HW 12-9

1. a) .551 b) .006
2. a) .017 b) .013 c) .729
3. a) .61 b) Not independent
4. a) participate in sports but do not play in the band
   play in the band but do not participate in sports
   participate in sports and play in the band
   do not participate in sports nor play in the band

   b) 429 + 33 = 462. P(S) = .55

   c) P(B) = $\frac{1}{14}$

   d) Yes independent

Name Key Alg 2 HW 12-9

1. When a person is selected at random from a very large population, the probability that the selected person is right-handed is 0.82. If three people are selected at random, what is the probability that
   a. they are all right-handed?
   $(.82)(.82)(.82)$
   $\approx .551$
   b. none of them is right-handed.
   $1-.82=.18$
   $(.18)^3 \approx .006$

2. According to the website www.census.gov, based on the 2010 US population, the probability that a randomly selected male is 65 or older is 0.114, and the probability that a randomly selected female is 65 or older is 0.146. (Round to 3 decimal places)

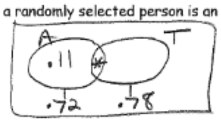
a. If a male and a female are selected at random, determine the probability that both people are 65 or older. (Hint: Use the multiplication rule for independent events)
$(.114)(.146) = .017$

b. If two males are randomly selected, what's the probability that both are 65 or older?
$(.114)(.114) = .013$

c. If two females are randomly selected, what's the probability that neither of them are 65 or older?
$1-.146=.854$
$(.854)(.854) \approx .729$

3. In a large community 72% of the people are adults (A), 78% of the people have traveled outside the state (T), and 11% are adults who have not traveled outside the state.

a. Use a Venn diagram to calculate the probability that a randomly selected person is an adult and has traveled outside the state.
$.72-.11 = .61$




b. Use the multiplication (or product) rule for independent events to decide whether the events *is an adult* and *has traveled outside the state* are independent.
$P(A \text{ and } T) \stackrel{?}{=} P(A) \cdot P(T)$
$.61 \stackrel{?}{=} (.72) \cdot (.78)$
$.61 \neq .5616$
$\therefore$ Not independent

4. Let S represent the number of students who participate in organized sports and let B represent the number of students in the band.


a) Use the Venn diagram to complete each statement.

Total = 429 + 33 + 27 + 351 = 840

o 429 students participate in sports but do not play in the band.

o 27 students play in the band but do not participate in sports.

o 33 students participate is sports and play in the band.

o 351 students do not participate in sports nor play in the band.

b) Write an expression representing how you would find the number of students in sports. Determine that number and the probability a randomly selected student participates in sports. (exact value)

# in sports = 429 + 33 = 462

840 = 429+33+27+351
total

$P(S) = \frac{462}{840}$ (=.55)

c) Write an expression representing how you would find the number of students in band. Determine that number and the probability a randomly selected student participates in band. (exact value)

# in band = 33 + 27 = 60

$P(B) = \frac{60}{840}$ or $\frac{1}{14}$

d) Use the multiplication rule for independent events to determine if the events student participates in sports and student participates in band are independent. Justify your answer.

$P(S \text{ and } B) \stackrel{?}{=} P(S)P(B)$

$\frac{33}{840} \stackrel{?}{=} (.55)(\frac{1}{14})$

$.0392857143 = .0392857143$

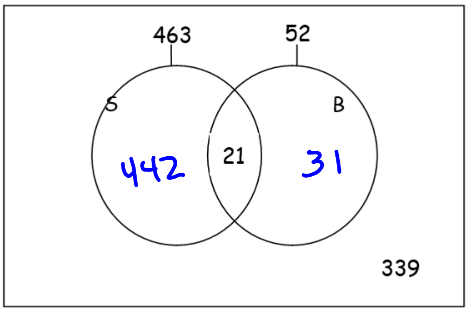
or $\frac{11}{280} = \frac{11}{280}$ ✓

yes Independent

**Day 10 Probability Rules – Interpret probabilities, use the addition rule and disjoint events**

Warm-up: If the given information is:

- o 463 students are in sports (S)
- o 52 students are in the band (B)
- o 21 students are in both sports and band




a) Write an expression and find the number of students in sports or the number of students in band. (S or B) ← includes Both

$P(S \text{ or } B) = 442 + 21 + 31 = 494$

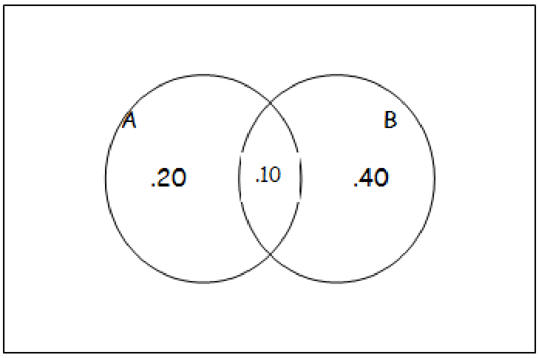
or $463 + 52 - 21$

b) Compare and explain your answer to a neighbor.

