RLP-ALG2B · RLP Algebra 2B — Logarithms, Transformations, Trigonometry and Statistical Inference

Unit 4: Statistical Inferences

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 4.1 — Surveys, Experiments and Observational Studies

FLUENCY

1. Classify: researchers randomly select 1,200 Missouri adults by phone and ask about health insurance.

2. Classify: 40 volunteers are randomly assigned to a new or standard reading app, and scores are compared.

3. Classify: a study compares asthma rates in neighborhoods near and far from freeways.

4. Which design supports generalizing to a population, and which supports cause and effect?

5. An online poll where anyone can vote gets 30,000 responses. Name the type of sample and its main problem.

6. Define parameter and statistic, with one example of each from a survey of 500 Missouri teenagers.

APPLICATION

7. A headline says: 'Students who eat breakfast earn higher grades, so breakfast raises grades.' Name the design, a possible confounding variable and a design that could test the causal claim.

8. A school surveys the first 50 students to arrive in the morning about the start time. Why might this be biased, and how could it be fixed?

9. In the 1954 Salk vaccine field trial, part of the trial randomly assigned children to vaccine or placebo. Why did random assignment matter?

CHALLENGE

10. Design a study of whether a new study-hall schedule improves homework completion at your school that supports both generalizing to the school and a causal conclusion.

REVIEW

11. A quantity starts at 15,000 and grows by 5% each year. Write a model and find its value after 4 years, to the nearest whole number.

12. Find the exact value of $\sin(3\pi/4)$.

Lesson 4.2 — Normal Distributions and Population Percentages Lab

FLUENCY

1. A distribution is approximately normal with mean 70 and standard deviation 8. Find the z-score of 76.4 and the proportion of values below it.

2. A distribution is approximately normal with mean 64 and standard deviation 2.8. Find the z-score of 65.2 and the proportion of values below it.

3. A distribution is approximately normal with mean 3.1 and standard deviation 0.4. Find the z-score of 3.9 and the proportion of values below it.

4. A distribution is approximately normal with mean 100 and standard deviation 15. Find the z-score of 119.0 and the proportion of values below it.

5. X is normal with mean 500 and standard deviation 100. Find $P(406 < X < 566)$.

6. X is normal with mean 170 and standard deviation 9. Find $P(168 < X < 183)$.

7. X is normal with mean 24 and standard deviation 3. Find $P(20 < X < 25)$.

8. X is normal with mean 24 and standard deviation 3. Find $P(19 < X < 30)$.

9. Battery life is normal with mean 40 h and SD 5 h (illustrative). Use the empirical rule to estimate the percent lasting 35-45 h and less than 30 h.

APPLICATION

10. For the batteries above, find P($X < 45$), P($X > 52$) and the 90th percentile with technology.

11. A warranty covers batteries that fail before 32 hours. What percent of batteries will be claimed?

12. County household incomes have mean \$95,000 and median \$78,000. Is a normal model appropriate? Explain.

CHALLENGE

13. Above what battery life are the top 2.5% of batteries? Compare the technology answer with the empirical-rule estimate.

REVIEW

14. Convert $11\pi/6$ radians to degrees.

15. Evaluate: $\log_{10} \sqrt{10}$

Lesson 4.3 — Is the Model Consistent? Simulation and Fair Decisions

FLUENCY

1. $X \sim \text{Binomial}(n = 19, p = 0.6)$. Find $P(X = 8)$, $P(X \le 8)$, and the mean and standard deviation of X.

2. $X \sim \text{Binomial}(n = 17, p = 0.6)$. Find $P(X = 12)$, $P(X \le 12)$, and the mean and standard deviation of X.

3. $X \sim \text{Binomial}(n = 6, p = 0.75)$. Find $P(X = 5)$, $P(X \le 5)$, and the mean and standard deviation of X.

4. A game pays −5 with probability 1/3; 35 with probability 5/12; 50 with probability 1/4. Find the expected value.

5. A game pays 5 with probability 2/13; 15 with probability 6/13; 35 with probability 2/13; 45 with probability 3/13. Find the expected value.

