Transition to Mathematical Proofs
Chapter 2 - Set Theory Assignment

Instructions: For the below questions, show all of your work. For the proofs, be sure that you

(i) include a Discussion section;
(ii) write a complete proof in full English sentences;
(iii) if hand-writing, write legibly and clearly.

Question 1. In the notes, we proved one of DeMorgan's Set Theory laws. Prove the remaining one. That is, prove the following statement:

Let S and T be sets. Then

$$\overline{S \cap T} = \overline{S} \cup \overline{T}.$$

Question 2. In the notes, we proved one distributive law. Prove the remaining one. That is, prove the following statement:

Let S, T, and R be sets. Then,

$$S \cap (T \cup R) = (S \cap T) \cup (S \cap R).$$

Question 3. Let A, B, C, and D be sets. Show that if $A \subset B$ and $C \subset D$, then $A \times C \subset B \times D$.

Question 4. Let A, B, and C be sets. Show that

$$A \times (B \cap C) = (A \times B) \cap (A \times C).$$

Question 5. Let A, B, and C be sets. Show that

$$A \times (B \cup C) = (A \times B) \cup (A \times C).$$