1. Use a properly labeled Venn diagram to determine the validity of the following argument. Explain. *(10 points)*

> 1. All nurses are women.
> 2. Bill is a nurse.
> _____
>
> Therefore Bill is a woman.

2. For the symbolic statement $p \rightarrow q$, construct a truth table to show that the converse of the statement is logically equivalent to the inverse of the statement. *(10 points)*

3. Write the following argument in symbolic form. Then use a truth table to determine if the argument is valid. *(10 points)*

> If the defendant goes to jail, then the defendant is not innocent. If the defendant's lawyer is good, then the defendant does not go to jail. Therefore, the defendant is not innocent or the lawyer is not good.

4. If $U = \{a, b, c, d, e, f, g, h, i, j, k, l, m\}$, $A = \{a, c, e, g\}$ and $B = \{g, i, k, m\}$, find the set $(A \cup B)'$. Illustrate $(A \cup B)'$ by shading the result in a Venn diagram. *(10 points)*

5. List all of the subsets of the set $\{a, b, c\}$. If A is a set with $n(A) = k$, how many subsets of A are there? Explain. *(10 points)*

6. In a group of 150 students, 55 play tennis, 76 play racquetball, and 41 play neither? How many of the students play both tennis and racquetball?

   Draw a properly labeled Venn diagram and explain your reasoning. *(10 points)*

7. Compute the numbers $_6P_2$ and $_6C_2$. For the set $\{a, b, c, d, e, f\}$, list all the subsets of cardinality two and explain how this list is related to one of the numbers you just computed. *(10 points)*

8. In how many ways can 6 math books and 4 stat books be lined up on a shelf (without regard to subject)? In how many ways can this be done if books of the same subject are adjacent? Explain your counting argument. *(10 points)*

9. From a group of 8 men and 9 women, how many different ways are there to choose a 5-person committee consisting of 3 women and 2 men? Explain your counting argument. *(10 points)*

10. How many different 5-card poker hands consist of four of a kind? Explain. *(10 points)*