Normal Distribution & Sampling Distribution Probabilities Using TI-84

Statistics Worksheet · Grade 11–12 / College Intro Stats

Name: ________________________________ Date: ___________________

Learning Objectives

- Calculate probabilities for a sampling distribution using normalcdf on the TI-84
- Identify and apply the standard error (sigma divided by square root of n) for sampling distributions
- Interpret probability results in the context of real-world word problems involving the normal distribution

Problems

1. A package of 100-watt GE soft white light bulbs states the bulbs have a mean lifespan of 730 hours with a standard deviation of 52 hours. What is the standard error of the mean for a random sample of 27 bulbs? Round to four decimal places.

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{52}{\sqrt{27}}$$

2. Using the light bulb scenario (mean = 730 hours, standard deviation = 52 hours, n = 27), write the correct normalcdf syntax you would enter into the TI-84 to find P(X-bar > 740). Fill in each argument: lower, upper, mean, and standard deviation (use the standard error).

$$\text{normalcdf}(\textit{lower},\ \textit{upper},\ \mu,\ \sigma_{\bar{x}})$$

3. Using the light bulb scenario (mean = 730 hours, standard deviation = 52 hours, n = 27), find the probability that the mean lifespan of the sample exceeds 740 hours. Round to four decimal places.

$$P(\bar{X} > 740)$$

4. Using the same light bulb scenario (mean = 730 hours, standard deviation = 52 hours, n = 27), find the probability that the mean lifespan of the sample is less than 700 hours. Round to four decimal places.

$$P(\bar{X} < 700)$$

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5. Using the same light bulb scenario (mean = 730 hours, standard deviation = 52 hours, n = 27), find the probability that the mean lifespan of the sample is between 715 hours and 737 hours. Round to four decimal places.

$$P(715 < \bar{X} < 737)$$

6. A manufacturer claims that AA batteries have a mean lifespan of 200 hours with a standard deviation of 15 hours. A quality inspector randomly samples 36 batteries. Find the probability that the sample mean lifespan is greater than 205 hours. Round to four decimal places.

$$P(\bar{X} > 205),\ \mu = 200,\ \sigma = 15,\ n = 36$$

7. The heights of adult men in a city are normally distributed with a mean of 70 inches and a standard deviation of 3 inches. A random sample of 25 men is selected. Find the probability that the sample mean height is between 69 inches and 71 inches. Round to four decimal places.

$$P(69 < \bar{X} < 71),\ \mu = 70,\ \sigma = 3,\ n = 25$$

8. The fill weights of cereal boxes are normally distributed with a mean of 18 ounces and a standard deviation of 0.5 ounces. A store receives a shipment of 40 boxes. Find the probability that the sample mean fill weight is less than 17.9 ounces. Round to four decimal places.

$$P(\bar{X} < 17.9),\ \mu = 18,\ \sigma = 0.5,\ n = 40$$

9. The complete probability distribution table below shows the four probability calculations for the light bulb scenario. Use the TI-84 normalcdf function with mean = 730, standard deviation = 52, and n = 27 to verify and fill in the missing probability values.

Event	normalcdf Syntax	Probability
P(X-bar > 740)	normalcdf(740, 1E99, 730, 52/√27)	
P(X-bar < 700)	normalcdf(-1E99, 700, 730, 52/√27)	
P(715 < X-bar < 737)	normalcdf(715, 737, 730, 52/√27)	

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Event	normalcdf Syntax	Probability
P(X-bar < 730)	normalcdf(-1E99, 730, 730, 52/√27)	

10. A hospital records show that the daily number of patient admissions is normally distributed with a mean of 85 patients and a standard deviation of 12 patients. The hospital director wants to plan staffing for the next quarter. For a random sample of 50 days, find: (a) the probability the sample mean exceeds 88 admissions per day, (b) the probability the sample mean is between 82 and 87 admissions per day, and (c) the value of x such that there is only a 5% chance the sample mean exceeds x. Round all answers to four decimal places.

