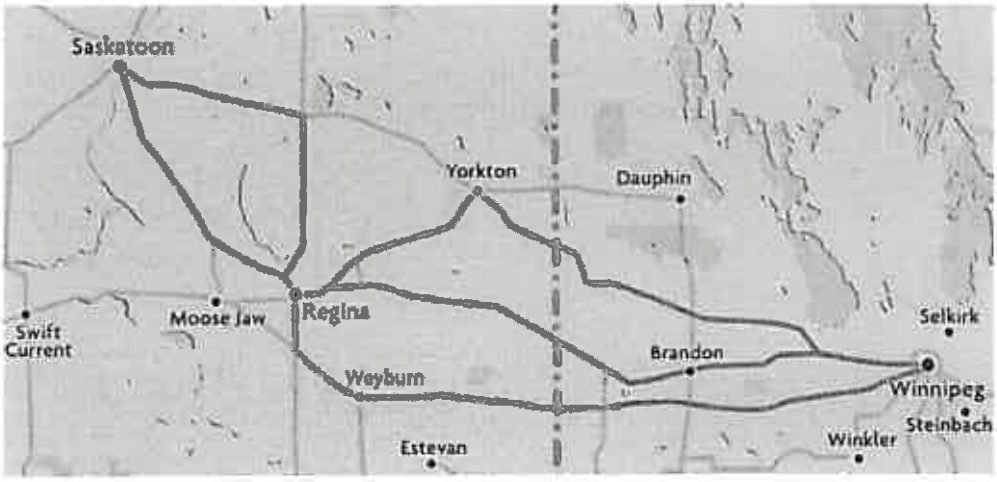
FOM 12

4.1 – Counting Principles

Example 1: Serge lives in Winnipeg. This summer he plans a sight-seeing trip that includes visiting his family in Regina and Saskatoon. There are many places he might visit on the trip, but he knows he will stop in Regina to visit his brother and then in Saskatoon to visit his parents. He has chosen and mapped out three different routes he can take from Winnipeg to Regina and two different routes he can take from Regina to Saskatoon.



What are Serge's three options to get from Winnipeg to Regina to visit his brother?

A: Yorkton → Regina
B: Brandon → Regina
C: Weyburn → Regina

What are the two options Serge has to get from Regina to Saskatoon to visit his parents?

D: East Rd
E: West Rd

Create a Sample Space to find the total number of possible paths Serge has to travel from Winnipeg to Saskatoon.

AD BD CD
AE BE CE

Total of 6 different ways to get from Winnipeg to Saskatoon

How do the number of possible paths in each leg of the journey relate to the total number of ways that Serge can get from Winnipeg to Saskatoon?

$2 \times 3 = 6$

multiply the number of options in each leg of the journey to find total number of different ways to get there.

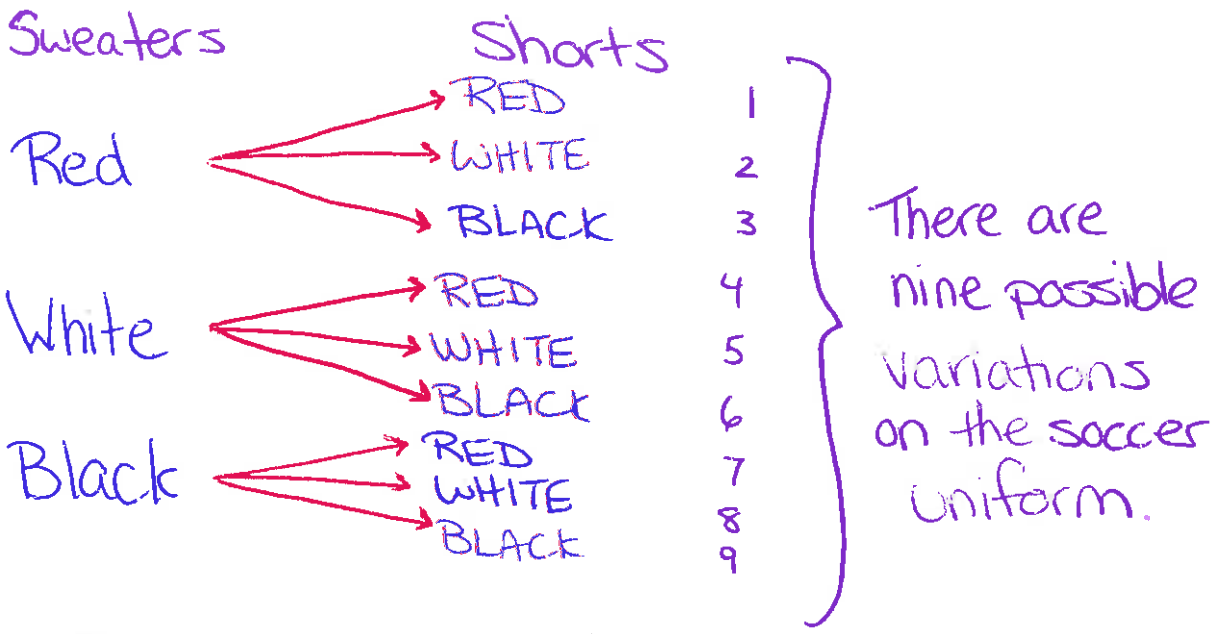
Fundamental Counting Principle: If there are a ways to perform one task and b ways to perform another, then there are $a \cdot b$ ways of performing both.

