

Few things to know:

- Suggestion Box (can be anonymous)
- Lots of group and partner work/activities
- I do lots of random calling on people, so be prepared to answer.
- Try my best to grade by next class, but not always possible
- Stay after school when Mrs. Watkins stays (Tuesday/Wednesday, with exceptions)
- Feel free to e-mail me anytime with questions  
(mwilmert@parkwayschools.net)

**Review:** Find the following probabilities

Do Now:

1. Rolling a die and getting an even number.

$$\frac{3}{6} = \frac{1}{2}$$

2. Drawing an Ace from a standard deck of cards.

$$\frac{4}{52} = \frac{1}{13}$$

3. The probability that it will rain is 30%. What is the probability it won't rain? What kind of probability is this?

70% chance  
will not rain

↓  
Subjective

Unit 3 Day 1:  
Discrete Probability Distributions  
**(5-1) Probability Distributions**  
**(5-2) Expected Value**

**Random Variable:** a variable whose values are determined by chance.

**RECALL:**

**Discrete Variables:** Variables that can be counted. WHOLE NUMBERS

**Continuous Variables:** Decimal or fractional values

## I. Probability Distributions

**Probability Distribution**-> consists of the values a random variable can assume and the corresponding probabilities of the values.

EX: Create a probability distribution for the sum of rolling two dice

|                  |                |                |                |               |                |               |                |               |                |                |                |
|------------------|----------------|----------------|----------------|---------------|----------------|---------------|----------------|---------------|----------------|----------------|----------------|
| Outcome (X)      | 2              | 3              | 4              | 5             | 6              | 7             | 8              | 9             | 10             | 11             | 12             |
| Probability P(X) | $\frac{1}{36}$ | $\frac{1}{18}$ | $\frac{1}{12}$ | $\frac{1}{9}$ | $\frac{5}{36}$ | $\frac{1}{6}$ | $\frac{5}{36}$ | $\frac{1}{9}$ | $\frac{1}{12}$ | $\frac{1}{18}$ | $\frac{1}{36}$ |

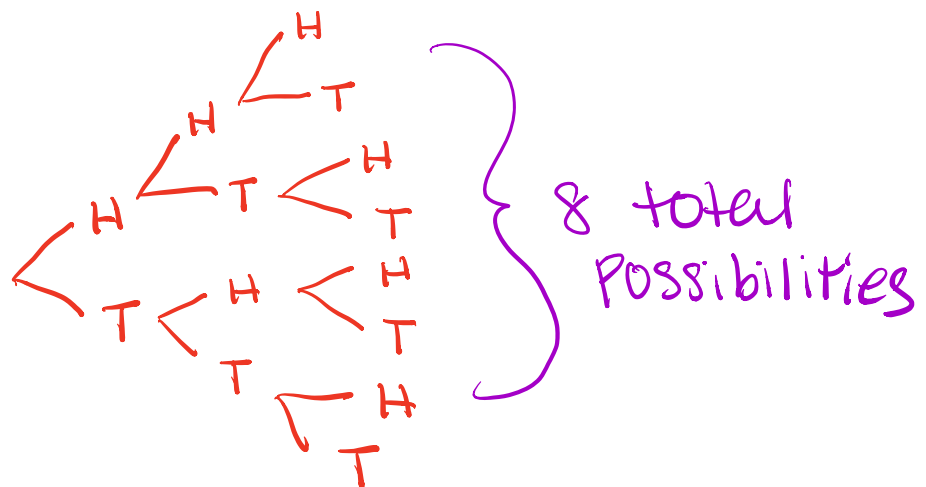
## I. Probability Distributions

## Example

You are tossing three coins. Represent the probability distribution

| #of tails X      | 0             | 1             | 2             | 3             |
|------------------|---------------|---------------|---------------|---------------|
| Probability P(X) | $\frac{1}{8}$ | $\frac{3}{8}$ | $\frac{3}{8}$ | $\frac{1}{8}$ |

