Geometry

Probability

Probability

Probability is the likeliness of some event occurring. For example, what is the probability of flipping and coin and landing with heads up?

In order to answer this question, we must examine the **sample space** or the set of all possible outcomes of the toss.

In our coin experiment, the sample space includes only two elements--heads and tails. The toss itself is called the **event**.

Probability

The probability of an event is determined by dividing the number of successes by the total number of outcomes in the sample space.

A coin has one (1) head and one (1) tail. If I desire a head on my coin toss and it occurs, that is called a success. There is one head and two possible outcomes in the sample space.

The notation of this probability would be written as P(Heads)= 1/2 or .5.

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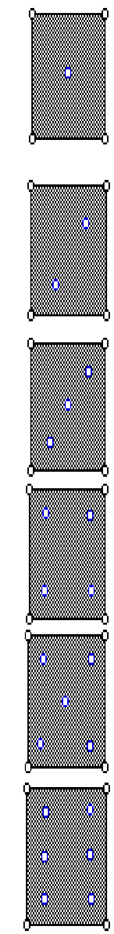
The sum of all probabilities of an event must equal 1.

P(Heads) and P(Tails): P(H) + P(T) = 0.5 + 0.5 = 1

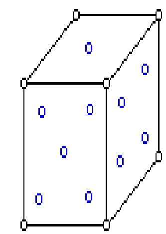
Probability

Observe the image of a die, and the 6 possible outcomes from one roll of the die.

Possiblities of a roll of the die



Suppose you were asked the probability of rolling a 5. There is only one side of the die that contains a 5 but there are 6 possible outcomes.



Therefore the probability of rolling a 5 is 1/6. Mathematically this could be written as P(5)=1/6.

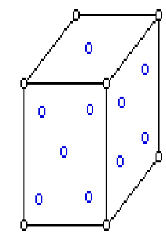
Probability

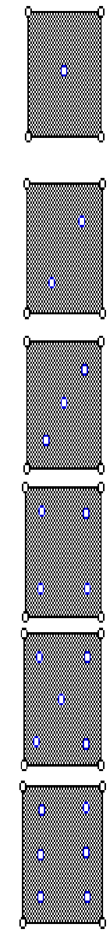
Similarly:
P(1, 2) = 1/3
P(odd) = 1/2
P(7) = 0

The sum of all probabilities of an event must equal 1.

P(1) + P(2) + P(3) + P(4) + P(5) + P(6) =
1/6 + 1/6 + 1/6 + 1/6 + 1/6 + 1/6 = 1

Possiblities of a roll of the die





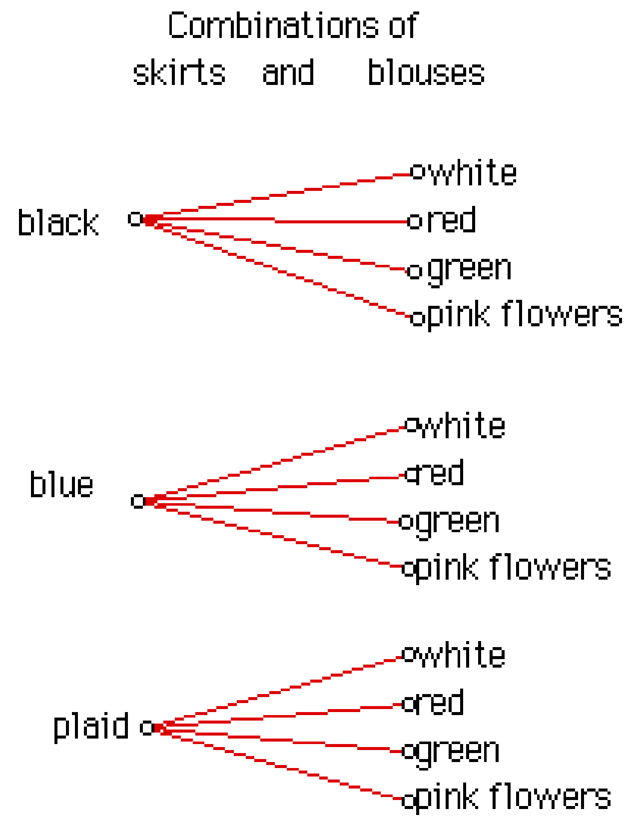
Probability of Compound Events

In probabilities involving multiple events where the events are independent of each other use the following:

