5-4

Mean, Variance, Standard Deviation for Binomial Distributions

For Any Discrete Probability Distribution:

Formula 5-1 $\mu = \Sigma[x \cdot P(x)]$

Formula 5-3 $\sigma^2 = [\Sigma x^2 \cdot P(x)] - \mu^2$

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For Any Discrete Probability Distribution:

Formula 5-1 $\mu = \Sigma[x \cdot P(x)]$

Formula 5-3 $\sigma^2 = [\Sigma x^2 \cdot P(x)] - \mu^2$

Formula 5-4 $\sigma = \sqrt{[\Sigma x^2 \cdot P(x)] - \mu^2}$

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For Any Discrete Probability Distribution:

Formula 5-1 $\mu = S[x \cdot P(x)]$

Formula 5-3 $s^2 = [S\, x^2 \cdot P(x)] - \mu^2$

Formula 5-4 $s = \sqrt{[S\, x^2 \cdot P(x)] - \mu^2}$

or use calculator

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 <u>Binomial</u> Distributions:

Formula 5-6 $\mu = n \cdot p$

Formula 5-7 $s^2 = n \cdot p \cdot q$

For Binomial Distributions:

Formula 5-6 $\mu = n \cdot p$

Formula 5-7 $\sigma^2 = n \cdot p \cdot q$

Formula 5-8 $\sigma = \sqrt{n \cdot p \cdot q}$

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:

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 = μ - 2 s

Maximum usual values = μ + 2 s

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

For this binomial distribution,

μ = 7 girls

s = 1.9 girls

μ - 2 s = 7 - 2(1.9) = 3.2

μ + 2 s = 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)**

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
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12	0.006
13	0.001
14	0.000