A ____________________is defined as any activity or phenomenon that meets the following conditions.

1.

2.

3.

Examples of Experiments

_____________________: The process through which some type of observation is obtained. An outcome is produced that cannot be predicted.

________________________________: one basic outcome of an experiment

________________________________: A form of representation which presents the collection of all possible sample points.

Basic Probability Rules for Sample Points:

1.The probability of one single sample point occurring must be between 0 and 1 inclusive.

2. The sum of all probabilities of sample points within a single sample space must sum to 1.

Event:

_________________________________: Calculated through summing probabilities of simple events within the sample space.

Example 1: Rolling a die

Experiment:

Sample point:

Sample space:

Example 2:

Experiment:

Sample point:

Sample space:

Event:

Classical Probability

Using the classical approach to probability, the probability of an event *A*, denoted *P*(*A*), is given by

Relative Frequency

If an experiment is performed *n* times, under identical conditions, and the event *A* happens *k* times, the **relative frequency** of *A* is given by the following expression.

Understanding Events

________________________________: Two events are said to be independent if the occurrence or non occurrence of one event does not change the probability associated with the other event.

________________________________: Two events are dependent if they are not independent, essentially one event occurring or not occurring affects the probability associated with the other event.

________________________________: Two events are mutually exclusive if the occurrence of one event prohibits the occurrence of the other. The events cannot both occur. (strongest case of dependent events)

__________: The union of two events represents the event in which either event A occurs, event B occurs, or they both occur.

__________: The intersection of two events represents the event in which both event A and event B occur.

__________: Two events whose probabilities reference the same event, sum to one, and represent all possibilities of the event

The Addition Rule

For any two events A and B

Mutually Exclusive Events

If Events A and B are mutually exclusive then

Conditional Probability

The conditional probability of A, given that B has already occurred is

Multiplicative Probability Rule:

If two events A and B are independent then the probability of events A and B is

A **binomial experiment** has the following characteristics:

1.
2.
3.
4. probability of success remains the same for each trial

Binomial Probability

Where…

p: probability of success on a single trial

q: 1-p or probability of failure

n: number of trials

x: number of successes in *n* trials

Binomial Probability Formula

Combination Formula

Example 5

For a binomial with $n = 5$ and $p = .25$, find the $P(X = 1)$.

Example 6

For a binomial with $n = 5$ and $p = .25$, find the $P(X = 2)$.

Example 7

For a binomial with $n = 5$ and $p = .25$, find the $P(X = 3)$.

Random Variables and Probability Distributions

A ______________________ is a numerical outcome of a random process.

A ___________________________________is a model that describes a specific kind of random process. A distribution displaying all possible probabilities connected to the values of a random value.

Random variables can be either ______________________or______________________.

A discrete random variable is a random variable which has a ______________________number of possible outcomes.

A continuous random variable is a random variable whose ______________________can assume any one of a countless number of values in an interval.

__________________ or _____________________________ of the discrete random variable x is

_______________________of a discrete random variable x is ______________________of a discrete random variable x is

Example 8

Given the probability distribution below find the **expected value, variance, and standard deviation**.

x	1	2	3	4
p(x)	.4	.54	.02	.04

A test contains five multiple choice questions, each with 4 possible answers. If a student guesses at all five questions, use the binomial probability formula to find the probability of the following:

The probability of getting 0 correct

The probability of getting 1 correct

The probability of getting 2 correct

The probability of getting 3 correct

The probability of getting 4 correct

The probability of getting 5 correct

X	0	1	2	3	4	5
P(X)						

Find the mean, variance, and standard deviation for the binomial distribution.

Mean, Variance, and Standard Deviation of Binomial Distribution

Example 9

Suppose the probability that a patient will recover from some blood disease is .30. Assuming that this situation has all the characteristics for a binomial probability and that it is known that 15 people have this disease find each of the following.

a. The probability no one recovers from the disease

b. the probability that exactly 4 people will recover from the disease

c. the probability at least one person recovers from the disease

d. The mean μ or expected number of people who will recover

e. The variance or σ^2 for the number of people who will recover.

f. The standard deviation or σ for the number of people who will recover

Probability Distribution for the Blood Disease Example

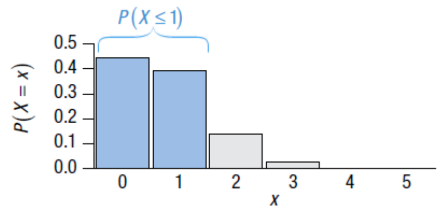
$\boldsymbol{P(X=0)=}$	$\boldsymbol{P(X=4)=}$	$\boldsymbol{P(X=8)=}$	$\boldsymbol{P(X=12)=}$
$\boldsymbol{P(X=1)=}$	$\boldsymbol{P(X=5)=}$	$\boldsymbol{P(X=9)=}$	$\boldsymbol{P(X=13)=}$
$\boldsymbol{P(X=2)=}$	$\boldsymbol{P(X=6)=}$	$\boldsymbol{P(X=10)=}$	$\boldsymbol{P(X=14)=}$
$\boldsymbol{P(X=3)=}$	$\boldsymbol{P(X=7)=}$	$\boldsymbol{P(X=11)=}$	$\boldsymbol{P(X=15)=}$

