

# Agenda

## Homework (AP)

Pg.309-311 #39-42, 45(a,b), 57, 58, 60

- Warm Up
- Checkup
  - ~~Check, copies~~
- Tree diagrams
- Five Rules of Probability
  - ~~Check, Copies~~
- Exit Pass

10 min

## Homework (reg)

Pg.416-417 #6.30, 6.36

Pg.423-424 #6.37, 6.39

25 min

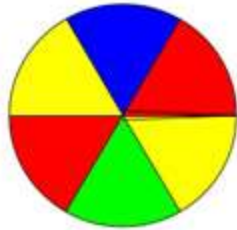
20 min

5 min

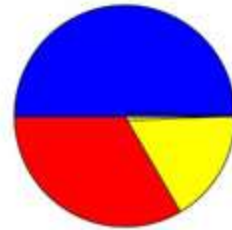
# Warm Up

***Calculate the probability of each of these events:***

1. Selecting a Jack from a standard card deck.
2. Rolling a *sum of 3* on two rolls of a fair 6-sided die.
3. Landing in the **blue** on Spinner A (see below).
4. Landing in the **blue** on Spinner B (see below).



Spinner A



Spinner B

5. What does it mean to say that the probability of winning the California Super Lottery is 1 in 18 million?

# Absent tomorrow

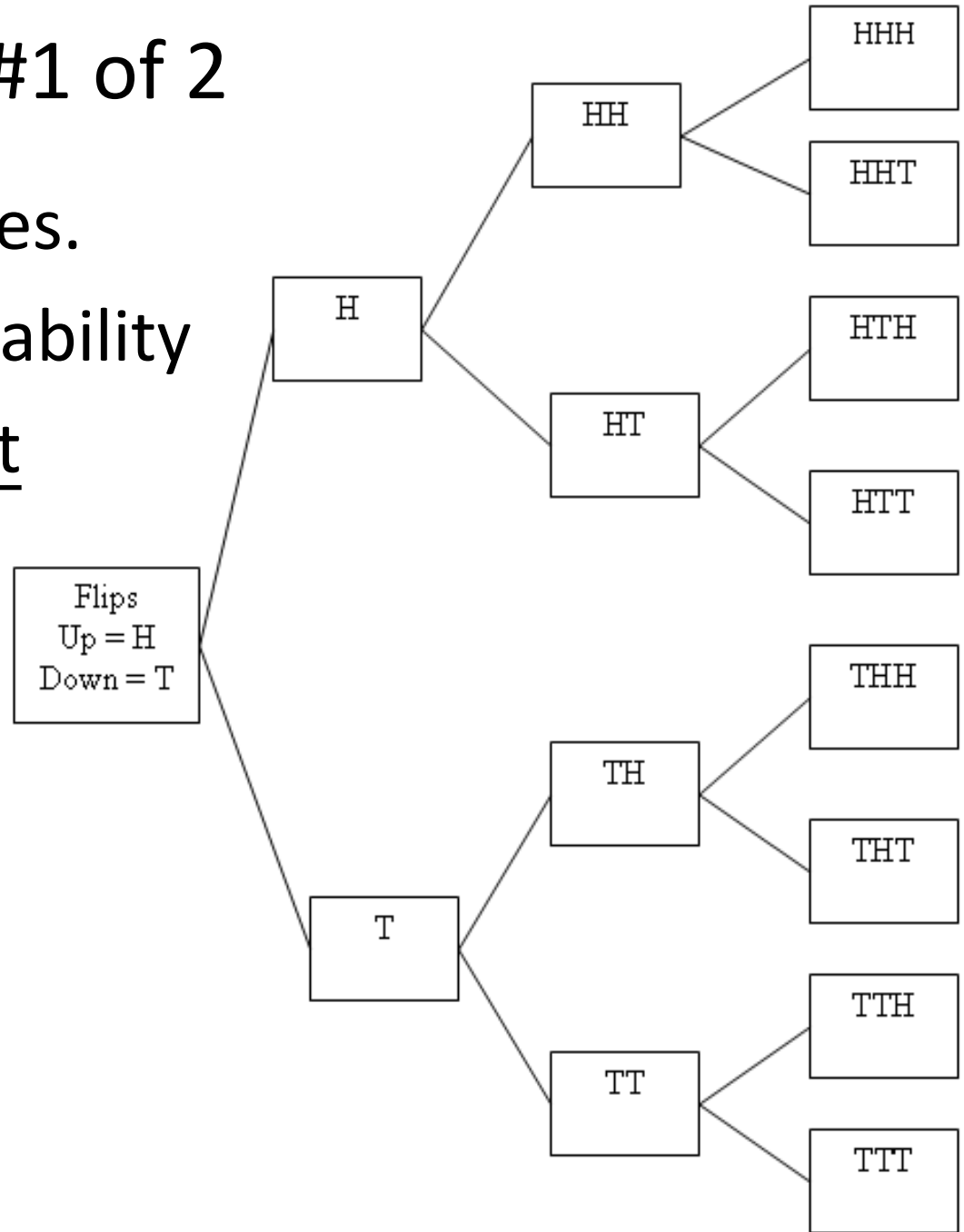
- I won't be here tomorrow.
- Your sub will be Ms. Jaime Hurst (same as last time)
- Here's the instructions I've left Ms. Hurst:
  1. Take attendance, then hand out the worksheet that I've left on my desk.
  2. Tell students to turn their desks into groups of 4, and work together to complete the worksheet.
  3. I've left you an answer key. Students should do the following, in this order, if they have trouble with a problem:
    - A. *Work together to try to figure it out.*
    - B. *Ask if their answer is correct. (Example: "I got 60% for #4. Is that correct?")*
    - C. *Ask you what the correct answer is.*
    - D. *Ask to see the explanation on the answer key.*
  4. At the end of class, **collect the worksheets** and tell students to return desks to their original position. Students should be in their seats until the bell rings.
- There are 13 problems. Do #1-11, and *try* #12 and #13.
- If you finish early, keep working on your "Five Rules of Probability" handout (from today).

