Pg. 560 5-33 E00, 23, 35, 41, 49-57 odd, 71

8.4 Counting Theory

Open

Graduation announcements have an option of 4 different color schemes, 3 fonts, and 2 seals. How many different announcements do you have to choose from?

Tree Diagram

$4 \cdot 3 \cdot 2 =$ **24 choices**

Independent Events - events that do not influence the outcome of the other

with replacement - independent
without replacement - dependent
i.e. Drawing sticks

Example 1 I want to arrange 4 students and assign each a position. Pres, VP, Secretary, Treasurer. Are these events dependent or independent? How many ways can they be arranged

Dependent; $4 \cdot 3 \cdot 2 \cdot 1 = 24$ ways

Suppose I only need a Pres and VP from that same group. How many possibilities are these?

$4 \cdot 3 =$ **12 possibilities**

n-factorial $n! = n(n-1)(n-2)\ (3)(2)(1)$

and $0! = 1$

(1.e) $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = \boxed{120}$

"5 factorial"

Calculator: Scientific - PRB !

Graphing - MATH PRB !

Permutation - order matters

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

other notations: $P\hat{}r$, ${}_nP_r$

Repetition is not Allowed

Combination - order does not matter

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

other notations: $C\hat{}r$, ${}_nC_r$

Permutation	vs.	Combination
From a class of 23 students you must select a VP, Pres, Sec, Treas.		From a class of 23 you must select a committee of 4 students
${}_{23}P_4 = \frac{23!}{(23-4)!}$		${}_{23}C_4 = \frac{23!}{(23-4)!4!}$
$= \frac{23!}{19!}$		$= \frac{23!}{19!4!} = \frac{23 \cdot 22 \cdot 21 \cdot 20 \cdot \cancel{19!}}{\cancel{19!}\,4!}$
$= \frac{23 \cdot 22 \cdot 21 \cdot 20 \cdot \cancel{19!}}{\cancel{19!}}$		$= \frac{23 \cdot 22 \cdot 21 \cdot 20}{4 \cdot 3 \cdot 2 \cdot 1}$
$= 23 \cdot 22 \cdot 21 \cdot 20$		$= \frac{212520}{24} = \boxed{8855}$
$= \boxed{212520}$		

8.4 Counting Theory

Calculator: Scientific: PRB nCr (or) nPr
Graphing: MATH PRB nCr (or) nPr

Distinguishing between Permutations and Combinations (Chart pg. 559)

(a) Codes on a bike lock ⇒ permutation
(b) Tournament of 12 teams where everyone must play eachother once. No home/away advantaged. ⇒ Combination
(c) telephone number ⇒ permutation
(d) Sample of 5 apples from a batch of 20 = Com

70

Examples

(37) 26 letters: 4-letter call letters

(a) $2 \cdot 25 \cdot 24 \cdot 23 = 27{,}600$ ways

2 options (K or W) · 25 options left · 24 options left · 23 options left

(b) $2 \cdot 26 \cdot 26 \cdot 26 = 35152$

(c) $2 \cdot 24 \cdot 23 \cdot 1 = 1104$

(39) $5 \cdot 3 = 15$ names

(43) ${}_6P_6 = \boxed{720}$ order matters

OR

$6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = \boxed{720}$

(54) ${}_{12}C_3 = \boxed{220}$

(70) $40 \cdot 40 \cdot 40 = 64{,}000$

* Can't use Permutations because repetition is not allowed in permutations or combinations.