\*Think about your sample space first

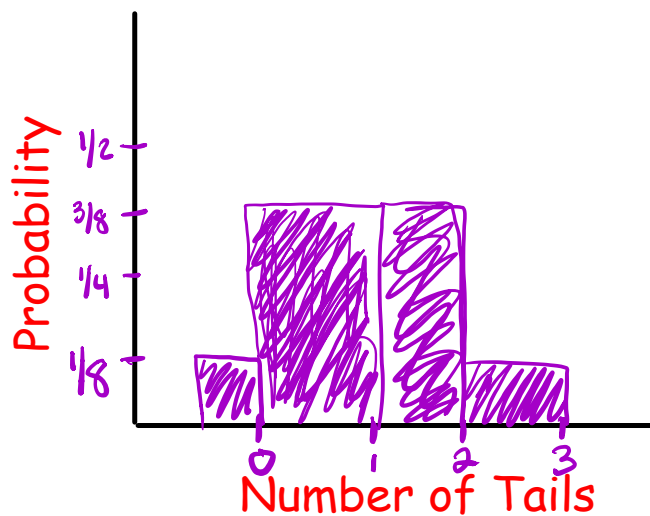


# I. Probability Distributions

## Example

Lets graph the previous example.

Probability Distribution for # of Tails



# I. Probability Distributions

## Example

You have 5 \$1 bills, 3 \$5 bills, 6 \$10 bills, and 1 \$20 bill in your pocket.

Create a probability distribution for grabbing one bill from your pocket.

$$\begin{array}{cccc} 5 & + & 3 & + & 6 & + & 1 & = & 15 & \text{total bills} \\ \downarrow & & \downarrow & & \downarrow & & \downarrow & & & \\ \$1 & & \$5 & & \$10 & & \$20 & & & \end{array}$$

|      |     |     |     |      |
|------|-----|-----|-----|------|
| x    | 1   | 5   | 10  | 20   |
| P(x) | 1/3 | 1/5 | 2/5 | 1/15 |



## I. Probability Distributions

## Example

A car dealership keeps track of the # of cars it rents and for how long. Construct a probability distribution and Graph.

| <u>X</u> | <u>#of Days</u> |
|----------|-----------------|
| 0        | 15              |
| 1        | 25              |
| 2        | 10              |

