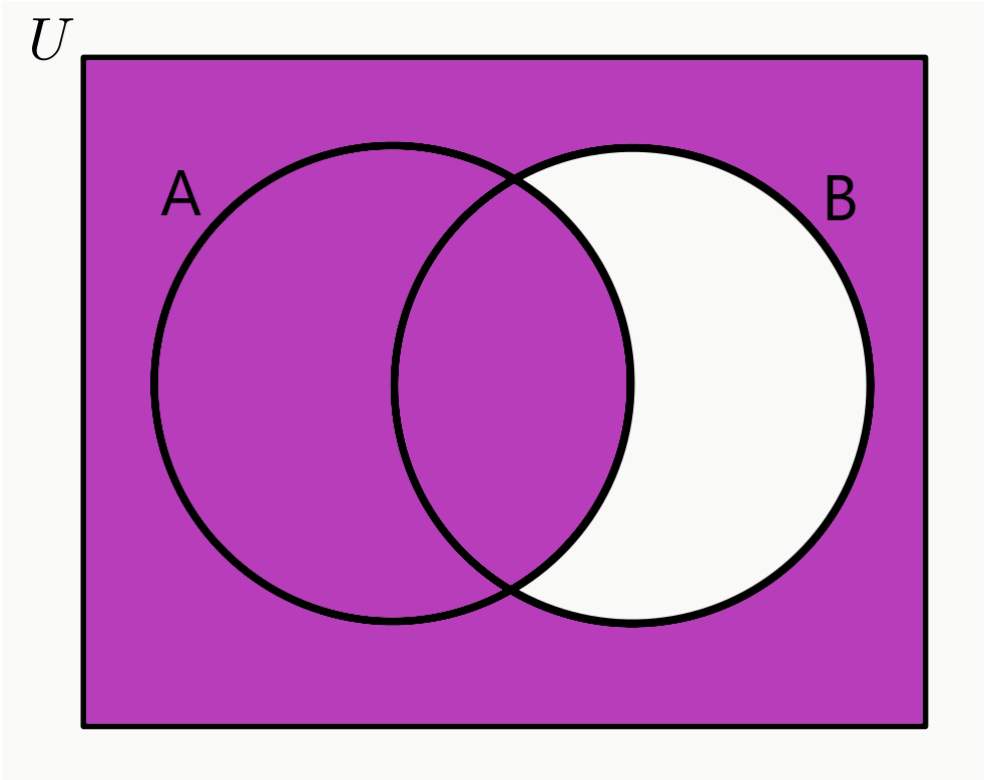
2. Let $A = \{1, 2, 3, 4, 5\}$, $B = \{3, 4, 5, 6, 7\}$, and $C = \{1, 2, 6, 7\}$, with the universal set being $U = \{1, 2, 3, \ldots, 10\}$. Write down the following sets by listing their elements:

   (a) $(A \cap B) \cup B^c$
   (b) $A \setminus (A \setminus B)$
   (c) $A \cap (B \setminus A)$
   (d) $A \cup (B \cap C)$
   (e) $(A \cup B) \cap C$
   (f) $(A \cup B) \cap (A \cup C)$
   (g) $A^c \cup B^c \cup C^c$
   (h) $A^c \cap (B \setminus C^c)$

