1. (15 pts.) If 8 identical blackboards are to be divided among 4 (distinct) schools, how many divisions are possible?

2. Let E, F, and G be three events. Find expressions for the following events so that of E, F, and G (5 pts. each):
   a) E and F do not both occur
   b) at least one event but not more than two events occur
   c) F occurs without all three occurring.

3. Let Δ denote the “exclusive or” operation on sets, that is,
   \[ A \Delta B = (A \cap B^c) \cup (B \cap A^c). \]
   a) (10 pts.) Express \( P(A \Delta B) \) in terms of \( P(A) \), \( P(B) \), and \( P(A \cap B) \).
   b) (5 pts.) Is Δ an associative operation, that is, for sets \( A, B, \) and \( C \), is it true that \( (A \Delta B) \Delta C = A \Delta (B \Delta C) \)? (Yes or No).

4. A fair coin is tossed four times. Let \( A \) be the event that a head occurs on the first toss, and let \( B \) be the event that two heads and two tails occur.
   a) (5 pts. each) Compute \( P(A) \), \( P(B) \), and \( P(A \cap B) \).
   b) (5 pts.) Are \( A \) and \( B \) independent? (Yes or No).

5. (15 pts.) In a class, there are 4 first-year boys, 6 first-year girls, and 6 sophomore boys. How many sophomore girls must be present if, when a student is selected at random, the events the student is a boy and the student is a freshman are to be independent?

6. In a certain community, 36% of the families own a dog, and out of these families 22% also own a cat. In addition, 30% of the families in the community own a cat. What is (10 pts. each):
   a) the probability that a randomly selected family owns both a dog and a cat;
   b) the conditional probability that a randomly selected family owns a dog given that it owns a cat?