Set Proofs

1. Show that the intersection distributes over the union: For any sets A, B, and C, prove that $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$.

2. Show that the union distributes over the intersection: For any sets A, B, and C, prove that $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$.

3. Use the distributive property to simplify the expression:
$(A \cup B) \cap (A \cup C) = A \cup (B \cap C)$

4. Use the distributive property to simplify the expression:
$(A \cup B) \cap (C \cup D) = (A \cap C) \cup (A \cap D) \cup (B \cap C) \cup (B \cap D)$

5. Use the distributive property to simplify the expression:
$(A \cup B) \cap (A \cap B) = A \cap B$

6. Use the distributive property to simplify the expression:
$(A \cap B) \cup (A \cup C) = A \cup (B \cap C)$

7. Use the distributive property to simplify the expression:
$(A \cap B) \cup (C \cap D) = (A \cup C) \cap (B \cup D)$

8. Use the distributive property to simplify the expression:
$(A \cap B) \cup (C \cup D) = (A \cup C) \cap (A \cup D) \cap (B \cup C) \cap (B \cup D)$

9. Show that the union of two sets is equal to the complement of their intersection: For any sets A and B, prove that $A \cup B = (A^c \cap B^c)^c$, where A^c and B^c are the complements of A and B, respectively.

10. Use the distributive property to simplify the expression:
$(A^c \cap B) \cup (A \cap B^c) = (A \cup B) \setminus (A \cap B)$