

Instructions: You need not simplify, but you must write your answer using only numbers and the operations of addition, subtraction, multiplication, division, power and factorial. That is, “ $5!/2!$ ” is OK, but “ $P(5, 3)$ ” is not finished.

1. A box labeled ‘ A ’ contains 6 toys, and a box labeled ‘ B ’ contains 13 toys. All the toys are different.

(a) Suppose a child is told to select **one** toy, to be chosen either from box A **or** from box B . How many possible outcomes are there?

Ans: There are 2 tasks: select from box A (6 possibilities), or select from box B (13 possibilities). Since the sets are disjoint there are $6 + 13 = 19$ possibilities.

(b) Suppose the instructions are to select **two** toys, one from box A **and** one from box B . How many possible outcomes are there?

Ans: These are the same 2 tasks, but *both* must be done. So, multiply the numbers $6 \cdot 13 = 78$.

2. The 13-letter string "WASHINGTONIAN" has 3 occurrences of 'N' and 2 occurrences each of the letters 'A' and 'I', and no other repetitions.

(a) How many different 13-letter strings are arrangements of this string?

Ans: $\frac{13!}{3!2!2!}$.

(b) How many arrangements of this string contain the three substrings "NNN", "AA" and "II"?

Ans: Permutations of the 9 objects, 'NNN', 'AA', 'II', 'W', 'S', 'H', 'G', 'T', and 'O': $9!$ arrangements.