1. Let \( x \in (A-B)-C \). Based on the definition of difference set, we have \( x \in (A-B) \) and \( x \in C \). Further expanding it, \( x \in A \) and \( x \in B \) and \( x \in C \). Since \( x \in A \) and \( x \in B \), we have \( x \in (A-B) \). Our goal is to show that we also have \( x \in (B-C) \), which is equivalent to 
\[ \neg (x \in B) \land (x \in C) \equiv (x \in B) \lor (x \in C). \]
Since we have \( x \in B \), we must have \( (x \in B) \lor (x \in C) \). Therefore, \( x \in (B-C) \).

Based on that \( x \in (A-B) \) and \( x \in (B-C) \), we conclude that \( x \in (A-B)-(B-C) \).
We finished the first part of the proof.

Let \( x \in (A-C)-(B-C) \). We have
\[
(x \in (A-C)) \land (x \in (B-C))
\]
\[
= (x \in A) \land (x \in (A-C)) \land ((x \in B) \lor (x \in C))
\]
\[
= (x \in A) \land ((x \in C) \land (x \in B)) \lor (x \in F)
\]
\[
= (x \in A) \land (x \in B) \land (x \in C)
\]
\[
= (x \in (A-B)) \land (x \in C)
\]
\[
= x \in (A-B)-C
\]
We completed the proof.

2. \( \begin{array}{c}
\text{A} \\
\text{B} \\
\text{C} \\
\text{U} \\
\end{array} \)

\( \begin{array}{c}
\text{A} \\
\text{B} \\
\text{C} \\
\text{U} \\
\end{array} \)

\( \text{A} \cap (B \cup C) \)

\( \neg A \land \neg B \land \neg C \)
(A-B) U (A-C) U (B-C)

3. a) No. If ACC and BCC, \( A \cap C = C = B \cap C \) no matter how different \( A \) and \( B \) are.
   
   b) No. If \( C \subseteq A \) and \( C \subseteq B \) \( A \cap C = B \cap C \) even though \( A \) and \( B \) are different.

4. \( \{1, 3, 5\} \oplus \{1, 2, 3\} = \{5, 2\} \)

5. No. For instance \( A = \{1, 3\}, B = \{1, 2\} \) and \( C = \{1, 2, 3\} \)
   
   \( A \oplus (B \oplus C) = \{1\} \oplus \{3\} = \emptyset \)
   
   \( (A \oplus B) \oplus C = \{2\} \oplus \{1, 2, 3\} = \{1, 3\} \)

6. a) Domain: \( \mathbb{Z}^+ \times \mathbb{Z}^+ \) range: \( \mathbb{Z}^+ \)
   
   b) Domain: \( \{1, 2, 3\} \times \{1, 2, 3, 4, 5, 6, 7, 8, 9\} \)
      
      or \( \mathbb{N} \times \{0\} \)
   
   c) Domain: all the bit strings range: \( \mathbb{Z} \)

7. a) Yes
   
   b) No. Not one-to-one and not onto.
   
   c) No. Not onto because \( \frac{x+1}{x+2} \) cannot be 1.
   
   d) Yes.