TOOL: It is possible to solve many problems that involve the counting of events by plotting the events on a diagram with one axis for each component of the event. At each location in the diagram, we may list a probability for that event. Alternatively, we may use only 1's and 0's if we are counting outcomes in events and wish to indicate which outcomes are possible.

The *n*th axis may represent the following characteristics, among others:

i)   The outcome that occurs in one of several experiments performed at the same time. (Rolling several dice at once is an example. There is one axis for each die. Each axis lists the six possible numbers on the die.)

ii)   The outcome that occurs in the *n*th of a sequence of trials. (Flipping a coin several times in succession is an example. The axis for each flip has only two values: heads or tails.)

iii)   The participant that finishes in *n*th place in a contest. (The runner who finishes in *n*th place in a race is an example. The first axis is for the first- place runner and lists all the runners. The second axis is for the second-place runner and lists all the runners, and etc.)

iv)   Any characteristic that categorizes or measures some aspect of outcomes, even if they are not distinct aspects. (Rolling a single die is an example. We could have one axis for the number that appears on the die and another axis with a 1 or 0 indicating whether or not the number on the die is odd. Note that, since the number and the property of being odd are deterministically linked, only certain entries in the diagram can have nonzero probability.)

v)   An unmentioned characteristic of an event. (The height of people in an experiment where only their weight was measured is an example.)

>   **NOTE:** Whenever the value of some characteristic of an event is unspecified, that characteristic may have any value and still be part of the event. (If we are considering the probability of the event that a person weighs between 130 and 140 pounds, for example, then we allow them to have any possible height.)

>   **NOTE:** When we write P(A), this is mathematically equivalent to P(A, B=*any value*) = P(A, B1) + P(A, B2) + ... where B1, B2, ... are all the possible distinct values of B.