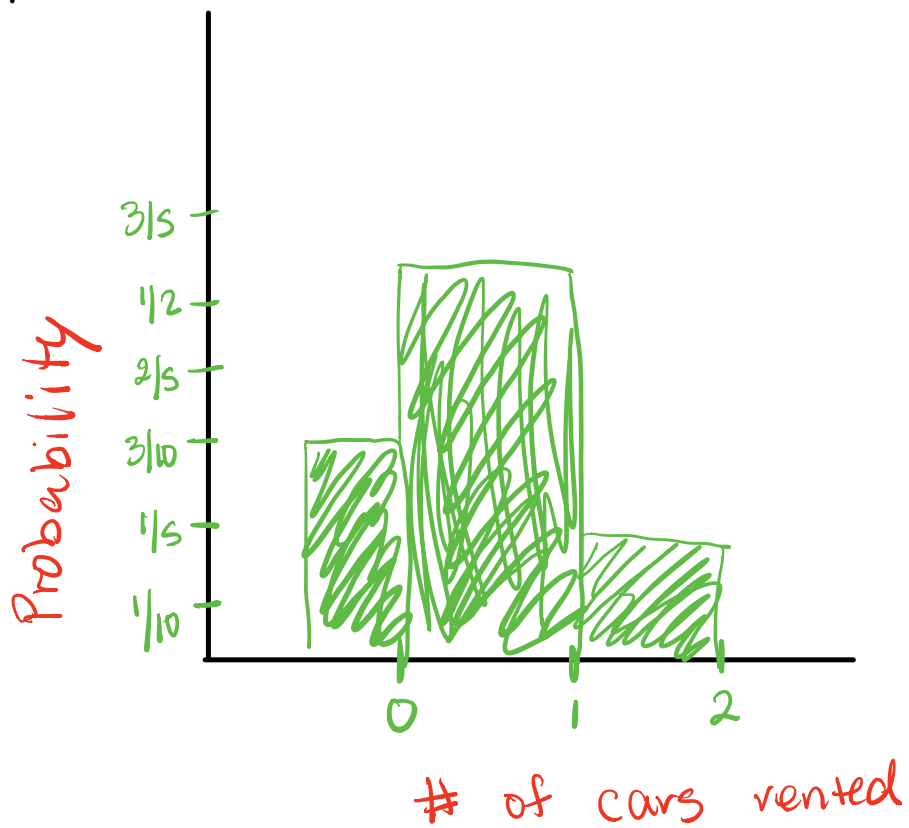
} 50 total

|                     |                |               |               |
|---------------------|----------------|---------------|---------------|
| # of cars rented    | 0              | 1             | 2             |
| Probability of P(X) | $\frac{3}{10}$ | $\frac{1}{2}$ | $\frac{1}{5}$ |

# I. Probability Distributions

## Example

Graph.



## I. Probability Distributions

### **Requirements for a probability distribution**

- 1.) The sum of the probabilities of all events must equal 1
- 2.) The probability of each event must be between 0 and 1

## II. Expected Value

### **EXPECTATION (A.K.A. EXPECTED VALUE)**

The expected value of a discrete random variable of a probability distribution is the theoretical average of the variable.

NOTATION:  $E(X)$

HOW TO FIND: Take each probability multiplied by each value and add.

## II. Expected Value

## Example

**\*When doing expected value questions. Think about how much you would actually win.**

One thousand tickets are sold at \$1 each for a color TV valued at \$350. What is the expected value of the gain if a person purchases one ticket? (gain)

|        | win      | loss       |
|--------|----------|------------|
| $x$    | 349      | -1         |
| $P(x)$ | $1/1000$ | $999/1000$ |

$$E(x) = 349 \left( \frac{1}{1000} \right) + (-1) \left( \frac{999}{1000} \right)$$

$$= -0.65$$

$$\boxed{-\$0.65}$$

## II. Expected Value

Expected value is also used to determine if a game is fair.

\* If the expected value = 0, then the game is fair.

\*If the expected value is **negative**, then the game is in favor of the house.

\*If the expected value is **positive**, then the game is in favor of the player

## II. Expected Value

### Example

One thousand tickets are sold at \$1 each for four prizes of \$100, \$50, \$25, and \$10. What is the expected value if a person purchases 1 ticket?

|      |        |        |        |        |          |
|------|--------|--------|--------|--------|----------|
| x    | 99     | 49     | 24     | 9      | -1       |
| P(x) | 1/1000 | 1/1000 | 1/1000 | 1/1000 | 996/1000 |

$$E(x) = 99\left(\frac{1}{1000}\right) + 49\left(\frac{1}{1000}\right) + 24\left(\frac{1}{1000}\right) + 9\left(\frac{1}{1000}\right) + (-1)\left(\frac{996}{1000}\right)$$
$$= -0.815$$

$$\boxed{-\$0.82}$$

## II. Expected Value

## Example

The fee for entering a dog in a dog show is \$75. The owner of the winning dog receives \$2,000. Forty dogs are entered in the show. What is the expected value for each contestant?

|        |        |         |
|--------|--------|---------|
| $x$    | 1925   | -75     |
| $P(x)$ | $1/40$ | $39/40$ |

$$-\$25$$

$$E(x) = 1925\left(\frac{1}{40}\right) + (-75)\left(\frac{39}{40}\right) = -25$$



## II. Expected Value

## Example

Your mother is sending a "care package" to you in college. She insures delivery of the package by paying \$1.60 extra. If the package is lost in the mail, your mother will collect \$60. The probability that the package is lost is .001.

What is the expected value of the insurance?

|      |       |        |
|------|-------|--------|
| X    | 1.60  | -58.40 |
| P(X) | 0.999 | 0.001  |

$$E(X) = 1.6(0.999) + (-58.40)(0.001) = 1.54$$

\$1.54

## Assignment:

Unit Plan Day 1 HW Worksheet

Unit 4 Quiz

Monday 2/24

Unit 4 Test

Friday 3/13