**Addition Rule:** The addition rule states that for any two events A and B,

P(A or B) = $P(A) + P(B) - P(A \cap B)$

1.




a) .20 = P(A and not B)

.10 = P(A and B)

.40 = ~~P(Not A and B)~~ = P(B and Not A)

b) P(A) = .20 + .10 = .30

P(B) = .40 + .10 = .50

c) P(A or B) = .20 + .10 + .40 = .70

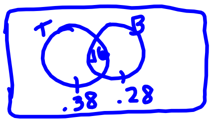
.30 + .50 − .10 = .70

$P(A) + P(B) - P(A \cap B)$

2. When a car is brought to a repair shop for service, the probability that it will need the transmission fluid replaced is .38, the probability that it will need the brake pads replaced is .28, and the probability that it will need both the transmission fluid and the brake pads replaced is .16. Let the event that a car needs the transmission fluid replaced be T and the event that a car needs the brake pads replaced be B.

(a) What are the values of: P(T) = .38 P(B) = .28 P(T and B) = .16

(b) Draw a Venn Diagram to represent only the part (a) values




(c) Use the addition rule to find the probability that a randomly selected car needs the transmission fluid or the brake pads replaced.

$$P(T \text{ or } B) = P(T \overset{\text{or}}{\cup} B) = P(T) + P(B) - P(T \overset{\text{and}}{\cap} B)$$
$$= .38 + .28 - .16 = .5$$

3. Josie will soon be taking exams in math and Spanish. She estimates that the probability she passes the math exam is 0.9 and the probability that she passes the Spanish exam is 0.8. She is also willing to assume that the results of the two exams are independent of each other.

$P(m) = .9$ $P(S) = .8$

(a) Using Josie's assumption of independence, calculate the probability that she passes both exams. Consider independence, addition rule and/or multiplication rule.

$$P(m \cap S) = P(m) * P(S) \leftarrow \text{b/c they are indep.}$$
$$= (.9)(.8)$$
$$= .72$$

(b) Find the probability that Josie passes at least one of them. Consider what passing at least one of them means.

$$P(m \overset{\text{or}}{\cup} S) = P(m) + P(S) - P(m \overset{\text{and}}{\cap} S)$$
$$= .9 + .8 - .72$$
$$= .98$$

4. An animal hospital has 5 dogs and 3 cats out of 10 animals in the hospital. What is the probability that an animal selected at random is a dog or a cat? Could an animal be both a dog and a cat?

NO

$$P(D \text{ or } C) = P(D) + P(C) - \cancel{P(D \cap C)}^{0}$$
$$= 5/10 + 3/10$$
$$= 8/10$$

5. At Baker High School, 100 students are involved in an afterschool community service program. Students can only sign up for one project. Currently, 25 students are involved in cleaning up nearby parks, 20 students are tutoring elementary students in math, and the rest of the students are working at helping out at a community recreational center. What is the probability that a randomly selected student is involved in cleaning up nearby parks or tutoring elementary students in math?

$$P(C \text{ or } T) = P(C) + P(T) - \cancel{P(C \cap T)}^{0}$$
$$= \frac{25}{100} + \frac{20}{100}$$
$$= 45/100$$

6. How do #s 4 & 5 differ from 1 through 3?

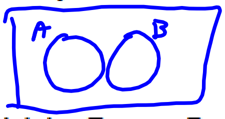
*The probabilities of events in #s 4 & 5 do not have outcomes in common that need to be subtracted out.*

(No both)

DEFINITION: "mutually exclusive"

Two events are said to be "disjoint" if they have no outcomes in common

If events A and B are disjoint, what would the Venn diagram look like? (No "both")




**Addition Rule For Disjoint Events:** For any two disjoint events A and B,

P(A and B) = 0

P(A or B) = P(A) + P(B)

7. A number cube has faces numbered 1 - 6.

(a) If the number cube is rolled once, then the events the result is even and the result is 5 are disjoint (disjoint or not disjoint?). Explain.

can't be even and 5

(b) The events the result is even and the result is greater than 4 are not disjoint (disjoint or not disjoint?). Explain.

6 is both even and > 4

8. A set of 40 cards consists of:
   - o 10 black cards showing squares
   - o 10 black cards showing circles
   - o 10 red cards showing Xs
   - o 10 red cards showing diamonds

(a) A card is selected at random from the set. Find the probability that the card is black or shows a diamond.

$$P(B \text{ or } \diamond) = P(B) + P(\diamond)$$
$$= \frac{20}{40} + \frac{10}{40} = \frac{30}{40}$$

Disjoint or Not Disjoint? Disjoint

(b) A card is selected at random. Find the probability that the card is red or shows a diamond.

$$P(R \text{ or } \diamond) = P(R) + P(\diamond) - P(R \cap \diamond)$$
$$= \frac{20}{40} + \frac{10}{40} - \frac{10}{40} = \frac{20}{40}$$

Disjoint or Not Disjoint? Not disjoint

9. A red cube has faces labeled 1 through 6, and a blue cube has faces labeled in the same way. The two cubes are rolled. Find the probability that

(a) both cubes show 6s.

$$P(6 \cap 6) = \frac{1}{6} \times \frac{1}{6} = \frac{1}{36}$$

(b) the total score is at least 11.

$$P(\geq 11) = P(11) + P(12)$$

$$= P(5,6) + P(6,5) + P(6,6)$$

$$= \frac{1}{6} \times \frac{1}{6} + \frac{1}{6} \times \frac{1}{6} + \frac{1}{6} \times \frac{1}{6}$$

$$= \frac{3}{36}$$