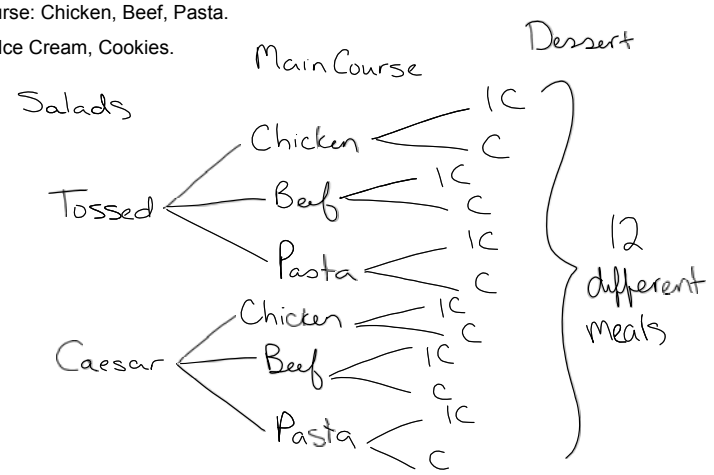
5.1 Fundamental Counting Principle

Ex.) Use a tree diagram to determine how many different meals could you have with the following choices:

Salads: Tossed, Caesar.

Main Course: Chicken, Beef, Pasta.

Dessert: Ice Cream, Cookies.



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Tree diagrams work well for small sets, but can be time consuming for larger sets. The **Fundamental Counting Principle** allows us to do these calculations for larger sets more quickly.

With the Fundamental Counting Principle, we <u>create blank spaces</u> that will be filled with the <u>number of options</u> we have for that space. Use the Fundamental Counting Principle for the previous example:

$$\underset{\text{Salad}}{2} \cdot \underset{\text{main course}}{3} \cdot \underset{\text{dessert}}{2} = \boxed{12}$$

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Ex.) You have 6 pairs of pants, 12 shirts, and 3 pairs of shoes. How many outfits could you make?

$\frac{6}{\text{pants}} \cdot \frac{12}{\text{shirts}} \cdot \frac{3}{\text{shoes}} = \boxed{216 \text{ outfits}}$

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Restrictions: fill in the restriction first, then work with the remaining items

Ex.) How many 2-digit, odd numbers can be made from 1, 2, 4, 5, 7, 8, 9, if:

a) Repeats are allowed.

$\underline{7} \cdot \underset{\text{odd}}{\underline{4}} = \boxed{28}$

b) Repeats are not allowed.

$\underline{6} \cdot \underset{\text{odd}}{\underline{4}} = \boxed{24}$

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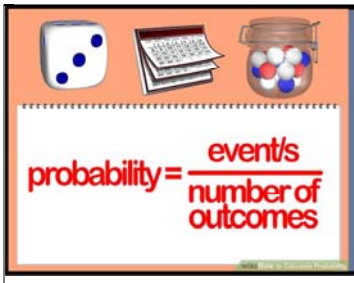

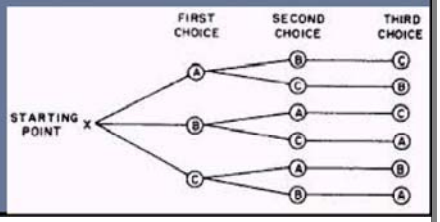

Ex.) How many 3-digit, odd numbers (with no repeats) can be made from: 0, 1, 4, 5, 6, 8, 9.

$\underset{\text{Can't be 0}}{5} \cdot 5 \cdot \underset{\text{odd}}{3} = 75$

Ex.) How many 3-digit, even numbers (with repeats allowed) can be made from: 2, 3, 4, 6, 7, 8.

$6 \cdot 6 \cdot \underset{\text{even}}{4} = 144$

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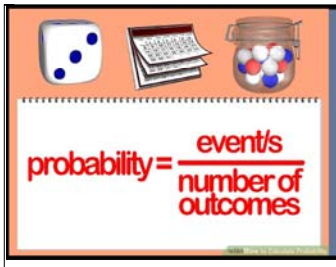

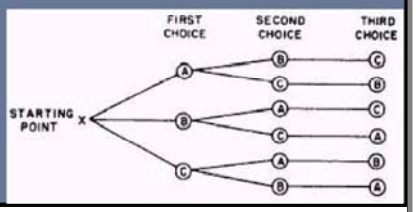

Ex.) How many License Plates (3 digits and 3 letters) can be made with: 26 letters in alphabet, aeiou vowels, consonant, 10 digits

a) no restrictions

$\underset{\#}{10} \cdot \underset{\#}{10} \cdot \underset{\#}{10} \cdot \underset{L}{26} \cdot \underset{L}{26} \cdot \underset{L}{26} = 17\,576\,000$

b) no *I* or *O*

$\underset{\#}{10} \cdot \underset{\#}{10} \cdot \underset{\#}{10} \cdot \underset{L}{24} \cdot \underset{L}{24} \cdot \underset{L}{24} = 13\,824\,000$

c) first letter is your initial and last number is odd

$\underset{\#}{10} \cdot \underset{\#}{10} \cdot \underset{\#}{5} \cdot \underset{L}{1} \cdot \underset{L}{26} \cdot \underset{L}{26} = 338\,000$

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Ex.) *Create* [redacted] *from the letters* questions: no repeats, [redacted]

LACOMBE

a) total number of arrangements of all letters

$7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 5040$

b) 4-letter word arrangements

$7 \cdot 6 \cdot 5 \cdot 4 = 840$

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c) 4-letter word that ends in E

$6 \cdot 5 \cdot 4 \cdot \underset{E}{1} = 120$

d) 4-letter word that contains E

$6 \cdot 5 \cdot 4 \cdot \underset{E}{1} = 120$

OR

$6 \cdot 5 \cdot \underset{E}{1} \cdot 4 = 120$

OR

$6 \cdot \underset{E}{1} \cdot 5 \cdot 4 = 120$

OR

$\underset{E}{1} \cdot 6 \cdot 5 \cdot 4 = 120$

480

* OR : add +

AND : multiply ×

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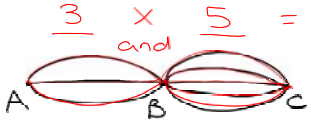
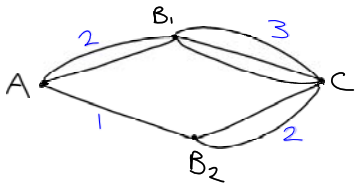
Ex.) Pathways:

3 x 5 = 15
and





Via B_1 OR Via B_2

$(2 \times 3) + (1 \times 2)$

$= 6 + 2$

$= \boxed{8}$

Pg. 73 # 1, 2, 4-6, 9, 11, 15.

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