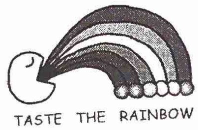
Name: ______________________________ Hour: _____ Date: ______

Lesson 6.3: Day 3: Where are all the red Skittles?



Mrs. Gallas loves red Skittles, but the last time she got a fun size bag there were no red Skittles! The bag was manufactured at the Skittles factory where 10,000 Skittles are made each hour. 20% of the Skittles are red. To make a fun size bag, 10 Skittles are chosen for each bag. What are the chances of getting a fun size bag with no red Skittles?

1. Is this a binomial setting? Explain.

B – Success → Red skittle
Failure → Not red

I – Independent? No! There is no replacement. This is not a binomial setting

2. Find the probability of getting 0 red Skittles in a group of 10 from the factory if this is **not** a binomial setting. Show your work.

$P(\text{No reds}) = \frac{8000}{10000} \times \frac{7999}{9999} \times \cdots \frac{7991}{9991} = .1073$

3. Find the probability of getting 0 red Skittles in a group of 10 from the factory if this were a binomial setting. Show your work.

$P(\text{No reds}) = {}_{10}C_0 \times .2^0 \times .8^{10} = .1074$

10% Rule

If sample is less than 10% of pop. a binomial can be used.

4. How do your answers from #2 and #3 compare? Why do you think this is?

There are so many skittles that taking one out doesn't make much difference.

To ensure that she gets more red Skittles, Mrs. Gallas buys a jumbo bag of Skittles which contains 900 Skittles. Let *X* = number of red Skittles in a bag of 900 Skittles. Use a binomial distribution to model the situation.

5. Find the mean and standard deviation of *X*.

$\mu_X = 900 \times .20 = 180 \quad \sigma_X = \sqrt{900 \times .2 \times .8} = 12$

6. What is the probability of getting at most 150 red Skittles?

binomcdf(900, .20, 150) = .006

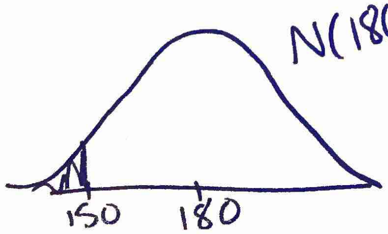
7. If we were to make a histogram of *X*, what do you think the shape would be?

Approximately normal

Large Counts
$n \times p \geq 10$ and $n(1-p) \geq 10$

8. Redo problem #6 above with a normal distribution and compare your answers.

N(180, 12)



$z = \frac{x-\mu}{\sigma}$

$z = \frac{150-180}{12}$

$= -2.5$

Area = .006

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Name: ______________________________ Hour: _____ Date: ______

Lesson 6.3 Day 3– Normal Approximation to Binomial Distributions

Important ideas: 10% Rule When taking a random sample of size n, from a population N you can use a binomial if $n < .10N$	Large Counts Condition Use a Normal distr. to model a binomial if $n \times p \geq 10$ and $n(1-p) \geq 10$.

Check Your Understanding

In a survey of 500 U.S. teenagers aged 14 to 18, subjects were asked a variety of questions about personal finance. One question asked whether teens had a debit card. Suppose that exactly 12% of teens aged 14 to 18 have debit cards. Let X = the number of teens in a random sample of size 500 who have a debit card.

1. Explain why X can be modeled by a binomial distribution even though the sample was selected without replacement.

B - Success → Debit Card
Failure → No Debit Card
N - n = 500
I - Not independent but 500 < 10% of population
S - p = .12

2. Use a binomial distribution to estimate the probability that 50 or fewer teens in the sample have debit cards.

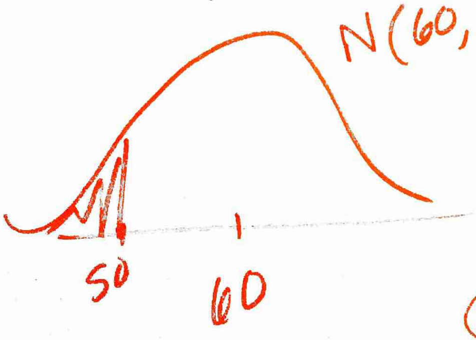
Binomcdf (500, .12, 50) = .093

3. Justify why X can be approximated by a Normal distribution.

$500 \times .12 = 60 \geq 10$ ✓
$500 \times .88 = 440 \geq 10$ ✓
Large counts condition was met.

4. Use a Normal distribution to estimate the probability that 50 or fewer teens in the sample have debit cards.

N(60, 7.27)



$$z = \frac{x-\mu}{\sigma}$$

$$z = \frac{50-60}{7.27}$$

$$= -1.38$$

Area = .084

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