$\mu = 85,\ \sigma = 12,\ n = 50$

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Normal Distribution & Sampling Distribution Probabilities Using TI-84 — Answer Key

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Answer Key

1. Answer: 10.0071 hours

- Identify sigma = 52 and n = 27.
- Calculate sqrt(27) ≈ 5.1962.
- Divide: 52 ÷ 5.1962 ≈ 10.0071 hours.

2. Answer: normalcdf(740, 1e99, 730, 52/sqrt(27))

- Lower bound = 740 (the value we exceed).
- Upper bound = 1E99 (represents positive infinity on TI-84).
- Mean = 730.
- Standard deviation = 52 / sqrt(27) ≈ 10.0071.

3. Answer: 0.1588

- Use normalcdf(740, 1E99, 730, 52/sqrt(27)) on the TI-84.
- Standard error = 52 / sqrt(27) ≈ 10.0071.
- The calculator returns approximately 0.1588.
- Interpretation: There is about a 15.88% probability the mean exceeds 740 hours.

4. Answer: 0.0014

- Use normalcdf(-1E99, 700, 730, 52/sqrt(27)) on the TI-84.
- Standard error = 52 / sqrt(27) ≈ 10.0071.
- The calculator returns approximately 0.0014.
- Interpretation: There is only about a 0.14% chance the mean lifespan is below 700 hours.

5. Answer: 0.5091

- Use normalcdf(715, 737, 730, 52/sqrt(27)) on the TI-84.
- Standard error = 52 / sqrt(27) ≈ 10.0071.
- The calculator returns approximately 0.5091.
- Interpretation: There is about a 50.91% chance the mean lifespan is between 715 and 737 hours.

6. Answer: 0.0228

- Standard error = 15 / sqrt(36) = 15 / 6 = 2.5 hours.
- Use normalcdf(205, 1E99, 200, 2.5) on the TI-84.
- The calculator returns approximately 0.0228.
- Interpretation: There is about a 2.28% chance the sample mean exceeds 205 hours.

7. Answer: 0.9044

- Standard error = 3 / sqrt(25) = 3 / 5 = 0.6 inches.

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• Use normalcdf(69, 71, 70, 0.6) on the TI-84.
• The calculator returns approximately 0.9044.
• Interpretation: There is about a 90.44% chance the sample mean is between 69 and 71 inches.

8. Answer: 0.1029

• Standard error = 0.5 / sqrt(40) ≈ 0.07906 ounces.
• Use normalcdf(-1E99, 17.9, 18, 0.5/sqrt(40)) on the TI-84.
• The calculator returns approximately 0.1029.
• Interpretation: There is about a 10.29% chance the sample mean weight is below 17.9 ounces.

9. Answer: 0.1588; 0.0014; 0.5091; 0.5000

Event	normalcdf Syntax	Probability
P(X-bar > 740)	normalcdf(740, 1E99, 730, 52/√27)	0.1588
P(X-bar < 700)	normalcdf(-1E99, 700, 730, 52/√27)	0.0014
P(715 < X-bar < 737)	normalcdf(715, 737, 730, 52/√27)	0.5091
P(X-bar < 730)	normalcdf(-1E99, 730, 730, 52/√27)	0.5000

• For P(X-bar > 740): normalcdf(740, 1E99, 730, 10.0071) ≈ 0.1588.
• For P(X-bar < 700): normalcdf(-1E99, 700, 730, 10.0071) ≈ 0.0014.
• For P(715 < X-bar < 737): normalcdf(715, 737, 730, 10.0071) ≈ 0.5091.
• For P(X-bar < 730): Because 730 is the mean, exactly half the distribution lies below it, so probability = 0.5000.

10. Answer: (a) 0.0385; (b) 0.8254; (c) approximately 87.79 admissions

• Standard error = 12 / sqrt(50) ≈ 1.6971.
• (a) normalcdf(88, 1E99, 85, 1.6971) ≈ 0.0385.
• (b) normalcdf(82, 87, 85, 1.6971) ≈ 0.8254.
• (c) Use invNorm(0.95, 85, 1.6971) ≈ 87.79 on the TI-84; the 95th percentile of the sampling distribution is approximately 87.79 admissions.

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