Checkup time

# Tree Diagrams

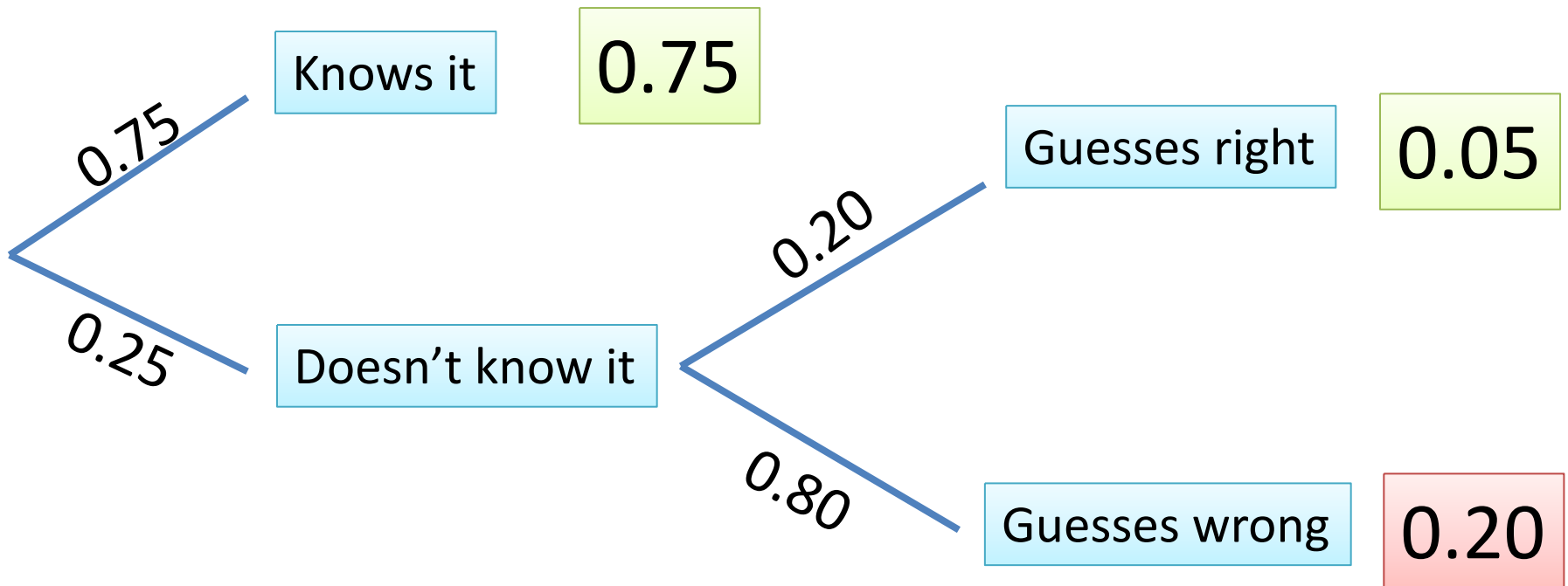
# TREE – Example #1 of 2

- I flip a coin 3 times.
- What is the probability of getting at least two Heads?