6. A game pays −10 with probability 2/7; 0 with probability 4/21; 25 with probability 5/21; 45 with probability 2/7. Find the expected value.

APPLICATION

7. A fair coin is flipped 100 times. Find P(60 or more heads) and say whether 60 heads is evidence against fairness.

8. A spinner is claimed to land on blue 25% of the time. In 200 spins it lands on blue 38 times. Find P(38 or fewer) under the claim and interpret.

9. A $1 game pays $5 when two dice sum to 7 or 11. Find the player's expected net result per play. Who gains in the long run?

CHALLENGE

10. Design a fair way to choose one of five club members using only a coin, and show each member has probability 1/5.

REVIEW

11. Solve for x: $3^x = 3.5$. Give an exact answer using logarithms and a decimal to the nearest thousandth.

12. Find the exact value of $\tan(330°)$.

13. Two players take turns rolling two dice; the first to roll a sum of 7 wins. Find the probability the first player wins.

Lesson 4.4 — Margins of Error and Randomization Tests

FLUENCY

1. In a random sample of 1000, 289 said yes. Construct a 95% confidence interval for the population proportion.

2. In a random sample of 500, 244 said yes. Construct a 90% confidence interval for the population proportion.

3. In a random sample of 800, 255 said yes. Construct a 95% confidence interval for the population proportion.

4. In a random sample of 200, 62 said yes. Construct a 99% confidence interval for the population proportion.

5. In a random sample of 1000, 486 said yes. Construct a 95% confidence interval for the population proportion.

6. Find the margin of error (about 2 standard deviations) for $\hat{p} = 0.62$ with $n = 400$, and with $n = 1{,}600$.

7. Find the margin of error for $\hat{p} = 0.5$ and $n = 1{,}000$.

APPLICATION

8. A survey (illustrative) of 1,500 Missouri adults finds 58% support, with a reported margin of ±3.3 points. Compute $2\sqrt{(p(1-p)/n)}$ and explain any difference. Does the survey establish majority support?

9. In a randomized experiment, silence scores averaged 30.5 words and notification scores 26.0. In 1,000 shuffles, 2 differences were 4.5 or more. Write the conclusion.

10. A poll finds 52% ± 3 points support. A headline says 'Majority supports.' Evaluate it.

CHALLENGE

11. How large a sample gives a margin of error of 3 percentage points when $\hat{p}$ is near 0.5?

REVIEW

12. Solve for x: $10^x = 250$. Give an exact answer using logarithms and a decimal to the nearest thousandth.

13. Find the exact value of $\cos(4\pi/3)$.

Unit 4 checkpoint

1. Students who choose an online section are compared with those who choose in-person. Design?
   A. Survey
   B. Experiment
   C. Observational study
   D. Census

2. True or false: Random selection allows a cause-and-effect conclusion.
3. Normal, mean 40, SD 5: percent between 30 and 50?
   A. 68%
   B. 84%
   C. 95%
   D. 99.7%
4. For the same distribution, P(X < 45) ≈ _____.
5. True or false: The empirical rule can be applied to any data set with a mean and SD.
6. A fair coin gives 60+ heads in 100 flips about 2.8% of the time. Best conclusion for a coin with 60 heads?
   A. The coin is proved unfair
   B. Evidence the coin favors heads
   C. Consistent with a fair coin
   D. Nothing can be said
7. In the $1 dice game paying $5 on 7 or 11, P(win) = _____/36.
8. Quadrupling a survey's sample size makes the margin of error…
   A. a quarter
   B. half
   C. the same
   D. double
9. For p̂ = 0.62 and n = 400, the margin of error (2 SD) is about _____.
10. True or false: A randomization proportion of 0.0017 proves the treatment affected every subject.
11. 52% ± 3 points. Does this establish a majority?
    A. Yes
    B. No, the interval includes values below 50%
    C. Only if n > 1,000
    D. Yes, 52 > 50

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