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

   > 1. All artists are master photographers.
   > 2. Ansel Adams is an artist.
   >
   > Therefore, Ansel Adams is a master photographer.

2. Use truth tables to determine if the statements $p \rightarrow q$ and $\sim p \vee q$ are logically equivalent. *(9 points)*

3. Determine which pairs of statements are equivalent: *(9 points)*

   (a) I am a rebel if I do not have a cause.

   (b) I am a rebel only if I do not have a cause.

   (c) I am not a rebel if I have a cause.

   (d) If I am not a rebel, I have a cause.

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

   > All MA 110 students study conscientiously. Students who do not study conscientiously don't make good grades. Jim is a student who does not make good grades. Therefore, Jim is not a MA 110 student.

5. If $U = \{1, 2, 3, \ldots 50\}$, $A = \{5, 10, 15, \ldots, 50\}$ and $B = \{3, 6, 9, \ldots, 48\}$, enumerate the set $A \cup B'$. *(9 points)*

6. Draw a Venn diagram that illustrates the set $A \cup (B \cap C)$. *(9 points)*

7. In a group of 287 students, 146 play tennis, 162 play racquetball, and 61 play neither? How many of the students play both tennis and racquetball?

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

8. In how many ways can 9 different people be lined up in a row? If three of the 9 must be lined up consecutively, in how many ways can this be done? *(9 points)*

9. From a group of 6 men and 8 women, how many different 5-person committees can be formed consisting of at least 2 from each gender? Explain your counting argument. *(9 points)*

10. How many different 5-card hands are there? Of these, how many have exactly 4 cards in one suit and the other card from a different suit? Explain your counting argument. *(9 points)*

11. A coin is tossed 4 times. Describe the sample space for this experiment. Then calculate the probability that a majority (3 or more) of the results are heads. Explain. *(9 points)*