

Let  $U = \{0, 1, 2, 3, 4, 5, 6, 7, 8, 9\}$  be the universal set,  $A = \{0, 1, 2, 3, 4, 5\}$ , and  $B = \{4, 5, 6, 7\}$ . Find each of the following numbers.

1.  $|A \times B|$

2.  $|\overline{A} \times \overline{B}|$

3.  $|A \times \overline{B}|$

4.  $|\overline{A} \times B|$

5.  $|A \times B| + |\overline{A} \times \overline{B}| + |A \times \overline{B}| + |\overline{A} \times B|$

6.  $|(A \cap B) \times (A \cup B)|$

7.  $|(A \cap B) \times \overline{(A \cup B)}|$

8.  $|\{T : T \subseteq U, |T \cap A| = 2 \text{ and } |T \cap B| = 2\}|$ . In other words, how many subsets  $T$  of  $U$  have exactly two elements in common with  $A$  and exactly two elements in common with  $B$ . Hint: start this problem by listing a few of the sets with the desired properties, and then ask yourself 'how much freedom is there in choosing such sets?'