Venn Diagrams

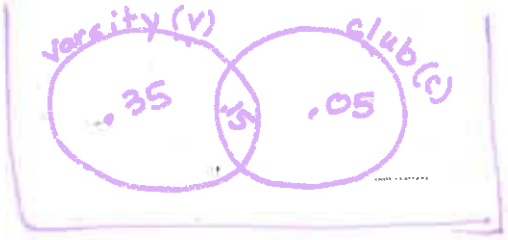
KEY

These diagrams work when you only have 2 events and they are NOT disjoint, meaning they have overlap or shared outcomes. You must draw the Venn Diagram yourself. Here are some problems:

1) A student curious about athletics at her high school decided to look at the proportion of students who play varsity sports and students who are in athletic clubs. She found that 50% of the students are involved in varsity sports throughout the year while 20% were involved in athletic clubs throughout the year. She also found an overlap of 15% of the students that are involved in both varsity sports and athletic clubs throughout the year. What's the probability that a random student at this high school will be involved with varsity sports OR athletic clubs?

a) 25%
b) 70%
c) 15%
d) 55%
e) 45%

not mutually exclusive



P(VorC)
= .35 + .15 + .05
OR
= .5 + .2 − .15

2) Call a household prosperous if its income exceeds $75,000. Call the household educated if the householder completed college. Select an American household at random, and let A be the event that the selected household is prosperous and B the event that it is educated. According to the Census Bureau, $P(A) = .125$, $P(B) = .237$, and the joint probability that a household is both prosperous and educated is $P(A \text{ and } B) = .077$. What is the probability $P(A \text{ or } B)$ that the household selected is either prosperous or educated?

P(A or B) = .125 + .237 − .077 or .048 + .077 + .16
= .285

Draw a Venn diagram that shows the relation between the events A and B in Exercise ~~2.67~~. Indicate each of the following events on your diagram and use the information in Exercise ~~2.67~~ to calculate the probability of each joint event. Finally, describe in words what each event is.

(a) {A and B} = .077
(b) {A and B^c} = .048

3) **PROSPERITY AND EDUCATION** Call a household prosperous if its income exceeds $100,000. Call the household educated if the householder completed college. Select an American household at random, and let A be the event that the selected household is prosperous and B the event that it is educated. According to the Census Bureau, P(A) = 0.134, P(B) = 0.254, and the jointprobability that a household is both prosperous and educated is P(A and B) = 0.080.

Find P(A or B) = .134 + .254 − .08 = .308

or
.054 + .08 + .174

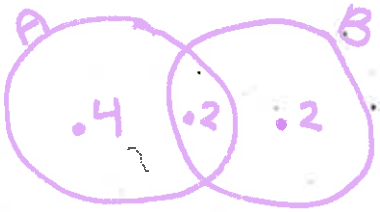
4. Big Boy Builders has 2 bids out on large contracts. The company president believes that the probability of winning the first contract (event A) is 0.6. He believes that the probability of winning the second contract is 0.4. He also believes that there is an outside chance of winning both contracts at 0.2.

a) What is the probability of winning at least one contract? (Show proper notation)

$P(A \text{ or } B) = .4 + .6 - .2$

or

$P(A \cup B) \quad .4 + .2 + .2 = .8$



b) What is the probability of winning the first contract but not the second? (Show proper notation)

$P(A \cap B^c) = .6 - .2 = .4$

c) What is the probability of winning the second contract given you have won the first contract? (Show proper notation)

$$P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{.2}{.6} = .3333$$

★ d) Prove that winning the first contract and the second contract are not independent.

not yet covered 1/12

$$P(A|B) = \frac{P(B \cap A)}{P(B)} = \frac{.2}{.4} = .5$$

$P(A) = .6$ Not independent

Knowing the outcome of one event changes the probability of the other.

$P(A|B) \neq P(A)$