10.1 / 10.2 Intro to Probability & Permutations

Obj: 1. Theoretical Probability
2. Fundamental Counting Principle
3. Permutations.

Probability: overall likelihood of an event occurring.

Theoretical Probability:

$$\frac{\#\text{ of desired outcomes}}{\#\text{ of possible outcomes}}$$

Apr 9-10:35 AM

What is the probability of rolling a 1 on one roll of a die?

$$\frac{1}{6}$$

rolling an odd #?

$$\frac{3}{6} = \frac{1}{2}$$

Example 1: prob. of rolling even # or five

$$\frac{4}{6} = \frac{2}{3} \approx .667 = 66.7\%$$

Apr 9-11:06 AM

Find the probability of selecting a king from a standard deck.

$$\frac{4}{52} = \frac{1}{13}$$

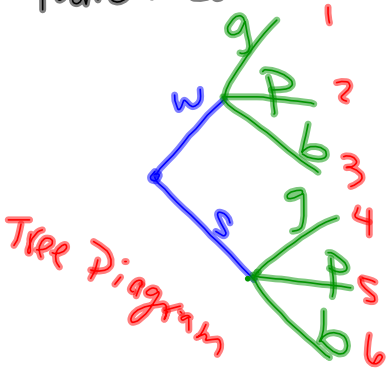
Apr 9-11:09 AM

If you check your email once every hour, what is the probability that you will check between 1:30 and 1:40?
1:30 and 1:34?

$$\frac{10}{60} = \frac{1}{6} \qquad \frac{4}{60} = \frac{1}{15}$$

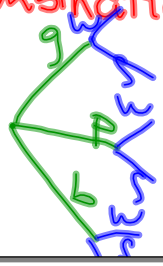
Apr 9-11:14 AM

For lunch, you can choose between soda & water for a drink and a garden, potato, or bean salad w/ your meal. How many lunch combos are there?



Tree Diagram

6 combinations



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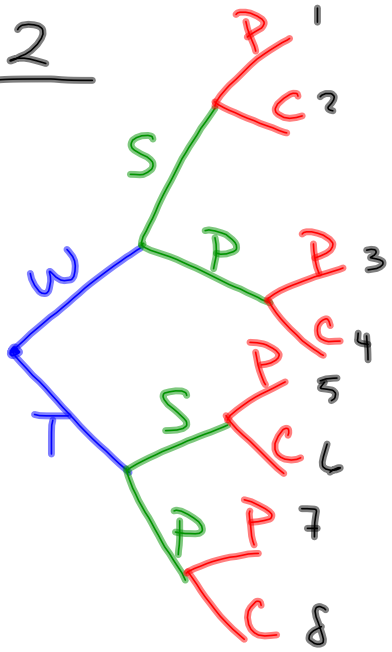
EX 2



8 combinations

Fundamental Counting Principle

$2 \cdot 2 \cdot 2 = 8$

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Fundamental Counting Principle:

If there are m # of ways an event can occur & n # of ways another event can occur, then there are $m \cdot n$ ways they both can occur.

Ex 3

$5 \cdot 3 \cdot 4 = 60$

Apr 9-11:24 AM

Ann is choosing a password for her email. It needs to be 2 letters followed by 4 #s. How many passwords are possible?

without repeating?

$26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 \cdot 10$

$= 6760000$

$26 \cdot 25 \cdot 10 \cdot 9 \cdot 8 \cdot 7$

$= 3276000$

Apr 9-11:26 AM

Permutations: arrangements of objects in a specific order.

# of permutations of n objects:

$$n! = n \cdot (n-1) \cdot (n-2) \cdot \ldots \cdot 1$$

$$6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$$

Apr 9-11:30 AM

Permutations of n objects taken r at a time:

$$_nP_r = \frac{n!}{(n-r)!}$$

How many ways can you listen to 5 (r) songs if you have 15 (n) to pick from?

$$_{15}P_5 = \frac{15!}{(15-5)!} = \frac{15!}{10!} = \frac{15 \cdot 14 \cdot 13 \cdot 12 \cdot 11 \cdot \cancel{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}}{\cancel{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}}$$

$$= 15 \cdot 14 \cdot 13 \cdot 12 \cdot 11 = 360{,}360$$

Apr 9-11:33 AM

Worksheet

b. $4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$

Ex 1 $_{n}6$ books on a shelf

$6! = 720$

Ex 2 $_{r}3$ people from $_{n}7$ = $_{7}P_{3} = \frac{7!}{(7-3)!} = 210$

Apr 9-11:37 AM

Permutations w/ Identical Objects:

n objects r identical

$$\frac{n!}{r!}$$

How many ways can I plant 11 flowers in a row if 4 are red, 5 are yellow and 2 are purple?

$$\frac{11!}{(4!\,5!\,2!)} = 6930$$

Apr 9-11:41 AM

Ex 3

3 math
4 science
7 reading
14 total

$$\frac{14!}{3!4!7!} = 120,120$$

Apr 9-11:47 AM

Circular Permutations

n objects

# of permutations in circle:

$$(n-1)!$$

Ex 4 $_{n}5$ vegetables on a platter

$$(5-1)! = 4! = 24$$

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