5.3 Permutation

ORDER MATTERS: Permutations
Order DOESN'T Matter: Combinations

Permutations: arrangements, order of objects

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

total # objects — how many you pick to arrange

Ex.) A class of 32 students are voting for a president, vice president, and secretary. How many possible arrangements are there?

order matter? yes, they are diff. jobs

$$_{32}P_3 = \frac{32!}{(32-3)!} = \frac{32!}{29!} = \frac{32 \cdot 31 \cdot 30 \cdot \cancel{29!}}{\cancel{29!}}$$

$$= 32 \cdot 31 \cdot 30$$

$$= 29\,760$$

$32\ {}_nP_r\ 3$

May 9-9:39 AM

Ex.) There are 10 different book on a shelf. Four are chosen to be arranged for a display. How many possible arrangements are there?

$$_{10}P_4 = \frac{10!}{(10-4)!} = \frac{10!}{6!} = \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot \cancel{6!}}{\cancel{6!}} = 5040$$

Ex.) For a play there are 4 male roles and 3 females roles. If there are 6 actors and 8 actresses to pick from, how many casts are available?

Actresses & Actors

$= {}_8P_3 \times {}_6P_4$

$= 336 \times 360$

$= 120\,960$

and - mulitply
or - add

May 9-9:40 AM

Ex.) Matt has downloaded 10 new songs from an online music store. He wants to create a playlist using 6 of these songs arranged in any order. How many different 6-song playlist can be created from his new downloaded songs?

$_{10}P_6 = \frac{10!}{4!} = \frac{10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot \cancel{4!}}{\cancel{4!}} =$ 151 200 playlists

Ex.) Tania needs to create a password for a social networking website she registered with. The password can use any digits from 0 to 9 and/or any letters of the alphabet. The password is case sensitive, so she can use both lower- and upper-case letters. A password must be at least 4 characters to a maximum of 6 characters, and each character can be used only once in the password. How many different passwords are possible?

10
26
26
62

$_{62}P_4$ 4 character or $_{62}P_5$ 5 character or $_{62}P_6$ 6 character

$13388280 + 776520240 + 4.42 \times 10^{10}$

$= 4.5 \times 10^{10}$

~~4.5E10~~ 4.5×10^{10}

May 9-9:40 AM

Ex.) At a used car lot, seven different car models are to be parked close to the street for easy viewing.

a) The three red cars must be parked so that there is a red car at each end and the third red car is exactly in the middle. How many ways can the seven cars be parked?

R _ _ R _ _ R

red & other cars

$= {}_3P_3 \times {}_4P_4$

$= 3! \times 4! =$ 144

b) The three red cars must be parked side by side. How many ways can the seven cars be parked?

R R R _ _ _ _

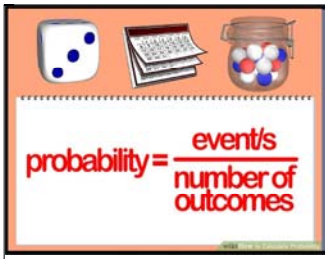
5

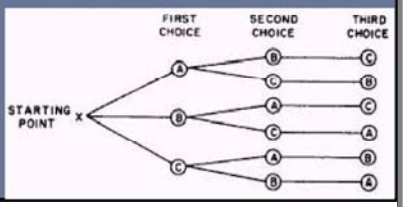
$3 \cdot 2 \cdot 1 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

$\times 5$

${}_3P_3 \times {}_4P_4 \times 5 = {}_3P_3 \times {}_5P_5 =$ 720

May 9-10:45 AM





Ex.) A social insurance number (SIN) in Canada consists of a nine-digit number that uses the digit 0 to 9.

a) If there are no restrictions on the digits selected for each position in the number, how many SIN's can be created if each digit can be repeated?

$10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 10^9 = 1{,}000{,}000{,}000$

b) How does the compare with the number of SIN's that can be created if no repetition is allowed?

$10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 = 10! = {}_{10}P_{10} = 3{,}628{,}800$

Pg. 93 # 1ab, 2, 5, 7, 9-11, 15.

Pg. 104 # 1, 2, 4-6, 9-11.

May 9-10:45 AM