

1. What is the sum of the integers from 1 to 1000?
2. Simplify  $\sum_{m \leq i \leq n} x^i$ . Assume  $m \leq n$ .
3. Rolling a single die produces a random integer in the range 1 to 6. Each possible integer is equally likely to occur. Suppose you roll two dice and sum the two numbers produced. What are the possible sums and how likely is each sum?
4. Simplify  $\sum_i (i - a)^2 \binom{n}{i}$ .
5. Suppose the you flip a biased coin  $n$  times. The probability of  $k$  heads is  $\binom{n}{k} p^k (1 - p)^{n-k}$ . What is the most likely value of  $k$ ? Prove that your answer is correct. The best answer is one that is correct for all integer  $n$  and  $k$ , but if it is too hard to solve that form of the problem you may wish to use eq. 3-13 and assume that both  $k$  and  $n - k$  are large.
6. (Counts as two problems.) How often is each step in the following algorithm done?
  - Step 1. For  $i := 1$  to  $n$  do
  - Step 2.   begin
  - Step 3.     $A[i, i] := 0$ ;
  - Step 4.    for  $j := i + 1$  to  $n$  do
  - Step 5.      $A[i, j] := -A[j, i]$ .
  - Step 6.    end.