For this problem set, you may find it useful to consult Ken Rosen’s textbook *Discrete Math and Its Applications*. Your answers should be in complete sentences. You may use truth-tables were appropriate.

1. Give the contrapositive of the following statement. “If every bird flies, then there is a hungry cat.”
2. A proposition is a statement that can be true or false but not both. Let A, B, and C be propositions. Let denote logical AND, let denote logical OR, and let denote logical NOT. Argue that if is true, then must be true as well.
3. We use the notation to indicate that A implies B. This new proposition is true except when A is true and B is false. We write when either both A and B are true or both are false. Argue that if and only if and .
4. We will use the notation to indicate the number of elements in the set or its *cardinality*, e.g. is the number of elements in the set A. Consider four sets A,B,C,D such that the intersection of any three is empty. Use the inclusion-exclusion to give an expression for without using any union ( symbols.
5. State the formal definition of , and use the definition to show that the function is .
6. For every positive integer n, let denote the set . Use an inductive argument to show that

An alternative way to phrase the question is as follows. Let A be a set. We use the notation to indicate the power set of A, which consist of all subsets of A. For example, if , then . Considerand use an inductive argument to show that the sum .

(For example, the expansion for is )

1. Prove that the set of all languages over that have a bounded maximum string length is countable.