AFM Notes, Unit 1 Probability

1-5 More Probability

Name

Date 2-5-2020 Period 2

A compound probability is a probability involving two or more events, for example, the probability of Event A AND Event B happening.

AND => Multiply

Example 1: Coin Flip

What's the probability of flipping a coin twice and having it come up heads both times?

P(Comes up heads) = $\frac{\#\text{ of events}}{\#\text{ possible outcomes}} \cdot \frac{\#\text{ of events}}{\#\text{ possible outcomes}}$

P(1st flip comes up heads AND 2nd flip comes up heads)

$$\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4} = 25\%$$

The Multiplication Rule

When calculating the probability of two events, Event A and Event B, if the events are dependent, then the probability of both events happening is P(A) • P(B)

Compound Probability and Replacement

Example 2: Marbles

A bag contains 4 blue marbles, 6 green marbles and 3 yellow marbles. If two marbles are drawn at random from the bag, what's the probability of:

a) First drawing a green marble, and then drawing a yellow marble?

With replacement Independent

P(G and Y) =

$$\frac{6}{13} \cdot \frac{3}{13} = \frac{18}{169} = 0.106 = 10.6\%$$

Without replacement Dependent

P(G AND Y) =

$$\frac{6}{13} \cdot \frac{3}{12} = \frac{18}{156} = 0.115 = 11.5\%$$

b) Drawing two blue marbles?

With replacement

P(B and B) =

$$\frac{4}{13} \cdot \frac{4}{13} = \frac{16}{169} = 9.5\%$$

Without replacement

P(B and B) =

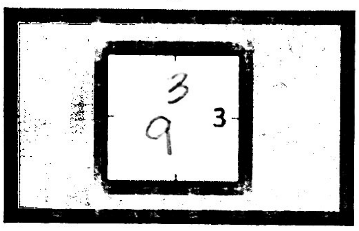
$$\frac{4}{13} \cdot \frac{3}{12} = \frac{12}{156} = 7.7\%$$

Geometric Probability - a probability that is found by calculating a ratio of lengths or area of a geometric figure.

P(Event) = $\dfrac{\text{Event Area}}{\text{Total Area}}$

Example 3: Geometric Probability of Rectangles $A = l \cdot w$

a) What is the probability that a point chosen at random in the rectangle will also be in the square.



P(point in square) = $\dfrac{9}{48}$ → area of square / area of total region

$\Downarrow$

18.8%

(b) What is the probability that a point chosen at random in the rectangle will be in the shaded area?

P(shaded region) = $\dfrac{\overset{\text{whole}}{48} - \overset{\text{part}}{9}}{\underset{\text{whole}}{48}} = \dfrac{39}{48} = 81.3\%$

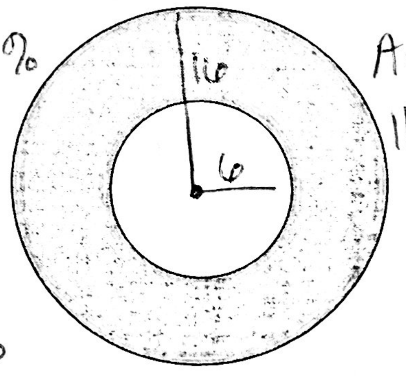
Example 4: Geometric Probability of Circles $A = \pi r^2$

The radius of the inner circle is 6cm, and the radius of the outer circle is 16cm. Find the probability that a point selected at random in the outer circle will be in the

$A = \pi(16)^2 = 804.2$

(a) inner circle

P(inner circle) = $\dfrac{113.1}{804.2} = 0.141 = 14.1\%$



$A = \pi(6)^2$
113.1

(b) shaded area

P(shaded) = $\dfrac{804.2 - 113.1}{804.2} = 0.859$

85.9%

Mutually Exclusive Events

When you roll a die, an event such as rolling a 1 is called a Simple event. because it consists of only one event.

An event that consists of two or more simple events is called a Compound event. Such as the event of rolling an odd number or a number greater than 5.

Mutually Exclusive Events is when two evens cannot occur at the same time. Like the probability of drawing a 2 or an ace is found by adding their individual probabilities.

If two events, A and B, are mutually exclusive, then the probability of A or B occurs is the sum of their probabilities.

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

Example 5: Two Mutually Exclusive Events
Keisha has a stack of 8 baseball cards, 5 basketball cards, and 6 soccer cards. If she selects a card at random from a stack, what is the probability that it is a baseball or a soccer card?

$$P(B \text{ or } S) = \frac{8}{19} + \frac{6}{19} = \frac{14}{19} = 0.736 = 73.6\%$$

Example 6: Three Mutually Exclusive Events
There are 7 girls and 6 boys on the junior class homecoming committee. A subcommittee of 4 people is being chosen at random to decide the theme for the class float. What is the probability that the subcommittee will have a least 2 girls?

→ combinations

2 girls, 3 girls, 4 girls

$$\frac{\overset{G}{{}_7C_2} \cdot \overset{B}{{}_6C_2}}{{}_{13}C_4} + \frac{\overset{G}{{}_7C_3} \cdot \overset{B}{{}_6C_1}}{{}_{13}C_4} + \frac{{}_7C_4 \cdot {}_6C_0}{{}_{13}C_4} =$$

$$\frac{21 \cdot 15}{715} + \frac{35 \cdot 6}{715} + \frac{35 \cdot 1}{715} = \frac{560}{715} = 0.783$$

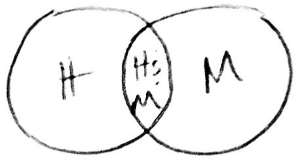
$$\frac{315}{715} + \frac{210}{715} + \frac{35}{715}$$

78.3%

Inclusive Events

Since it is possible to draw a card that is both queen and a diamond, these events are not mutually exclusive, they are inclusive events.

If two events, A and B, are inclusive, then the probability that A or ~~N~~ B occurs is the sum of their probabilities decreased by the probability of both occurring.



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

Example 7: Education

The enrollment at Southburg High school is 1400. Suppose 550 students take French, 700 take algebra, and 400 take both French and algebra. What is the probability that a student selected at random takes French or algebra?

P(French) + P(Algebra) − P(French & Algebra)

$$\frac{550}{1400} + \frac{700}{1400} - \frac{400}{1400} = \frac{17}{28} = 0.607 = 60.7\%$$

Conditional Probability

The probability of an event under the condition that some preceding event has occurred is called conditional probability. The conditional probability that event A occurs given that event B occurs can be represented by P(A|B).

The conditional probability of event A, given event B, is defined as $\frac{P(A \text{ and } B)}{P(B)}$

Example 8: Medicine

Refer to the application below. What is the probability that a test subject's hair grew, given that he used the experimental drug?

total: 4000

	Number of Subjects	
	Using Drug	Using Placebo
Hair Growth	1600	1200
No Hair Growth	800	400

$$P(\text{hair growth} \mid \text{used drug}) = \frac{1600}{4000} \Big/ \frac{2400}{4000} = 67\%$$

→ hair growth & used drug

→ used drug