1. (10 points) Show using induction that

$$\sum_{i=1}^{n} [F(i)]^2 = F(n) \cdot F(n+1).$$

2. (10 points) How many distinct binary operations can be defined on a set of n elements?

3. (10 points) Show that the set of all infinite length strings over the alphabet $\{a, b\}$ is not countable.

4. (10 points) Let A and B denote two arbitrary sets and let $P(A)$ and $P(B)$ denote their power sets respectively. Argue that,

$$P(A \cap B) = P(A) \cap P(B)$$

5. (20 points) Let A, B and C denote three arbitrary sets. Show that

   (a)

   $$(A \cup B) - C = (A - C) \cup (B - C)$$

   (b)

   $$[(A' \cup B') \cap A']' = A$$