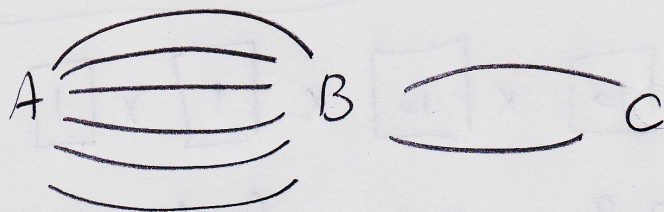


3.4 The Multiplication Principle

Multiplication Principle:

When performing a sequence of tasks,
the number of possibilities is multiplied.

Ex:



How many possible routes from A to C?

$$\boxed{6} \times \boxed{2} = 12$$

routes from A to B # routes from B to C

Ex: How many possible outcomes if we toss a coin four times?

e.g. $\begin{matrix} HHHH \\ THHT \end{matrix}$

$$\boxed{2} \times \boxed{2} \times \boxed{2} \times \boxed{2} = 16$$

options for 1st toss (H or T) 2nd toss 3rd 4th

Ex: How many 6-digit palindromes are there?

e.g. 784487

Cautions: not 019910

← technically not 6-digits
We would write 19910

$$\boxed{9} \times \boxed{10} \times \boxed{10} \times \boxed{1} \times \boxed{1} \times \boxed{1} = 900$$

Could be
1-9

0-9

0-9

fixed →

Ex: How many 5-digit passwords using digits 0-9 if adjacent digits can't be the same?

e.g. 13234 OK
13324 prohibited
01010 OK

$$\boxed{10} \times \boxed{9} \times \boxed{9} \times \boxed{9} \times \boxed{9} = 65,610$$

0-9

different than previous →

Ex: How many ways to arrange 7 books on a shelf from left to right?

$$\boxed{7} \times \boxed{6} \times \boxed{5} \times \boxed{4} \times \boxed{3} \times \boxed{2} \times \boxed{1}$$

options for 1st book 2nd book

$$= 5,040$$

Ex: 10 people interview for a job.

a) # ways to choose best and second-best?

$$\boxed{10} \times \boxed{9} = 90$$

ways to choose best 2nd-best

b) # ways to rank them 1 through 10?

$$\boxed{10} \times \boxed{9} \times \boxed{8} \times \dots \times \boxed{1} = 3,628,800$$

ways to choose 1st 2nd

Ex: How many 3-letter "words" can be formed from A, B, C if:

a) repetition is allowed

$$\boxed{3} \times \boxed{3} \times \boxed{3} = 27$$

A, B, or C

b) repetition is not allowed

$$\boxed{3} \times \boxed{2} \times \boxed{1} = 6$$