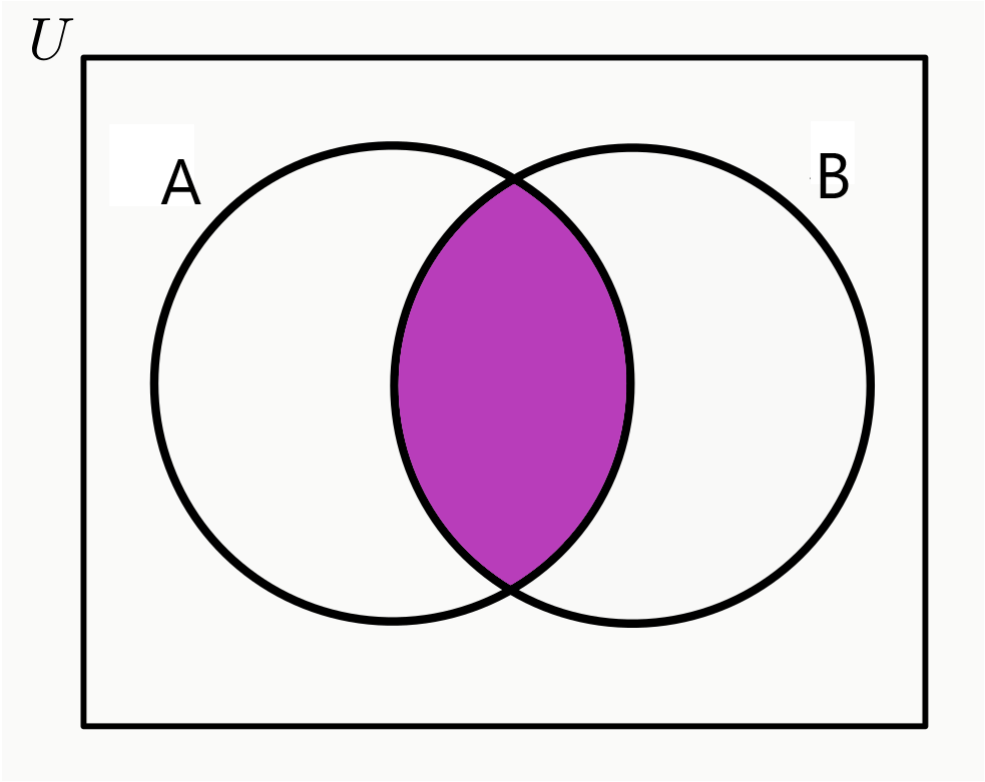
3. Give an example of three sets A, B and C such that $A \cap B \cap C = \emptyset$, but $A \cap B$, $B \cap C$ and $C \cap A$ are all non-empty.

Solutions

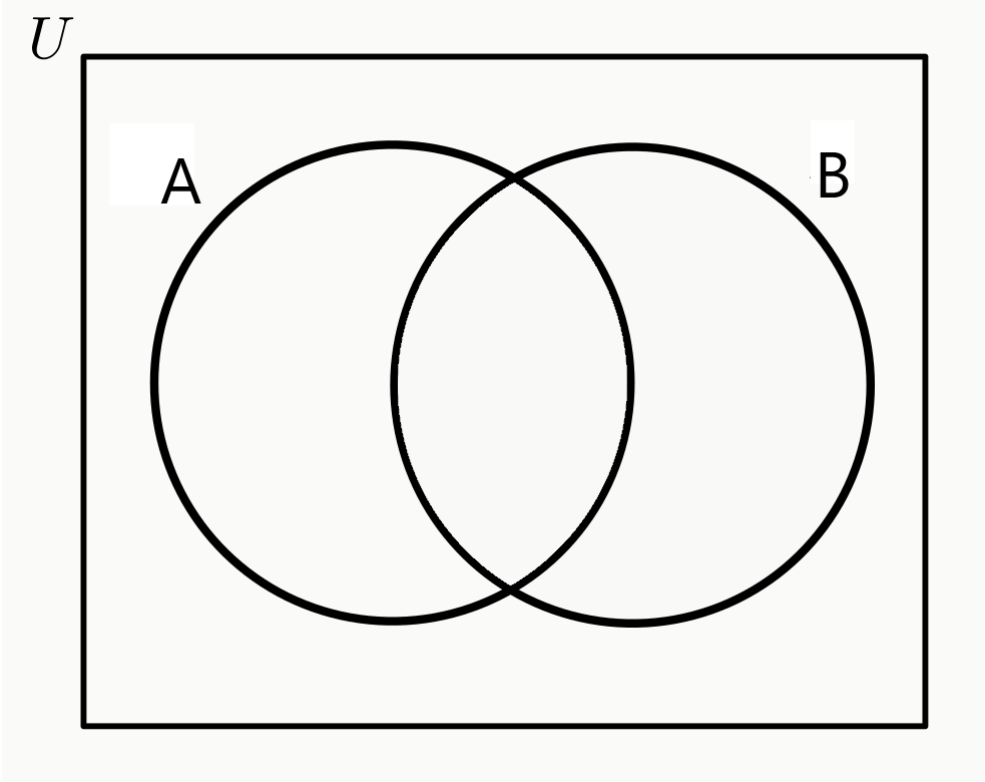
1. (a)