X	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
P(X)																

X	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
∑P(X)																

E Cumulative Binomial Probabilities

Numerical entries represent $P(X \le x)$.



						p				
n	**x**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
1	0	0.9000	0.8000	0.7000	0.6000	0.5000	0.4000	0.3000	0.2000	0.1000
	1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	0	0.8100	0.6400	0.4900	0.3600	0.2500	0.1600	0.0900	0.0400	0.0100
	1	0.9900	0.9600	0.9100	0.8400	0.7500	0.6400	0.5100	0.3600	0.1900
	2	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
3	0	0.7290	0.5120	0.3430	0.2160	0.1250	0.0640	0.0270	0.0080	0.0010
	1	0.9720	0.8960	0.7840	0.6480	0.5000	0.3520	0.2160	0.1040	0.0280
	2	0.9990	0.9920	0.9730	0.9360	0.8750	0.7840	0.6570	0.4880	0.2710
	3	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

E Cumulative Binomial Probabilities (cont.)

						p				
n	**x**	**0.1**	**0.2**	**0.3**	**0.4**	**0.5**	**0.6**	**0.7**	**0.8**	**0.9**
8	0	0.4305	0.1678	0.0576	0.0168	0.0039	0.0007	0.0001	0.0000	0.0000
	1	0.8131	0.5033	0.2553	0.1064	0.0352	0.0085	0.0013	0.0001	0.0000
	2	0.9619	0.7969	0.5518	0.3154	0.1445	0.0498	0.0113	0.0012	0.0000
	3	0.9950	0.9437	0.8059	0.5941	0.3633	0.1737	0.0580	0.0104	0.0004
	4	0.9996	0.9896	0.9420	0.8263	0.6367	0.4059	0.1941	0.0563	0.0050
	5	1.0000	0.9988	0.9887	0.9502	0.8555	0.6846	0.4482	0.2031	0.0381
	6	1.0000	0.9999	0.9987	0.9915	0.9648	0.8936	0.7447	0.4967	0.1869
	7	1.0000	1.0000	0.9999	0.9993	0.9961	0.9832	0.9424	0.8322	0.5695
	8	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
9	0	0.3874	0.1342	0.0404	0.0101	0.0020	0.0003	0.0000	0.0000	0.0000
	1	0.7748	0.4362	0.1960	0.0705	0.0195	0.0038	0.0004	0.0000	0.0000
	2	0.9470	0.7382	0.4628	0.2318	0.0898	0.0250	0.0043	0.0003	0.0000
	3	0.9917	0.9144	0.7297	0.4826	0.2539	0.0994	0.0253	0.0031	0.0001
	4	0.9991	0.9804	0.9012	0.7334	0.5000	0.2666	0.0988	0.0196	0.0009
	5	0.9999	0.9969	0.9747	0.9006	0.7461	0.5174	0.2703	0.0856	0.0083
	6	1.0000	0.9997	0.9957	0.9750	0.9102	0.7682	0.5372	0.2618	0.0530
	7	1.0000	1.0000	0.9996	0.9962	0.9805	0.9295	0.8040	0.5638	0.2252
	8	1.0000	1.0000	1.0000	0.9997	0.9980	0.9899	0.9596	0.8658	0.6126
	9	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

		p								
n	*x*	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
15	0	0.2059	0.0352	0.0047	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000
	1	0.5490	0.1671	0.0353	0.0052	0.0005	0.0000	0.0000	0.0000	0.0000
	2	0.8159	0.3980	0.1268	0.0271	0.0037	0.0003	0.0000	0.0000	0.0000
	3	0.9444	0.6482	0.2969	0.0905	0.0176	0.0019	0.0001	0.0000	0.0000
	4	0.9873	0.8358	0.5155	0.2173	0.0592	0.0093	0.0007	0.0000	0.0000
	5	0.9978	0.9389	0.7216	0.4032	0.1509	0.0338	0.0037	0.0001	0.0000
	6	0.9997	0.9819	0.8689	0.6098	0.3036	0.0950	0.0152	0.0008	0.0000
	7	1.0000	0.9958	0.9500	0.7869	0.5000	0.2131	0.0500	0.0042	0.0000
	8	1.0000	0.9992	0.9848	0.9050	0.6964	0.3902	0.1311	0.0181	0.0003
	9	1.0000	0.9999	0.9963	0.9662	0.8491	0.5968	0.2784	0.0611	0.0022
	10	1.0000	1.0000	0.9993	0.9907	0.9408	0.7827	0.4845	0.1642	0.0127
	11	1.0000	1.0000	0.9999	0.9981	0.9824	0.9095	0.7031	0.3518	0.0556
	12	1.0000	1.0000	1.0000	0.9997	0.9963	0.9729	0.8732	0.6020	0.1841
	13	1.0000	1.0000	1.0000	1.0000	0.9995	0.9948	0.9647	0.8329	0.4510
	14	1.0000	1.0000	1.0000	1.0000	1.0000	0.9995	0.9953	0.9648	0.7941
	15	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

X	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
∑P(X)																

Law of Large Numbers: