

3 APPLES + 2 APPLES =

"ARE YOU SURE EINSTEIN STARTED THIS WAY?"

CS151 Fall 2014
Lecture 18- 10/28

Combinatorics:
Counting

Prof. Tanya Berger-Wolf
<http://www.cs.uic.edu/bin/view/CS151/WebHome>

```

for i = n to 1 do
  say "      i little monkeys jumping on the bed
  One fell off and bumped his head
  So Momma called the doctor and the doctor said
  No more monkeys jumping on the bed!"
  
```

In my CompPopBio lab there are 128 processors. The probability of a CPU processor failing within a year is about 0.0003.

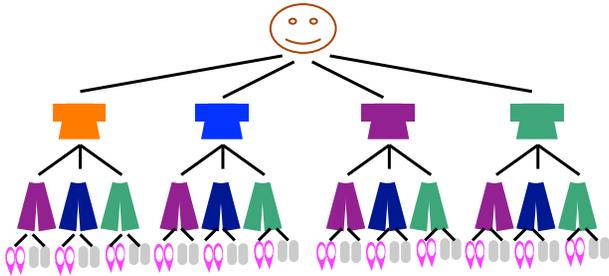
- Should I expect any processors to fail this year?
- How many processors would I have to have to almost guarantee an annual failure?

Lets start counting

- How many integers are there from 5 to 12?
5, 6, 7, 8, 9, 10, 11, 12 8
- How many integers are there from m to n?
m, m+1, m+2, m+3, ..., n=(m+(n-m)) n-m+1
- How many three-digit integers are there? m = 100, n = 999,
so 900
- How many three-digit integers are divisible by 5?
100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, ..., 994, 995, 996, 997, 998, 999
5*20 5*21 5*22 5*199 m = 20, n = 199,
so 180
- Let $A[0] A[1] \dots A[m] \dots A[n-1]$ be an array which is cut in the middle at $A[m]$. How many elements in each half? How many indices are there in the first half?

PossibilitiesTree

Suppose you have 4 shirts, 3 pairs of pants, and 2 pairs of shoes.
How many different outfits do you have?



Possibilities Tree

How many different game series are possible between two teams who play until one wins two games in a row or a total of three ?

Winner of game 1
Winner of game 2
Winner of game 3
Winner of game 4
Winner of game 5

10

© 2007 Thomson Higher Education

A PT is a good model for a sequence of events. It assists in counting, and can help you see special structure in the problem.

Multiplication Rule

If an operation consists of k steps and
 the 1st step can be done in n_1 ways
 the 2nd step can be done in n_2 ways (regardless of step 1)
 ...
 the k th step can be done in n_k ways (regardless of steps 1.. $k-1$)

then the entire operation can be done in $n_1 \times n_2 \times \dots \times n_k = \prod_{i=1}^k n_i$

6