

If  $S$  is a **finite set** then we let  $\#S$  denote its number of elements. We call this the **size** or the **cardinality** of  $S$ . Sometimes we will use the equivalent notation  $|S| := \#S$ .

1. If  $S$  and  $T$  are finite sets, what is the size of the Cartesian product  $S \times T$ ?
2. If  $S$  and  $T$  are finite sets, how many different functions are there from  $S$  to  $T$ ? Express your answer in terms of the numbers  $\#S$  and  $\#T$ .
3. Apply your answers from Problems 1 and 2 to show that there are 16 possible functions from the set  $\{T, F\}^2 := \{T, F\} \times \{T, F\}$  to the set  $\{T, F\}$ .
4. Explicitly write down all of the functions from  $\{1, 2, 3\}$  to  $\{T, F\}$ .
5. Explicitly write down all of the subsets of  $\{1, 2, 3\}$ .
6. If  $S$  is a set with  $n$  elements, how many different subsets does  $S$  have? [Hint: Compare your answers from Problems 4 and 5. Apply your answer from Problem 2.]