Homework Review: 13.1

11 3 : 7

prob: $\frac{\text{event can happen}}{\text{total outcomes}}$

odds: event can happen : event can not happen

35 people → 17 boys
→ 18 girls

$\frac{18}{35}$ (prob) 18 : 17

Finding Probabilities by using Permutations

A way of arranging a certain # of items

three people in a race

1.
2.
3.

What is a permutation?

Order is important!

Example: HECK

HECK
EHCK
KCHE
KHEC
⋮

Factorial Notation

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

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

Factorials give us a shorthand for calculating arrangements

n! = n * (n - 1) * (n - 2) ...

$21! = 21 \cdot 20 \cdot 19 \cdot 18 \cdot 17 \cdot 16 \cdot 15 \cdot 14 \cdot 13 \cdot 12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

<u>HECK</u>

$4! = 4 \cdot 3 \cdot 2 \cdot 1 = \boxed{24}$

Permutation formulas

$\left(0! = 1 \right)$

$\boxed{\frac{9!}{9!} = 1} = 0!$

Permutation formulas allow us to make probability calculations using factorials

${}_nP_n = n!$

${}_3P_3 = 3! = 3 \cdot 2 \cdot 1 = 6$

${}_nP_n$ = the number of permutations of n objects (arranging all the objects you have)

${}_nP_r = n! / (n - r)!$

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

${}_nP_r$ = the number of permutations of n objects taken r at a time

(pick "r" objects from a group of "n" objects)

$${}_{30}P_2 = \frac{30!}{(30-2)!} = \frac{30!}{28!}$$

# of objects you have

you're picking

HCKE

HECK

10. $\frac{8!}{3!}$

$$\frac{8\cdot7\cdot6\cdot5\cdot4\cdot\cancel{3}\cdot\cancel{2}\cdot\cancel{1}}{\cancel{3}\cdot\cancel{2}\cdot\cancel{1}} =$$

$$8\cdot7\cdot6\cdot5\cdot4 = 6720$$

$$\frac{8\cdot7\cdot6\cdot5\cdot4\cdot\cancel{3!}}{\cancel{3!}}$$

11. $\frac{12!}{9!}$

$$\frac{12\cdot11\cdot10\cdot\cancel{9!}}{\cancel{9!}} =$$

$$1320$$

12. $\frac{15!}{14!}$

$$\frac{15\cdot\cancel{14!}}{\cancel{14!}} = 15$$

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

16. ${}_8P_7 = \frac{8!}{(8-7)!}$

n r

$$\frac{8!}{1!} = 8\cdot7\cdot6\cdot5\cdot4\cdot3\cdot2$$

$$= 40320$$

17. ${}_{10}P_6 = \frac{10!}{(10-6)!}$

n r

$$= \frac{10!}{4!}$$

$$= \frac{10\cdot9\cdot8\cdot7\cdot6\cdot5\cdot\cancel{4!}}{\cancel{4!}}$$

$$= 151200$$

18. ${}_5P_0 = \frac{5!}{(5-0)!}$

n r

$$= \frac{5!}{5!} = 1$$

Find the number of ways you can arrange (a) all of the letters in the given word and (b) 2 of the letters in the word.

1. TACK

a. ${}_4P_4 = 4! = 24$

b. ${}_4P_2 = \frac{4!}{(4-2)!}$

$= \frac{4!}{2!}$

$= \frac{4 \cdot 3 \cdot \cancel{2!}}{\cancel{2!}}$

$= 12$

2. MAR

$\boxed{a.}$ 6

$\boxed{b.}$ ${}_3P_2 = \frac{3!}{(3-2)!}$

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

3. GAMER

$\boxed{a.}$ $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$

$\boxed{b.}$ ${}_5P_2 = \frac{5!}{(5-2)!}$

$= \frac{5!}{3!}$

$= \frac{5 \cdot 4 \cdot \cancel{3!}}{\cancel{3!}}$

$= 5 \cdot 4 = 20$

Soapbox Racing You are in a soapbox racing competition. In each heat, 7 cars race and the positions of the cars are randomly assigned.

a. In how many ways can a position be assigned? 5040 (Sample space)

b. What is the probability that you are chosen to be in the last position? *Explain* how you found your answer. $\frac{720}{5040} = .14$ (14%)

c. What is the probability that you are chosen to be in the first or second position of the heat that you are racing in? *Explain* how you found your answer. $\frac{720+720}{5040} = .29$ (28%)

d. What is the probability that you are chosen to be in the second or third position of the heat that you are racing in? *Compare* your answer with that in part (c). 28%

1 2 3 4 5 6 7

Luke Bregar Courtney Ethan Matt Hailey Kieran

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

In a recent survey, it was reported that of drivers who recently got in an accident, 75% of them were NOT eating food when they crashed their car. Is it therefore safer to eat while driving? Why or why not?

100 driving & crash

$\frac{75}{1075} \approx 7.5\%$ 75 not eating

$\frac{25}{50} = 50\%$ 25 were eating

1025 driving & no crash

1000 not eating

25 were eating

Homework:

p. 853, 4-32 even, 33