Problem 1. Consider the following six sets.

\[ A = \{1, 2, 4\} \]
\[ B = \{2, 3, 5\} \]
\[ C = \{1, 2, 3, 4\} \]
\[ D = \{2, 3, 4, 5, 6\} \]
\[ E = \{2, 3, 4, 5, 6\} \]
\[ F = \{0, 1, 2, 4, 5, 7\} \]
\[ U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10\} \]

a. A is a subset of which other sets?

b. What is A \( \cap \) B?

c. What is C \( \cap \) F?
d. What is $A \cap B \cap C$?

e. What is $A \cup (B \cap D)$?

f. What is $(A \cup B) \cap D$?

g. What is $(A \cup B) \cap (A \cup D)$?

h. What is $A \cap (B \cup D)$?

i. What is $(A \cap B) \cup (A \cap D)$?

j. What is $(A \cap B) \cup D$?

k. What is $(A \cup D) \cap (B \cup D)$?

l. What is $(A \cap D) \cup (B \cap D)$?
m. Given U, what is $A^C$?

n. Given U, what is $(A \cup B)^C$?

o. Given U, what is $(A \cap B)^C$?

p. What is $D \setminus E$?

q. What is $F \setminus A$?
Problem 2. Consider the following sets.

\[ A = \left\{ \frac{a}{b} : a \in \{0, 1, 2, 3, 4\}, -1 \leq b \leq 3 \text{ and } b \in \text{integers}, \ b \neq 0 \right\} \]

\[ B = \{\{x, y\} : x + y = 5, x < 3 \text{ and } x \in \text{natural numbers, } y \leq 7\} \]

\[ C = \{\{x, y\} : x + y = 5, x < 10 \text{ and } x \in \text{natural numbers, } y \leq 7 \text{ and } y \in \text{integers}\} \]

\[ D = \{\{x, y\} : x + 2y = 12, x < 10 \text{ and } x \in \text{natural numbers, } y \leq 7 \text{ and } y \in \text{integers}\} \]

\[ E = \{\{x, y\} : x + 2y = 12, x < 8 \text{ and } x \in \text{integers, } y \leq 7\} \]

\[ F = \{\{x, y\} : 4x + y = -1, x < 2 \text{ and } x \in \text{integers, } y \leq 7\} \]

\[ G = \{\{x, y\} : x + y = 5, x < 2 \text{ and } x \in \text{integers, } y \leq 7\} \]

\[ X = \{\{x, y\} : |x| < 10, \ |y| < 5\} \]

a. List or show the elements of each of the sets: A, B, C, D, E, F, G, and X.

Hints: For set A, first find acceptable numbers for b.

For sets B, C, D, E, F and G, the set will be composed of ordered pairs (x,y).
b. What is $A \cap B$?

c. What is $B \cap C$?

d. What is $B \cap D$?

e. What is $B \cap E$?

f. What is $E \cap F$?

g. What is $E \cap G$?

h. What is $E \cap F \cap G$ ?
Problem 3. Simplify the following fractions.

a. \( \frac{16}{20} \)

b. \( \frac{112}{77} \)

c. \( \frac{441}{189} \)

d. \( \frac{4158}{2160} \)

e. \( \frac{426888}{27720} \)

f. \( \frac{15015}{35343} \)
Problem 4. Complete the following operations.

a. \( \frac{14}{16} + \frac{1}{4} \)

b. \( \frac{112}{8} \)

c. \( \frac{15}{28} + \frac{3}{7} \)

d. \( \frac{17}{26} + \frac{7}{4} \)

e. \( \frac{6}{7} + \frac{33}{84} + \frac{5}{6} \)

f. \( \frac{7}{8} + \frac{11}{24} + \frac{1}{3} + \frac{7}{12} \)