

Homework Review: 13.1

Finding Probabilities by using Permutations

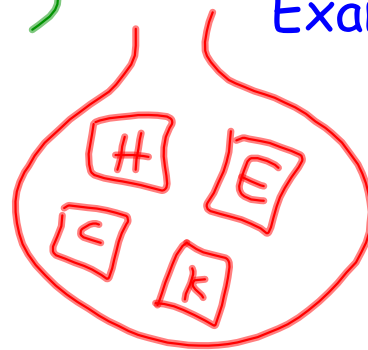
of ways you
can arrange certain
outcomes (the order
is important)

What is a permutation?

Order is important!

Example: HECK

HECK
HCEK
HKEC
KHEC



ways event
can occur

Sample space

$$4 \cdot 3 \cdot 2 \cdot 1 =$$

24

Factorial Notation

Factorials give us a shorthand for calculating arrangements

$$\begin{aligned} 9! &= \\ 9 \cdot (9-1)(9-2)(9-3) \dots \\ 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \end{aligned}$$

$$n! = n * (n - 1) * (n - 2) \dots$$

Permutation formulas

$$0! = 1$$

Permutation formulas allow us to make probability calculations using factorials

$${}_nP_n = n!$$

$${}_4P_4 = 4! = 4 \cdot 3 \cdot 2 \cdot 1 = 24$$

${}_nP_n$ = the number of permutations of n objects - how many ways can you arrange n objects?

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

$${}_4P_3 = \frac{4!}{(4-3)!} = \frac{4 \cdot 3 \cdot 2 \cdot 1}{1!} = 24$$

${}_nP_r$ = the number of permutations of n objects taken r at a time - how many arrangements of r objects can you pick from a group of n ?

$${}_4P_2 = \frac{4!}{(4-2)!} = \frac{4 \cdot 3 \cdot 2 \cdot 1}{2 \cdot 1} = \frac{24}{2} = 12$$

$$\begin{aligned}
 {}_{12}P_6 &= \frac{12!}{(12-6)!} = \frac{12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}}{\cancel{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}} \\
 &= \frac{12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6!}}{\cancel{6!}}
 \end{aligned}$$

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

$$\frac{8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot \cancel{3!}}{\cancel{3!}} =$$

$$\boxed{6720}$$

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

$$\frac{12 \cdot \cancel{11} \cdot 10 \cdot \cancel{9!}}{\cancel{9!}}$$

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

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

$$\boxed{15}$$

16. ${}_8P_7$

$n \nearrow \nwarrow r$

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

$$\frac{8!}{1!} = 8!$$

17. ${}_{10}P_6$

$n \nearrow \nwarrow r$

$$\frac{10!}{(10-6)!} = \frac{10!}{4!} =$$

$$10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5$$

18. ${}_5P_0$

$n \nearrow \nwarrow r$

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

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

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

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

2. MAR

3. GAMER

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?

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?
- b.** What is the probability that you are chosen to be in the last position?
Explain how you found your answer.
- 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.
- 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).

Homework:

~~p. 853, 4-32 even, 33~~

p. 853, 4-32 every 4th