4-4

Mean, Variance, Standard Deviation for Binomial Distributions

For Any Discrete Probability Distribution:

Formula 4-1 $\mu = \Sigma[x \cdot P(x)]$

Formula 4-3 $\sigma^2 = [\Sigma x^2 \cdot P(x)] - \mu^2$

Formula 4-4 $\sigma = \sqrt{[\Sigma x^2 \cdot P(x)] - \mu^2}$

or use calculator

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

For Binomial Distributions:

Formula 4-6 $\mu = n \cdot p$

Formula 4-7 $\sigma^2 = n \cdot p \cdot q$

Formula 4-8 $\sigma = \sqrt{n \cdot p \cdot q}$

Example: **Find the mean and standard deviation for the number of girls in groups of 14 births.**

We previously discovered that this scenario could be considered a binomial experiment where:

n = 14

p = 0.5

q = 0.5

Using the binomial distribution formulas:

$\mu = (14)(0.5) = 7$ girls

$\sigma = \sqrt{(14)(0.5)(0.5)} = 1.9$ girls (rounded)

Reminder

Minimum usual values = $\mu - 2\sigma$

Maximum usual values = $\mu + 2\sigma$

Example: Determine whether 12 girls among 14 births could easily occur by chance.

For this binomial distribution,

μ = 7 girls

σ = 1.9 girls

$\mu - 2\sigma = 7 - 2(1.9) = 3.2$

$\mu + 2\sigma = 7 + 2(1.9) = 10.8$

The usual number girls among 14 births would be from 3 to 11. So 12 girls in 14 births is an unusual result.

Using Probabilities to Determine When Results Are Unusual

X is unusually high if with *x* successes among *n* trials, P(x or more) is very small (such as 0.05 or less)

X is unusually low if with *x* successes among *n* trials, P(x or fewer) is very small (such as 0.05 or less)

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