# TREE – Example #2 of 2

Bobby knows about 75% of the material of this unit, so on any given test question, he'll know the answer 75% of the time. And if he doesn't, he'll guess. The questions are multiple-choice, A-E.

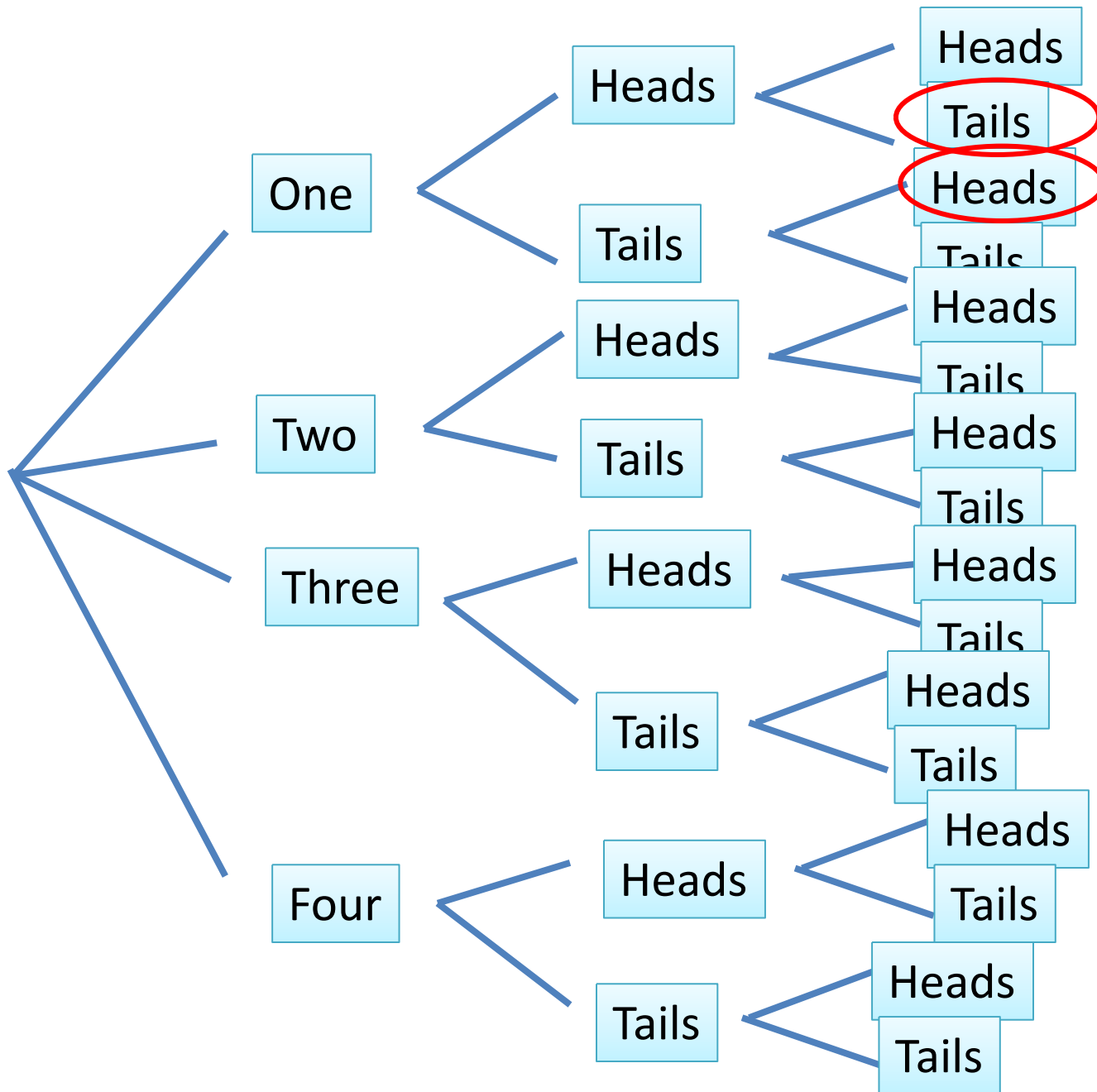


# Try it!

*I roll a 4-sided die and flip two fair coins.*

1. Make a tree of this situation.
2. What is the probability of getting a “1”, a Heads, and a Tails? (order doesn't matter)