Example 2: Hannah plays on her school soccer team. The soccer uniform has:

- three different sweaters: Red, White, and Black, and
- three different shorts: Red, White, and Black

How many different variations of the soccer uniform can the coach choose from for each game?

Method 1: Using a tree diagram to show the sample space:



Method 2: Using the Fundamental Counting Principle:

Total options = #sweaters x #socks

= 3 x 3

= 9 possible variations

Example 3: A luggage lock opens with the correct three-digit code. Each wheel rotates through the digits 0 to 9.

a) How many different three-digit codes are possible?

codes = Dial 1 x Dial 2 x Dial 3

= 10 x 10 x 10

Codes = 1000

b) Suppose each digit can be used only once in a code. How many different codes are possible when **repition is not allowed**?

Codes = D1 x D2 x D3

= 10 x 9 x 8 = 720 different possibilities

one # already used ← 2 #s already used.

Example 4: A standard deck of cards contains 52 cards divided into 4 suits (Hearts and Diamonds are Red, Spades and Clubs are Black). Each suit contains the numbers 2 – 10 and a Jack, Queen, King, and Ace.

Count the number of possibilities of drawing a single card and getting:

a) either a four or a seven

4♠ 7♠
4♣ 7♣
4♥ 7♥
4♦ 7♦

Eight Possibilities

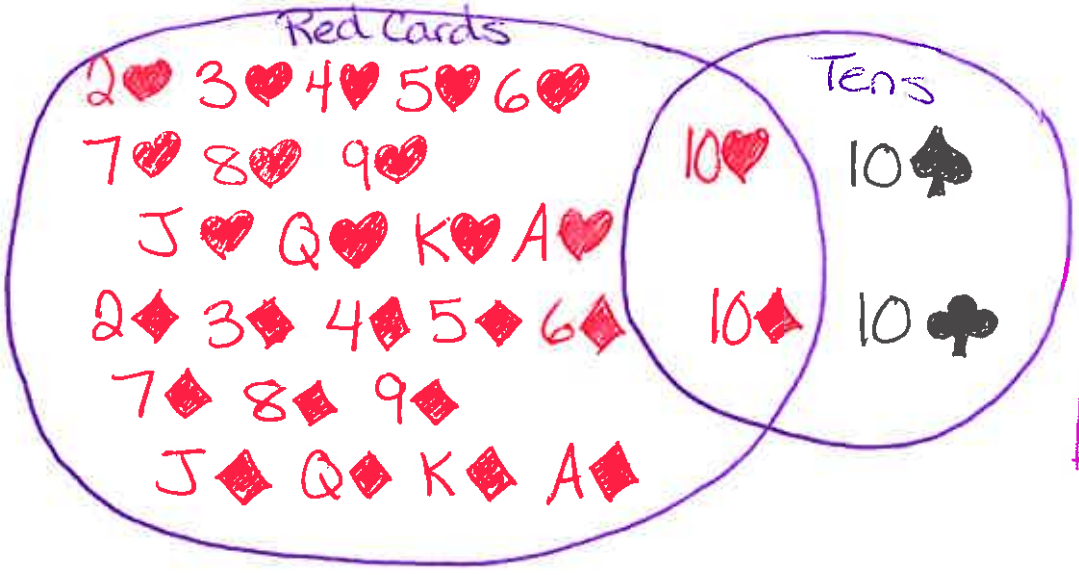
b) either a black face card or an ace

Black face cards { J♠ Q♠ K♠ / J♣ Q♣ K♣

Ten Possibilities

Aces { A♠ A♣ A♥ A♦

c) either a red card or a 10



28 Possibilities

*Since there is overlap you have to be careful! It isn't just the number of reds plus the number of tens.

Assignment: Pg. 235 #1 – 16 Extension (#18 – 21)