1. Use a properly labeled Venn diagram to determine the validity of the following argument. Explain. *(9 points)*

   1. All nurses are women.
   2. Ahmad is a nurse.

   _____

   Therefore, Ahmad is a woman.

2. Construct a truth table to show that the symbolic statement $p \rightarrow q$ is logically equivalent to its contrapositive. *(9 points)*

3. Write the following argument in symbolic form. Then use a complete truth table to determine if the argument is valid. *(9 points)*

   All hurricanes produce dangerous weather. Whenever there is dangerous weather, classes are canceled. Classes are not canceled. Therefore, there is no hurricane.

4. If $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$, $A = \{1, 3, 4, 6, 8, 11\}$ and $B = \{2, 4, 6, 8, 12, 14\}$, find the set $(A \cup B)'$. Then illustrate the set $(A \cup B)'$ by shading the result in a Venn diagram. *(9 points)*

5. Let $A = \{a, b, c, d\}$. List all the subsets of A that have cardinality two. How can you tell how many such subsets there are using a combination or permutation number without listing them? Explain. *(9 points)*

6. In a group of 500 people, 325 enjoy watching football, 246 enjoy watching baseball, and 57 don't enjoy watching either sport. How many of the people enjoy watching both sports?

   Draw a properly labeled Venn diagram and explain your reasoning. *(9 points)*

7. From a group of 10 people, in how many ways can they be lined up in a row? In how many ways can they be lined up if a given pair of people must be adjacent? *(9 points)*

8. How many different license tags can be generated if they consist of three capital letters followed by three digits (zero through nine) if none of the letters can be repeated? Explain. *(10 points)*

9. From a group of eight men and nine women, in how many ways can a committee of five be chosen? In how many ways can such a committee be chosen if there must be at least two of each gender? *(9 points)*

10. From a standard 52-card deck, how many different 5-card hands consist of three cards in one suit and two cards in a different suit? Explain. *(9 points)*

11. A coin is flipped four times and the result of each flip is recorded. Write out the sample space for this four-flip experiment. Then find the probability that the four flips result in more heads than tails. Explain. *(9 points)*