Lesson 26: How do venn diagrams help us solve probability problems?

Define and provide an example.

1. Disjoint

2. Independent

Bill from my wallet without looking

Sample Space:

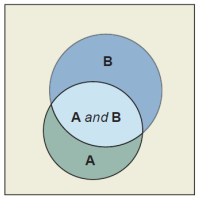
Combine outcomes:

Event **A :**

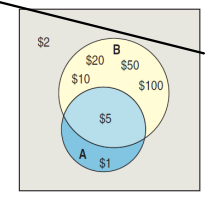
Event **B :**

Event **B :**

P(odd number value or a building)



Events **A** and **B** and their intersection.



Denominations of bills that are odd (**A**) or that have a building on the reverse side (**B**). The two sets both include the $5 bill, and both exclude the $2 bill.

Are these events disjoint?

P(odd number value or building)
$= P$(odd number value) $+ P$(building) $- P$(odd number value *and* building)
$= P(\$1, \$5) + P(\$5, \$10, \$20, \$50, \$100) - P(\$5)$.

General Addition Rule

We add the probabilities of two events and then subtract out the probability of their intersection.

$$P(\mathbf{A} \cup \mathbf{B}) = P(\mathbf{A}) + P(\mathbf{B}) - P(\mathbf{A} \cap \mathbf{B})$$

A survey of college students found that 56% live in a campus residence hall, 62% participate in a campus meal program, and 42% do both.

Question: What's the probability that a randomly selected student either lives or eats on campus?

Draw a venn diagram.

Let L = {student lives on campus} and M = {student has a campus meal plan}.

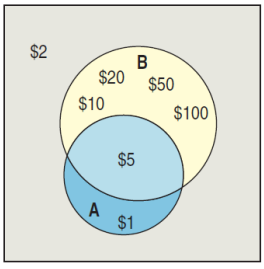
$$\begin{aligned} P(\text{a student either lives or eats on campus}) &= P(L \cup M) \\ &= P(L) + P(M) - P(L \cap M) \\ &= 0.56 + 0.62 - 0.42 \\ &= 0.76 \end{aligned}$$

Would you like dessert or coffee?

or

Maybe both

What is the probability that the bill we draw has *either* an odd value *or* a building but *not both?*



We return to our survey of college students: 56% live on campus, 62% have a campus meal program, and 42% do both?

Based on a Venn diagram, what is the probability that a randomly selected student

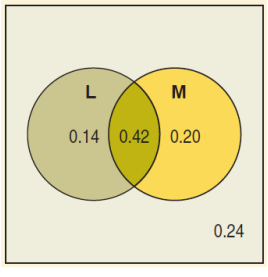
a) lives off campus and doesn't have a meal program?

b) lives in a residence hall but doesn't have a meal program?

Let L = {student lives on campus} and M = {student has a campus meal plan}. In the Venn diagram, the intersection of the circles is $P(L \cap M) = 0.42$. Since $P(L) = 0.56$, $P(L \cap M^C) = 0.56 - 0.42 = 0.14$. Also, $P(L^C \cap M) = 0.62 - 0.42 = 0.20$. Now, $0.14 + 0.42 + 0.20 = 0.76$, leaving $1 - 0.76 = 0.24$ for the region outside both circles.

Now . . . $P(\text{off campus and no meal program}) = P(L^C \cap M^C) = 0.24$

$P(\text{on campus and no meal program}) = P(L \cap M^C) = 0.14$



Police report that 78% of drivers stopped on suspicion of drunk driving are given a breath test, 36% a blood test, and 22% both tests.

Question:What is the probability that a randomly selected DWI suspect is given

1. a test?
2. a blood test or a breath test, but not both?
3. neither test?