4.4 Mean and Standard Deviation of Binomial Distributions

There are other formulas you can use to find the mean, variance, and standard deviation for binomial probability distributions.

These formulas are simpler than the ones for a 'generic' probability distribution.

Binomial Distribution: Formulas

Mean $\mu = n \cdot p$

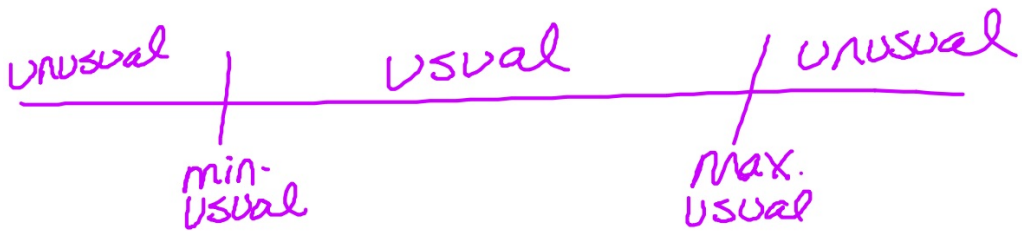
(expected value)

Std. Dev. $\sigma = \sqrt{n \bullet p \bullet q}$

Remember, the Range Rule of Thumb

max usual val = mean + 2std dev $= \mu + 2\sigma$

min usual val = mean - 2 std dev $= \mu - 2\sigma$



Find the mean and standard deviation of the binomial distribution with the given values of n and p.

1. n = 100; p = 0.5

$\mu = np = 100(.5) = 50$

$\sigma = \sqrt{npq} = \sqrt{100 \cdot .5 \cdot .5} = 5$

2. n = 64; p = 0.37

$\mu = 64(.37) = 23.7$

$\sigma = \sqrt{64 \cdot .37 \cdot .63} = 3.9$

A clothing store estimates that 26% of people who enter the store make a purchase. Suppose 50 people enter the store during 1-hour period. Find the mean and standard deviaiton.

$\mu = np = 50 \cdot .26 = 13$

$\sigma = \sqrt{50 \cdot .26 \cdot .74} = 3.1$

Is it unusual when 50 people enter the store that 4 people make a purchase?

min

$\mu - 2\sigma$

$13 - 2(3.1)$

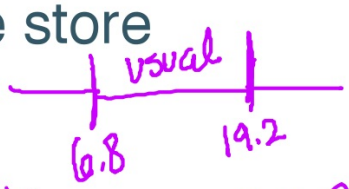
6.8

max

$\mu + 2\sigma$

$13 + 2(3.1)$

19.2



Yes; unusual

$4 < 6.8$

28% of college students say they use credit cards. 40 students are randomly selected.

Find the mean and standard deviation.

$\mu = 40 \cdot .28 = 11.2$

$\sigma = \sqrt{40 \cdot .28 \cdot .72} = 2.8$

Is it unusual for 16 of these students to be using a credit card?

min

$11.2 - 2(2.8)$

5.6

max

$11.2 + 2(2.8)$

16.8

Not unusual

16 is between 5.6 and 16.8

The accuracy of the rule of thumb depends on the value of p. If p is far away from 0.5, the rule of thumb will not be as accurate.

In other words, just because the rule of thumb says a value is unusual may or may not be true if the probability is far away from 0.5
(such as .1, .05, etc)