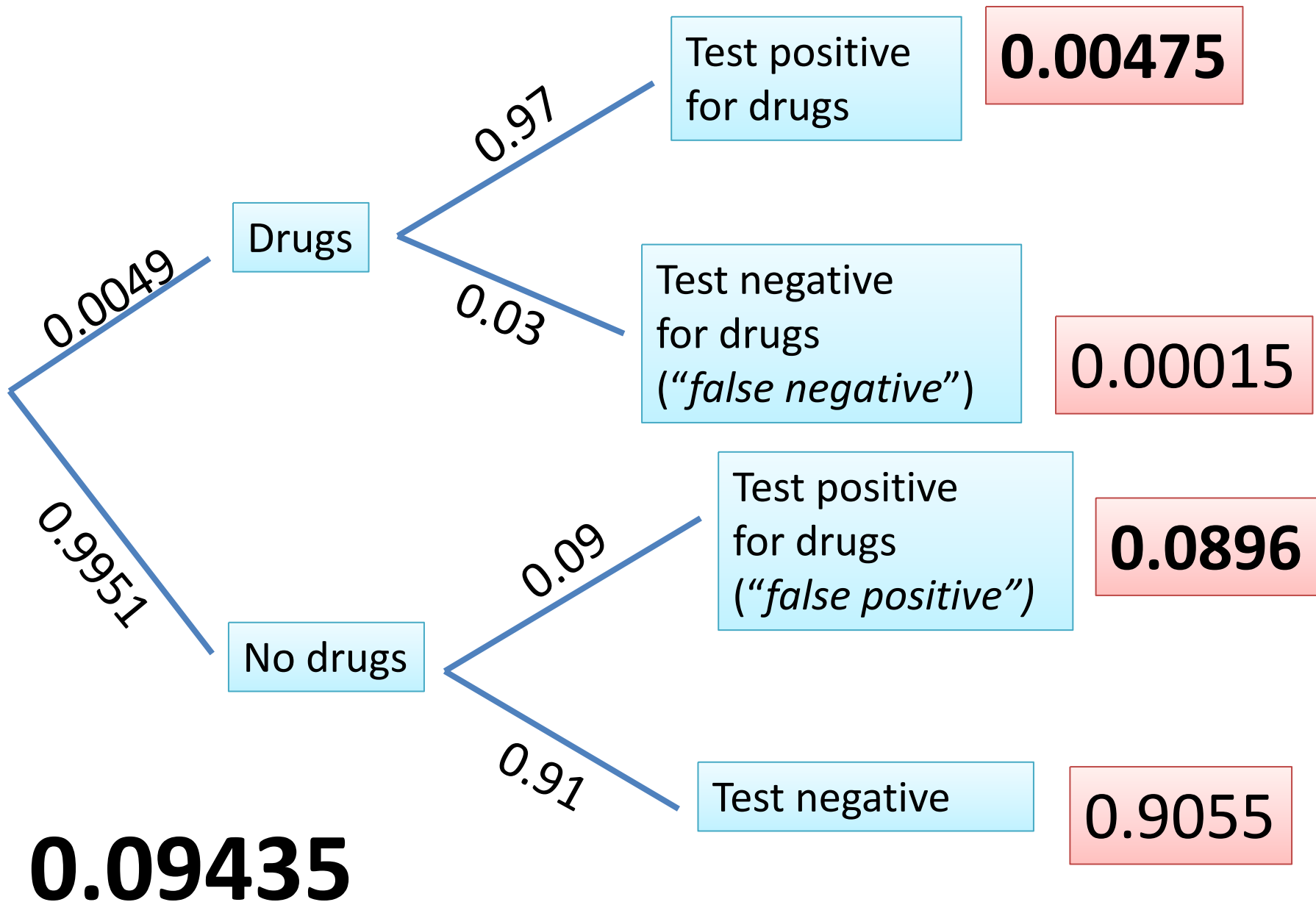




# Try it again!

Athletes are often tested for use of performance-enhancing drugs. Drug tests aren't perfect – they sometimes say that an athlete took a banned substance when that isn't the case (“false positive”). Other times, the test concludes that the athlete is “clean” when they actually took a banned substance (“false negative”). For one commonly used drug test, the **probability of a false negative is 0.03**, and **the probability of a false positive is 0.09**. A random survey (World Anti-Doping Agency, 12/22/2008) of 21,849 professional athletes from 1968-2008 found that **0.49% of professional athletes use(d) banned substances**.

