

Statistics 104 – Homework 7

Solution

Assignment:

1. Complete the following problems from the text: 7.7, 7.10, 7.11, 7.23, 7.24, 7.29, and 7.30.

If you have questions on these problems, please see your course instructor.

2. The maker of M&M's says on its website that 20% of Almond M&M's are yellow. Suppose that M&M's are packaged at random. We wish to examine the sample proportion of yellow M&M's, \hat{p} , in various sized bags.

- a) For each of the different sized bags, give the mean and standard deviation of the sampling distribution of \hat{p} . Also comment on whether or not the conditions are met for the sampling distribution to be approximately normal.

- i) Fun size bags containing 25 M&M's.

Sampling distribution of \hat{p} :

$$\text{mean} = 0.20, \text{ standard deviation} = \sqrt{\frac{0.20(0.80)}{25}} = 0.08$$

Success/Failure condition is not met. $np = 5$ which is less than 15.

- ii) Small bags containing 50 M&M's

Sampling distribution of \hat{p} :

$$\text{mean} = 0.20, \text{ standard deviation} = \sqrt{\frac{0.20(0.80)}{50}} = 0.057$$

Success/Failure condition is not met. $np = 10$ which is less than 15.

- iii) Large bags containing 200 M&M's

Sampling distribution of \hat{p} :

$$\text{mean} = 0.20, \text{ standard deviation} = \sqrt{\frac{0.20(0.80)}{200}} = 0.028$$

Success/Failure condition: This is met. $np = 40$ and $n(1-p) = 160$ both of which are at least 15.

- iv) Extra large bags containing 400 M&M's

Sampling distribution of \hat{p} :

$$\text{mean} = 0.20, \text{ standard deviation} = \sqrt{\frac{0.20(0.80)}{400}} = 0.020$$

Success/Failure condition is met. $np = 80$ and $n(1-p) = 320$ both of which are at least 15.

- b) For the extra large bags containing 400 M&M's, use the 68-95-99.7 Rule to describe how the sample proportion of yellow M&M's might vary from bag to bag.

68% of the time the sample proportion of yellow will fall between

$$0.02 - 0.02 = 0.18 \text{ and } 0.02 + 0.02 = 0.22$$

95% of the time the sample proportion of yellow will fall between

$$0.02 - 2(0.02) = 0.16 \text{ and } 0.02 + 2(0.02) = 0.24$$

99.7% of the time the sample proportion of yellow will fall between

$$0.02 - 3(0.02) = 0.14 \text{ and } 0.02 + 3(0.02) = 0.26$$

- c) In an extra large bag of 400 M&M's there are only 52 yellow M&M's. Is this an unusually small number of yellow M&M's? Explain.

$$\hat{p} = \frac{52}{400} = 0.13 \quad z = \frac{0.13 - 0.20}{0.02} = -3.5 \quad \text{Table Z : 0.0002}$$

The chance of getting 52 or fewer yellow M&M's in a random sample of 400 is only 0.02%. This is very unlikely, therefore 52 (out of 400) yellow M&M's is an unusually small number.

3. In an ABC News/Washington Post poll conducted between October 15 and October 18, 2009, 57% of those surveyed said they approved of the way Barack Obama is handling his job as president while 40% of those surveyed disapproved of the way he was handling his job and 3% were unsure. The poll asked 1,004 randomly selected adults in the U.S. the question: "Do you approve or disapprove of the way Barack Obama is handling his job as president?"

- a) What is the population?

The population consists of all adults in the U.S.

- b) What is the sample?

The sample consists of 1,004 adults in the U.S. contacted by ABC News/Washington Post.

- c) Give the number, not a proportion or a percentage, of adults in the sample who approve of President Obama's performance.

57% of 1,004 or 572 adults in the sample approve of President Obama's performance.

- d) The poll has a margin of error of 3.2 percentage points. What proportion of the entire U.S. adult population approve of the way President Obama is handling his job?

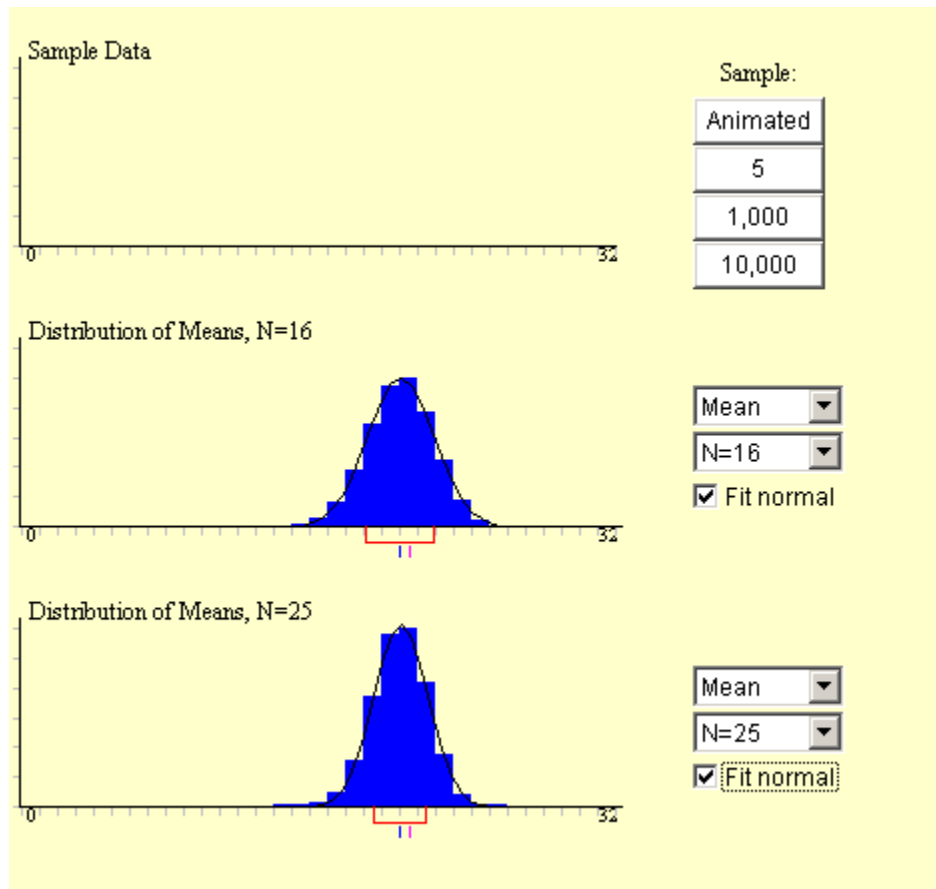
Between 53.5% and 60.2% of all adults in the U.S. approve of the way President Obama is handling his job.

4. The next page has a screen shot of the web page that simulates sampling from a population with a quantitative variable.

a) Describe the shape of the black population distribution.

The shape of the black population distribution is skewed to the left.

b) Sketch in the distribution of the sample mean \bar{y} for random samples of size 16 and 25 in the spaces provided below.



c) What are the means and standard deviations of these distributions?

Sample size	16	25
Mean	20.55	20.55
Standard Deviation	$7.37/4 = 1.84$	$7.37/5 = 1.47$