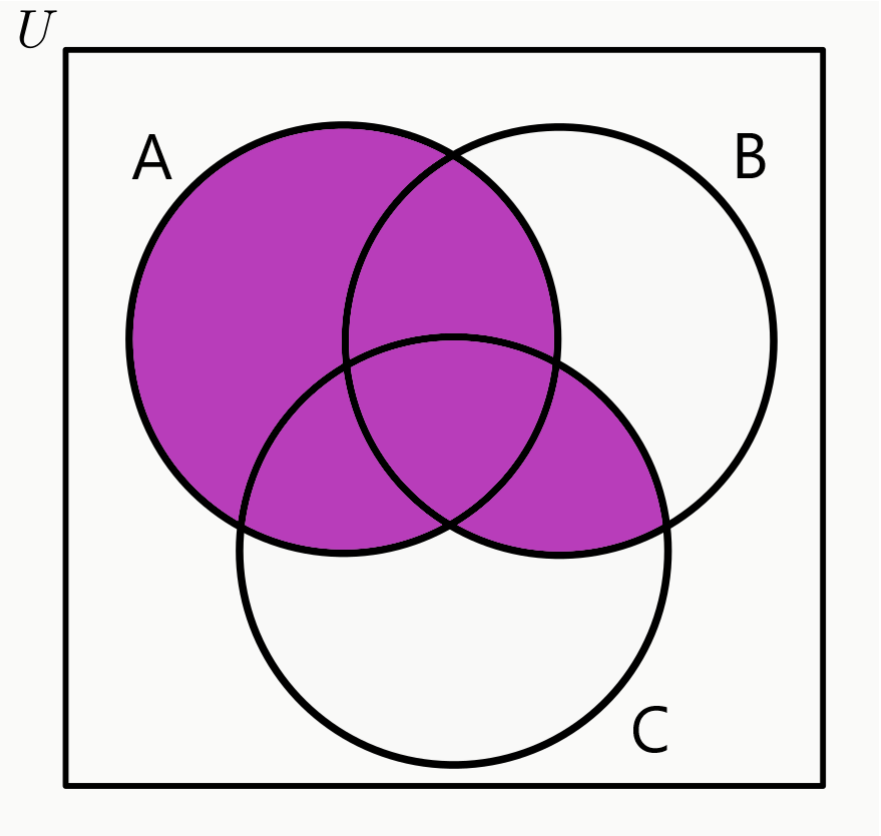
(b)



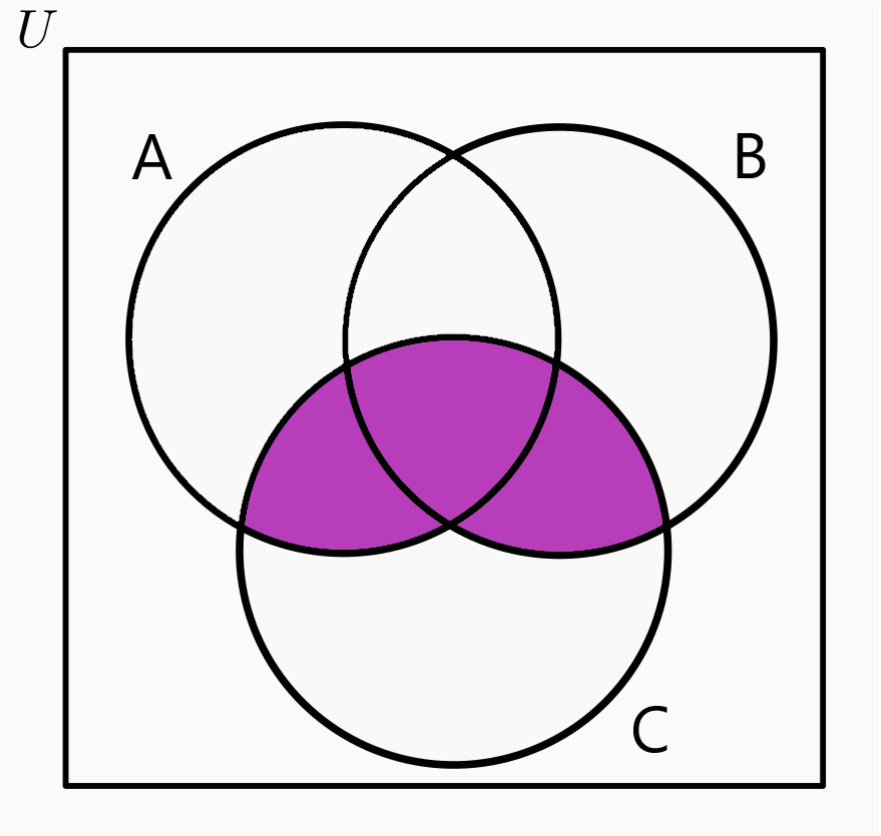
(c)