1. Make a tree diagram of this situation.
2. What is the probability that a randomly selected athlete will test positive for performance-enhancing drugs?



# The Five Rules of Probability

# #1: The “0-1” Rule

- “Any probability is a number between 0 and 1.”
  - 0 → never occurs
  - 1 → always occurs
- Door/Window:
  - Door: An event with probability 0
  - Window: An event with probability 1

## #2: The “100%” Rule

- “The sum of the probabilities of all possible outcomes must equal 1.”
- *Example:*
  - If  $P(\text{black/brown hair}) = .91$ , and  $P(\text{blonde hair}) = .045$ , what is  $P(\text{other colored hair})$ ?

- **Door. Solve for  $x$ :**

Age group	18 to 23	24 to 29	30 to 39	40 or over
Probability	0.57	0.17	0.14	$x$

- **Window. Solve for  $y$ :**

Dinner	Steak	Chicken	Fish	Tofu
Probability	0.43	0.37	0.18	$y$

# #3: The Complement Rule

- The probability that A does not occur is  $1 - P(A)$ .
  - Written as  $A'$  or  $A^C$
  - Called the “complement” of A
- *Example:*
  - If  $P(A)$  is the probability of rolling two dice and getting a sum of at least 4, what is  $P(A^C)$ ?
- **Door/Window.** Assume a roll of 2 standard dice.
  - Door:  $P(A^C)$ , if  $P(A)$  is the probability of a sum of at most 11
  - Window:  $P(A^C)$ , if  $P(A)$  is a sum of 2 or 12.

# Worksheet time

- Groups of 4.
- Do #1-6 on the back of your cheat-sheet.
- When the whole group is done, raise your hands.
- If you are correct, try #7-12.
  
- Use pencil.



## #4: The Addition Rule

- A or B  $\rightarrow$  sum of probabilities, minus “overlap”.
  - $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ .
  - Written as  $P(A \cup B)$ , the “union” of A and B
- *Example:*
  - What is the probability of drawing a Jack or a diamond from a standard deck?
- **Door/Window.** If you roll a standard die....
  1. Door:  $P(\text{even number } \underline{\text{or}} \ 5)$  on standard die
  2. Window:  $P(\text{even number } \underline{\text{or}} \ 4)$  on standard die
  3. Door:  $P(2 \underline{\text{or}} \ 3)$  on standard die
  4. Window:  $P(2 \text{ on standard die } \underline{\text{or}} \ \text{Heads on coin})$

# #5: The Multiplication Rule

- A **and** B  $\rightarrow$  product of probability of A and probability of B given that A has happened.
  - Written as  $P(A \cap B) = P(A) \cdot P(B | A)$ , “intersection” of A and B
  - If A and B are independent, the rule is  $P(A \cap B) = P(A) \cdot P(B)$
- *Example:*
  - What is the probability of getting an Ace and then a Jack?
  - What is the probability of getting an Ace and a Jack?
- **Door/Window.** What’s the probability?
  1. Door: rolling two dice and getting two 6’s
  2. Window: flipping three Heads
  3. Door: drawing two cards, getting a Queen and a King
  4. Window: drawing two cards, getting the Ace of spades and then the two of hearts
  5. *Challenge* . Drawing two cards, getting a Queen and a heart.

# #5 : Queen and Heart

0.0652

You could get a Queen of Hearts on the first draw.

**OR**

You could get a non-Queen Heart, and then a Queen.

**OR**

You could get a non-Heart Queen, and then a Heart.

**OR**

You could get a bad card, and then a Queen of Hearts.

$$\frac{1}{52} + \frac{12}{52} \cdot \frac{4}{51} + \frac{3}{52} \cdot \frac{13}{51} + \frac{35}{52} \cdot \frac{1}{51}$$

# Worksheet time

- Groups of 4.
- Do #7-12 on the back of your cheat-sheet.
- When the whole group is done, raise your hands.
- If you are correct, try #13-18 (conditional probability)
- Use pencil.

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# Exit Pass

## Homework (AP)

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1. If I pick a card, what is the probability that it is a Jack?
2. Let's say I get a Jack and set it aside. If I pick another card, what is the probability that it's a Queen?
3. Let's say I shuffle the cards back in and pick another card. What is the probability that it's a King?
4. What does your answer to #3 mean?  
Do not use the word "probability," "chance", or "likelihood".