Key

12-1 Notes,
Independent & Dependent Events, and the Counting Principle

WARM-UP:

1. Suppose you are packing for a trip and can take only one small bag of clothes. How do you decide what to pack?

2. A. Suppose you decide to take three shirts, a pair of jeans, and a pair of shorts, all of which are color-coordinated. How can you make a complete list of all the possible outfits without counting any outfit more than once? Make a list of your options.

S_1 - j　　S_1 - Sh
S_2 - j　　S_2 - Sh
S_3 - j　　S_3 - Sh

J: S_1 S_2 S_3
Shorts: S_1 S_2 S_3

B. How do you know you have included ALL of your options?

6

3. a. Suppose you are having posters for an event printed in two colors. Your color choices are black, blue, red, green, and purple. How can you make a complete list of all the possible pairs of colors without counting any pair more than once? Make a list of your options.

Black: Blue, Red, green, Purple
Blue: Red, green, Purple
Red: green, purple
green: purple

10

b. How do you know you have listed ALL possibilities?

4. How could you have determined the number of options you have in #2 and #3 without having to make a list of all your options?

#2　shirts x bottoms　$3 \times 2 = 6$

#3　colors x # colors　$5 \times 2 = 10$

This is known as the **Fundamental Counting Principle**
We can use this principle to determine **how many possible outcomes** an event will have. This rule can also be used for any number of events.

It states: "If event *M* can occur *m* ways and event *N* can occur *n* ways, then event *M* followed by event *N* can occur $m \cdot n$ ways"

EX: If event *M* can occur in 2 ways and event *N* can occur in 3 ways, then event *M* followed by event *N* can occur $2 \cdot 3$ ways or 6 ways.

Example 1: Determine the number of possible outcomes 4

A. A cafeteria offers drink choices of water, coffee, juice, and milk and salad choices of pasta, fruit, and potato. 3 How many different combinations of drink and salad are possible?

Drink · Salad
4 · 3 = 12 combinations.

B. The Palace of Pizza offers small, medium, or large pizzas with 12 different toppings available. How many different two topping pizzas do they serve? no doubles

T_1 = pick from 12
T_2 = pick from 11

size · T_1 · T_2
3 · 12 · 11 = 396 combinations of pizzas.

Independent & Dependent Events

- Independent Events: no impact on each other Example coin, rolling die
- Dependent Events: Has impact on each other: no replacement, no repetition

Example 2: Determine if events are independent or dependent

A. Tossing a penny and rolling a number cube Ind.

B. Choosing first and second place in an academic competition Dep.

C. Choosing between a comedy and an action video from the store Ind.

D. The numbers 1-10 are written on pieces of paper and are placed in a hat. Three of them are selected one after the other without replacement. dep.

E. Finishing in first, second, or third place in a ten-person race Dep.

F. Choosing a pizza size and a topping for the pizza Ind.

Example 3: Determine the number of outcomes for independent and dependent events

A. Kim won a contest on a radio station. The prize was a restaurant gift certificate and tickets to a sporting event. She can select from one of three different restaurants and tickets to a football, baseball, basketball, or hockey game. How many different ways can she select a restaurant followed by a sporting event?

Restaurant · game
3 · 4

12 different ways

Independent

B. Dane is renting a tuxedo for prom. Once he has chosen his jacket, he must choose from three types of pants and six colors of vests. How many different ways can he select his attire for the prom?

Pants · vests
3 · 6 = 18 ways

independent

C. Many answering machines allow owners to call home and get their messages by entering a three digit code. How many codes are possible?

Recall 0-9 digits

$10 \cdot 10 \cdot 10 = 1000$ codes.

Indep.

D. Charlita wants to take 6 different classes next year. Assuming that each class is offered each period, how many different schedules could she have?

$6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 720$ different Schedules

Dependent.

E. Each player in a board game uses one of six different pieces. If four players play the game, how many different ways could the players choose their game pieces?

$\underset{P_1}{6} \cdot \underset{P_2}{5} \cdot \underset{P_3}{4} \cdot \underset{P_4}{3} = 360$ ways. Dep.