

For single sample proportions, if

1. $np \geq 10$ and $n(1-p) \geq 10$
2. Given simple random sample
3. $n < 10\%$ population
4. Independent observations within the sample

Then \hat{p} has an approximately normal distribution.

For single sample means, if

1. Given simple random sample
2. $N < 10\%$ population
3. Independent observations within the sample
4. $N \geq 30$

Then \bar{x} has an approximately normal distribution.

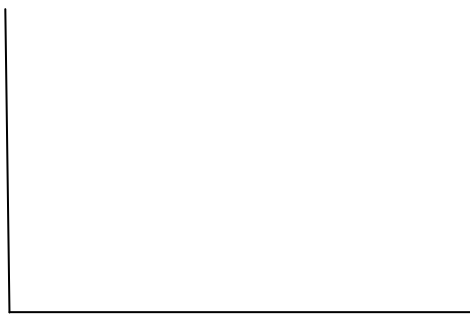
If the population has a normal distribution, then \bar{x} also has a normal distribution.

Problem 1. How sample means work

a. Create a frequency table and a histogram for the following table of sample means. Each sample was taken with a sample size of 30.

\bar{x}	7.78	7.28	8.14	8.22	8.06	8.29	7.86	8.52	7.83
s	2.80	2.00	2.58	2.59	2.34	1.93	2.72	2.63	2.09
\bar{x}	8.47	8.32	7.39	8.15	9.10	8.20	7.97	7.74	8.03
s	2.01	2.12	2.76	2.35	3.00	2.20	2.23	1.90	2.28

Column min - max	Frequency



- Calculate the mean and standard deviation of the sample means.
- Estimate the mean of the population.
- Estimate the standard deviation of the population.

Problem 2. How sample proportions work.

a. Create a frequency table and a histogram for the following table of sample proportions. Each was taken with a sample size of 30.

.378	.396	.396	.367	.386	.380	.368	.390	.391	.391
.401	.410	.410	.366	.405	.372	.350	.363	.365	.363

Column min - max	Frequency



b. Calculate the mean and standard deviation of the sample proportions.

c. Estimate the population proportion.

Practice Essay with sample means

A potato chip manufacturer makes snack size bags of potato chips. The Snack Pack of potato chips is advertised to weigh 3.5 oz.

- a. Which will have the smaller variability, a sample size of 50 or a sample size of 15? Explain.

- b. The weights of the snack size bags are normally distributed with mean 3.5 oz and standard deviation 0.2 oz. What percentage of bags will have a weight within 0.1 oz of the mean?

- c. What percentage of bags will weigh less than 3.3 oz?

- d. Out of the next 9 bags, what is the probability that 2 of them will weigh less than 3.3 oz?

Practice Essay with Sample Proportions

Fertilized chicken eggs from a particular supplier has a hatch rate of 75%.

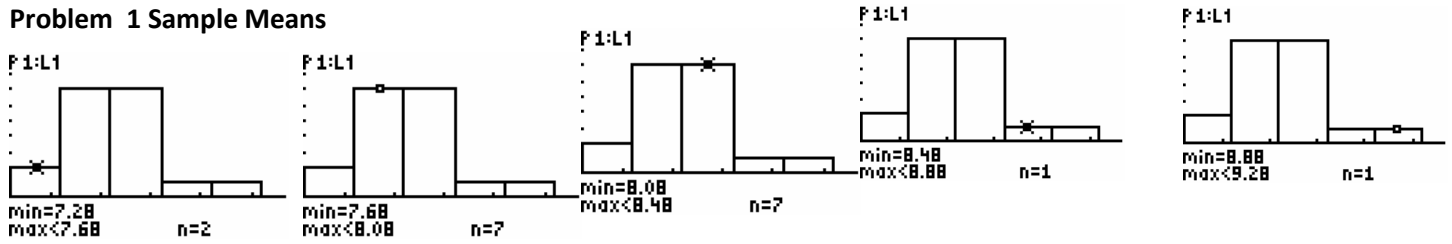
- a. How large must a sample be for the hatch rate of the sample to be approximately normal?

- b. Suppose you are given 45 randomly chosen fertilized eggs from this supplier. What is the probability that the hatch rate of the sample is at least 80%?

- c. Suppose you took 7 eggs home to hatch for Easter chicks with your family. What is the probability that only 4 eggs will hatch?

Example Answers:

Problem 1 Sample Means



Column min - max	Frequency
7.28 - < 7.68	2
7.68 - < 8.08	7
8.08 - < 8.48	7
8.48 - < 8.88	1
8.88 - < 9.28	1

b. $\mu_{\bar{x}} = 8.075, s_{\bar{x}} = .4185$ from calculator 1 var stats

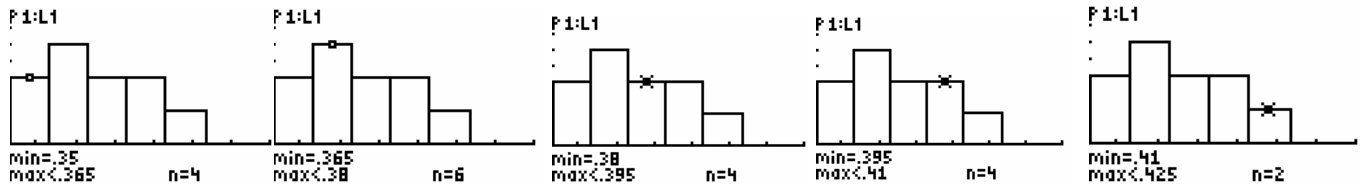
c. $\mu_{\bar{x}} = 8.075 = \mu$

d. Since $s_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$ then $.4185 = \frac{\sigma}{\sqrt{30}}$, so $\sigma = 2.29$

Samples were derived from RandNorm with pop mean = 8.0, pop std dev = 2.5, $n = 30$

Problem 2 Sample Proportions

Example Sample Proportions: Samples were derived from RandNorm with mean .37, $n = 30$



Column min - max	Frequency
.35 - <.365	4
.365 - <.38	6
.38 - <.395	4
.395 - <.41	4
.41 - <.425	2

From the graph you can see that the data is approximately normal. If you have 6 or 7 bins instead of 5, you might have seen outliers. This would be an error.

b. $\mu_{\hat{p}} = .3811$ This is our estimate of the population proportion. (part c)

$$s_{\hat{p}} = .01832$$

Practice Problems Answers

Snack bags:

- Sample size 50 has smaller variability because std dev of the sample is divided by the sqrt of sample size.
- 0.3829
- 0.1587
- Binomial. $N = 9$, $p = .1587$, $P(X = 2) = 0.2705$

Chicken eggs:

- Both np and $n(1-p)$ have to be 10 or greater. Choose n to be the larger number. $N = 40$.
- $N = 45$, $s = \sqrt{.75 * .25/45} = .0645$ $P(\hat{p} \geq .80) = .2191$
- $P(x = 4, n = 7) = .1730$ from calculator. Must use binomial dist. b/c sample size is too small.