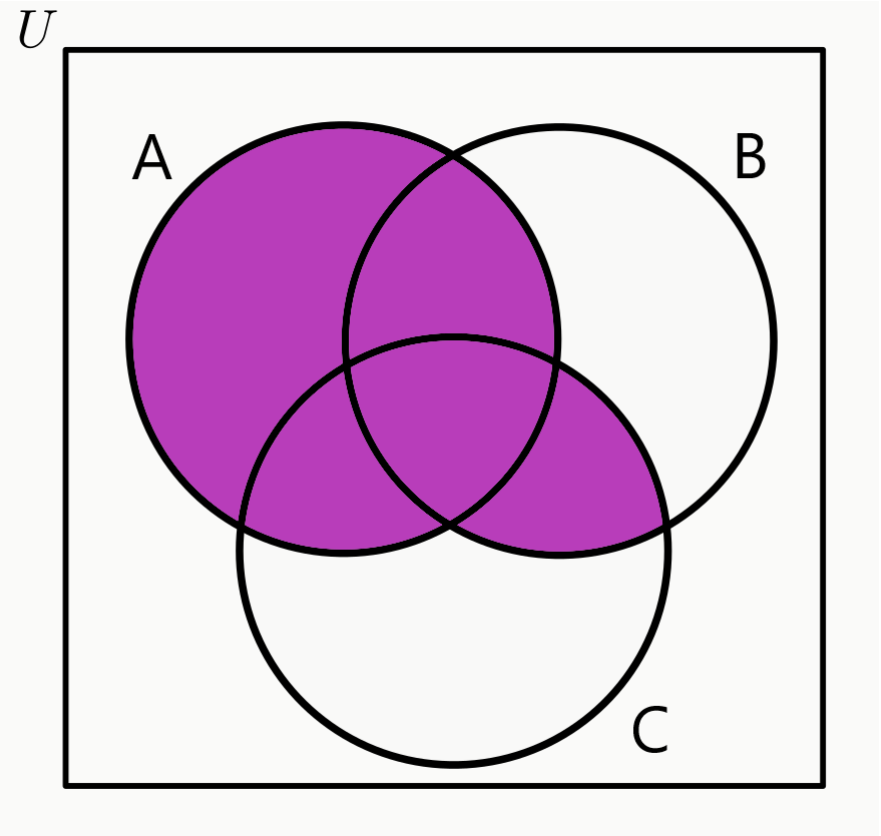
(d)



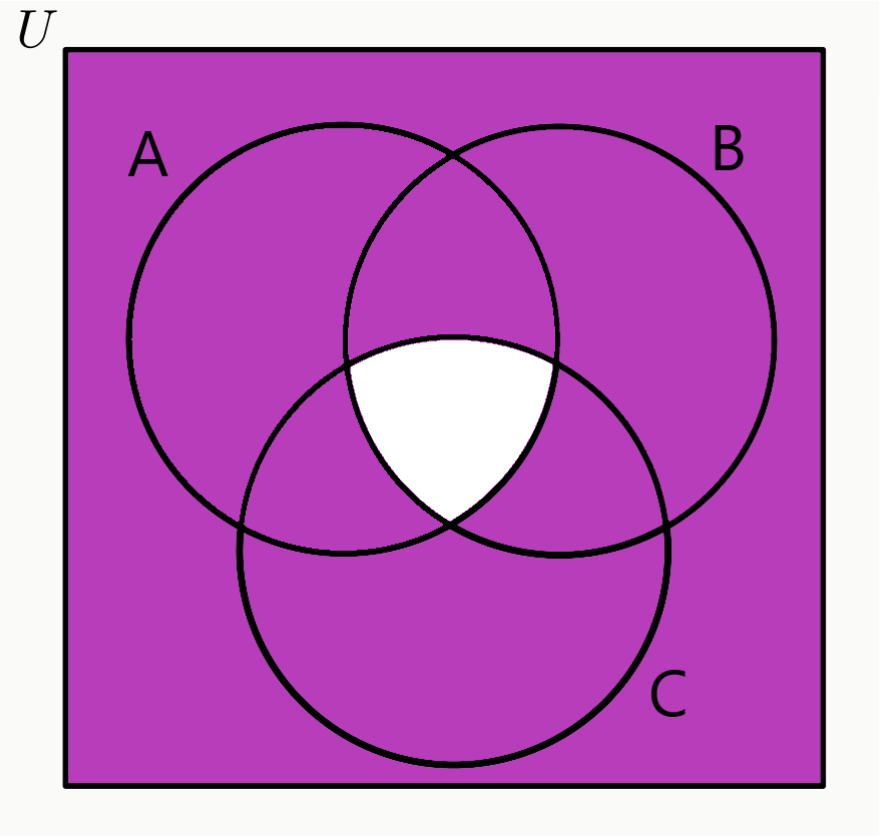
(e)