P(A and B) = P(A) * P(B)

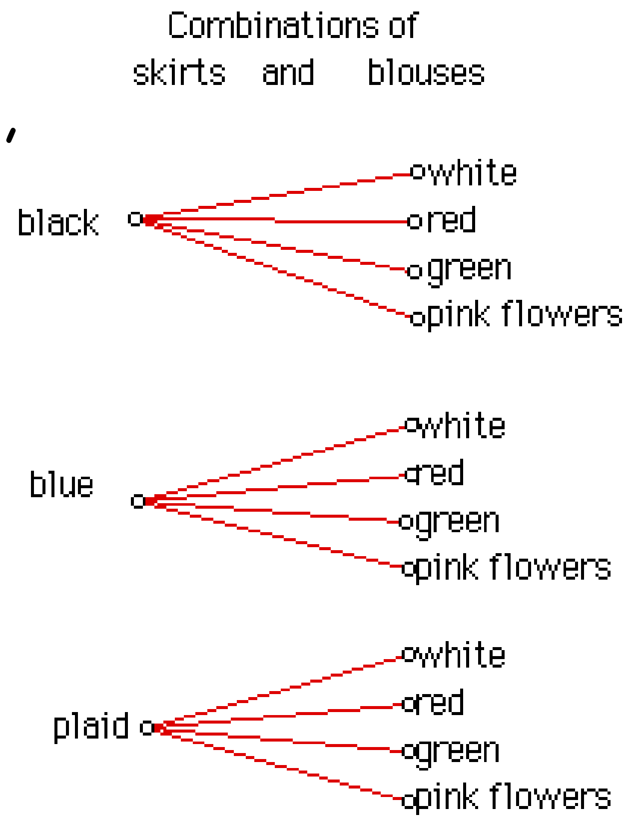
Probability of Compound Events

A student has three skirts to wear to school: 1 blue, 1 black, and 1 plaid. She has four blouses: 1 white, 1 red, 1 green and 1 with pink flowers. What is the probability that if she dressed in the dark (choosing her outfit at random), she would wear the plaid skirt with the blouse with pink flowers?



Probability of Compound Events

There are 12 possible outfits for the student to wear. There is only one successful outcome on the tree diagram. Therefore the P(plaid skirt, pink flower blouse) = 1/12.



Therefore: P(plaid) = 1/3
P(pink flowers) = 1/4

P(plaid and pink flowers) =
P(plaid) * P(pink flowers) = 1/12

Probability of Compound Events

What is the probability of rolling one die and getting a 2 AND flipping one coin and getting heads?

$$P(2 \text{ and heads}) = P(2) * P(\text{heads}) = 1/6 * 1/2 = 1/12$$

Probability of Compound Events

A deck of cards has 52 cards where 26 are red and 26 are black. What is the probability of randomly drawing two red cards in a row assuming you do not replace (without replacement) the first card you draw?

P(red and red) = P(red) * P(red) = 26/52 * 25/51 = 25/102

Notice the second draw has only 25 red remaining (recall probability of the defined as the likeliness of an event successfully occurring), out of 51 cards (since we did not replace the first card drawn.

Probability of Compound Events

If a bag contains 14 red marbles, 6 blue, and 10 green, what is the probability of selecting a blue and a green without replacement?

P(blue) = 6/30 and P(green) = 10/29, therefore the answer is 60/870 or .0689 or approximately 6.9%.