What is probability?

Probability is a measure that is associated with how certain we are of outcomes of a particular experiment or activity. A result of an experiment is called an **outcome**.

The **sample space** of an experiment is the set of all possible outcomes. Three ways to represent a sample space are: to list the possible outcomes, to create a tree diagram, or to create a Venn diagram.

Two basic rules of probability:

There are two basic rules of probability: **the multiplication rule** and **the addition rule**. These rules help to determine if an event is dependent or independent or whether it is mutually exclusive or not. Events *A* and *B* are **independent** if the knowledge that one occurred does not affect the chance the other occurs. Events *A* and *B* are **mutually exclusive** events if they cannot occur at the same time. This means that *A* and *B* do not share any outcomes and the probability of (*A* AND *B*) = 0.

The Multiplication Rule:

The following formula is true if an event is independent or dependent.

- $P(A|B) = P(A)$.

Example:

Felicity attends Modesto JC in Modesto, CA. The probability that **Felicity enrolls in a math class is 0.2** and the **probability that she enrolls in a speech class is 0.65.** The **probability that she enrolls in a math class GIVEN that she enrolls in speech class is 0.25.**

Let: *M* = math class P(M)= 0.2, *S* = speech class P(S)=0.65, *M*|*S* = math given speech P(M|S)=0.25

a. What is the probability that Felicity enrolls in math and speech?
   Find $P(M$ AND $S) = $ **$P(M|S)$ X $P(S) = $ 0.1625**
b. What is the probability that Felicity enrolls in math or speech classes?
   Find $P(M$ OR $S) = P(M) + P(S) - P(M$ AND $S)= $ **0.6875**
c. Are *M* and *S* independent? Is $P(M|S) = P(M)$? **Not independent.**
d. Are *M* and *S* mutually exclusive? Is $P(M$ AND $S) = 0$? **Not Mutually exclusive.**

Rules of Probability

Rules of Probability

The Addition Rule:

The following formula helps to determine whether an event is mutually exclusive or not mutually exclusive.

- $P(A$ AND $B) = 0$.

Example:

Klaus is trying to choose where to go on vacation. His two choices are: A = New Zealand and B = Alaska

- Klaus can only afford one vacation (meaning that these two events can't happen at the same time). The probability that he chooses A is **P(A) = 0.6** and the probability that he chooses B is **P(B) = 0.35.**
- **P(A AND B)** will be equal to **0** because Klaus can only afford to take one vacation.
- Therefore, the probability that he chooses either New Zealand or Alaska is the is **P(A OR B)** =?
- To obtain **P(A OR B)** the formula we need to use is **P(A) + P(B) = 0.6 + 0.35 = 0.95.**
- Note that the probability that he does not choose to go anywhere on vacation must be 0.05.

Sources:

3.3 Two Basic Rules of Probability - Introductory Statistics | OpenStax. (n.d.).

Openstax.org. https://openstax.org/books/introductory-statistics/pages/3-3-

two-basic-rules-of-probability

Disclaimer: We did not include all of the resources conferred to formulate this handout. We encourage students to conduct further research to find additional resources. The format of this list is not commensurate with a standard format.