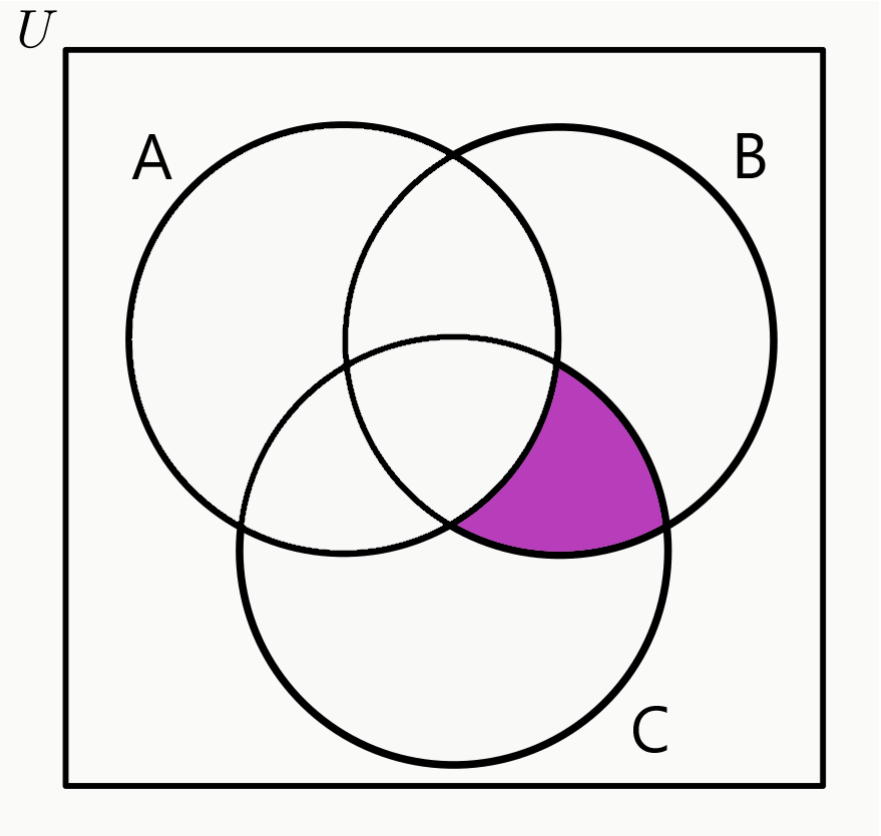
(f)



(g)



(h)



2. Let $A = \{1, 2, 3, 4, 5\}$, $B = \{3, 4, 5, 6, 7\}$, and $C = \{1, 2, 6, 7\}$, with the universal set being $U = \{1, 2, 3, \ldots, 10\}$. Write down the following sets by listing their elements:

   (a) $(A \cap B) \cup B^c = \{1, 2, 3, 4, 5, 8, 9, 10\}$
   (b) $A \setminus (A \setminus B) = \{3, 4, 5\}$
   (c) $A \cap (B \setminus A) = \emptyset$
   (d) $A \cup (B \cap C) = \{1, 2, 3, 4, 5, 6, 7\}$
   (e) $(A \cup B) \cap C = \{1, 2, 6, 7\}$
   (f) $(A \cup B) \cap (A \cup C) = \{1, 2, 3, 4, 5, 6, 7\}$
   (g) $A^c \cup B^c \cup C^c = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$
   (h) $A^c \cap (B \setminus C^c) = \{6, 7\}$

3. $A = \{1, 2\}$, $B = \{1, 3\}$, $C = \{2, 3\}$ is but one example.