4-3

Binomial Probability Distributions

Definition

Binomial Probability Distribution

1. The procedure must have a *fixed number of trials.*
2. The trials must be *independent*. (The outcome of any individual trial doesn't affect the probabilities in the other trials.)
3. Each trial must have all outcomes classified into *two categories*.
4. The probabilities must remain *constant* for each trial.

Notation for Binomial Probability Distributions

n = fixed number of trials
x = specific number of successes in n trials
p = probability of *success* in *one* of n trials
q = probability of *failure* in *one* of n trials ($q = 1 - p$)
$P(x)$ = probability of getting exactly x success among n trials

Be sure that *x* and *p* both refer to the same category being called a success.

Table 4-1

Probability Distribution
Number of Girls Among Fourteen Newborn Babies

x	$P(x)$
0	0.000
1	0.001
2	0.006
3	0.022
4	0.061
5	0.122
6	0.183
7	0.209
8	0.183
9	0.122
10	0.061
11	0.022
12	0.006
13	0.001
14	0.000

Method 1

Binomial Probability Formula

- ❖ $P(x) = \frac{n!}{(n-x)!\,x!} \cdot p^{x} \cdot q^{n-x}$

Example: Find the probability of getting exactly 3 correct responses among 5 different requests from AT&T directory assistance. Assume in general, AT&T is correct 90% of the time.

This is a binomial experiment where:

n = 5
x = 3
p = 0.90
q = 0.10

Example: Find the probability of getting exactly 3 correct responses among 5 different requests from AT&T directory assistance. Assume in general, AT&T is correct 90% of the time.

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x = 3
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Using the binomial probability formula to solve:

P(3) = 0.0729

Binomial Probability Formula

$$P(x) = \underbrace{\frac{n!}{(n-x)!\,x!}}_{\text{Number of outcomes with exactly } x \text{ successes among } n \text{ trials}} \cdot p^{x} \cdot q^{n-x}$$

Example

Nine percent of men and 0.25% of women cannot distinguish between red and green. This is the type of color blindness that causes problems with traffic signals. If six men are randomly selected for a study of traffic signal perceptions, find the probability that exactly two of them cannot distinguish between red and green.