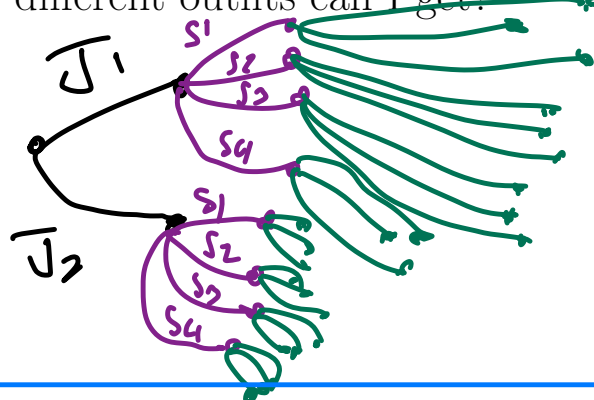


Probability Section 3.5 Counting

Counting Methods

Example 1. If I have 2 jackets, 4 shirts and 3 pants how many different outfits can I get?



Fundamental principle of counting If a first experiment can be performed in M distinct ways, and a second experiment can be performed in N distinct ways, then the two experiments can be performed in

$M \cdot N$ distinct ways!

exp 1: n_1

exp 2: n_2

exp 3: n_3

,

$n_1 \cdot n_2 \cdot n_3$

Example 2. How many 4 digit PINs are possible when the first digit can't be repeated?

10 9 9 9
 ↓
 choices

of distinct 4 digit
 pins $10 \cdot 9 \cdot 9 \cdot 9$
7290 ways

Example 3. A telephone number has 10 digits:

(area code) - - - - -

1. How many possible telephone numbers are there in each area code?

(- - -) 10 10 10 10 10 10 10
 $10^7 = 10,000,000$ phone #

2. How many telephone numbers are there in each area code where the first digit can't begin with a 0 and the last four digits can't repeat?

(- - -) 9 10 10 10 9 8 7
 $Ans = 9^2 \cdot 10^3 \cdot 8 \cdot 7 = 4,536,000$

Example 4. How many ways can eight people line up for a photograph?

8 7 6 5 4 3 2 1

ways = $8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 8!$

40,320 ways

Calculator: 8 MATH $\rightarrow$ PROB $\rightarrow$!

Factorial

$$n! = 1 \cdot 2 \cdot 3 \cdot 4 \cdot \dots \cdot n$$

$$5! = 1 \cdot 2 \cdot 3 \cdot 4 \cdot 5$$

Example 5. A local television station has eleven slots for commercials during a special broadcast. Six restaurants and 5 stores have bought slots for the broadcast.

(a) In how many ways can the commercials be arranged?

$$\underline{11} \quad \underline{10} \quad \underline{9} \quad \underline{8} \quad \underline{7} \quad \underline{6} \quad \underline{5} \quad \underline{4} \quad \underline{3} \quad \underline{2} \quad \underline{1}$$

$11!$ ways that the commercials can be arranged.

(b) In how many ways can the commercials be arranged so that the restaurants are grouped together and the stores are grouped together?

$$\underline{6} \quad \underline{5} \quad \underline{4} \quad \underline{3} \quad \underline{2} \quad \underline{1} \quad \underline{5} \quad \underline{4} \quad \underline{3} \quad \underline{2} \quad \underline{1}$$

rest. $6! \cdot 5!$ stores

or

$$\underline{5} \quad \underline{4} \quad \underline{3} \quad \underline{2} \quad \underline{1} \quad \underline{6} \quad \underline{5} \quad \underline{4} \quad \underline{3} \quad \underline{2} \quad \underline{1}$$

stores $5! \cdot 6!$ restaurants

Answer $6! \cdot 5! + 5! \cdot 6! = 172,800!$