

Give all answers in the simplest form that you can.

1. Give a table showing the probability of various number of heads that result when you flip a true coin three times.
  
2. A normal deck of cards has 52 cards. Each card is marked with a suit and a value. There are four suits, each suit has 13 values. If you draw two cards at random and without replacement, what is the probability that the two cards have the same suit?
  
3. An algorithm is looking for an item on a list of  $n$  items. It needs time  $i$  if the item being looked for is the  $i$ -th item on the list.
  - a. Suppose you are equally likely up any item on the list. What is the probability that the  $i$ -th item will be looked up.
  - b. What is the average time the algorithm will need under the assumptions of part a?
  - c. Suppose that the probability of looking up the  $i$ -th item is equal to  $\alpha/i$ . What is the value of  $\alpha$ ?
  - d. What is the average time the algorithm will need under the assumptions of part c?

4. Simplify  $\sum_i \binom{n}{i} \binom{i}{5} x^i$ .

5. Simplify  $\sum_{1 \leq i \leq n} i \lceil \lg i \rceil$  as much as you can.