RLP-STATSA · RLP Statistics A — Exploring Data, Study Design and Probability

Unit 1: Exploring One-Variable Data

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

Name _____ Period _____

Lesson 1.1 — Distributions and the Statistical Process

FLUENCY

1. For the data 2, 6, 7, 8, 13, 23, 26: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)

2. For the data 10, 10, 11, 12, 16, 22, 23, 25, 34: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)

3. Classify each variable as categorical or quantitative: (a) the NOAA station ID, (b) annual precipitation in inches, (c) the month of the wettest day, (d) whether a day had measurable rain.

4. Which display best shows how Missouri's monthly unemployment rate changed from 2016 to 2025: histogram, box plot or time plot?

5. The St. Louis annual-precipitation histogram (1950-2024) has bins 20-30, 30-40, 40-50, 50-60 and 60-70 inches with counts 11, 32, 22, 9 and 1. How many years had at least 40 inches?

6. Using the same histogram, what fraction of the 75 years had less than 30 inches?

7. Using the same histogram, which bin contains the median year? (There are 75 years, so the median is the 38th value.)

8. Describe the shape of the St. Louis precipitation histogram in one phrase.

APPLICATION

9. Kansas City precipitation, 1973-2024 (NOAA): mean 38.72 in, median 37.63 in, minimum 22.31 in, maximum 55.31 in. Predict the shape of its histogram and explain your reasoning from these four numbers.

10. BLS reports Missouri's seasonally adjusted unemployment rate as 3.4% in February 2020 and 11.6% in April 2020. (a) By how many percentage points did it rise? (b) By what factor? (c) Why would a histogram of the 2016-2025 monthly rates hide the most important fact about these data?

11. Missouri's monthly unemployment rates for 2019 (BLS, %) were 3.3, 3.3, 3.2, 3.1, 3.1, 3.1, 3.1, 3.2, 3.3, 3.3, 3.4, 3.4. Make a dot plot and describe the distribution.

12. Round St. Louis precipitation for 2015-2024 to whole inches: 61, 41, 37, 43, 54, 50, 43, 49, 33, 51. Make a stem-and-leaf plot with stems 3, 4, 5 and 6 (tens of inches) and describe the shape.

CHALLENGE

13. The BLS series has no value for October 2025 because of the 2025 lapse in federal appropriations. September and November 2025 were both 3.9%. A student fills in October as 3.9% and says nothing. Is that acceptable in a statistical report? What should the student do instead?

REVIEW

14. A quantity starts at 15,000 and grows by 12% each year. Write a model and find its value after 15 years, to the nearest whole number.

15. (Prerequisite: percent) St. Louis received 61.28 inches in 2015; its 1950-2024 mean is 38.81 inches. By what percent did 2015 exceed the mean?

Lesson 1.2 — Measuring Center and Spread

FLUENCY

1. For the data 3, 4, 11, 12, 26, 27, 28: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)

2. For the data 2, 3, 11, 15, 18, 21, 27, 30, 34: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)

3. For the data 2, 5, 6, 19, 23, 34, 39: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)

4. For the data 2, 3, 9, 10, 22, 24, 35, 37: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)

5. For the data 7, 8, 10, 15, 15, 16, 17, 19, 24, 24: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)

6. For the data 6, 7, 22, 28, 33, 34, 40: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)

7. Kansas City International Airport annual mean temperatures, 2020-2024 (°F): 55.7, 57.0, 55.7, 57.0, 57.1. Compute the mean, the deviations, the sum of squared deviations, the sample variance and the sample standard deviation by hand.

8. For the same five values, what would the population standard deviation (dividing by n) be, and when would it be the right choice?

APPLICATION

9. Kansas City precipitation, 2015-2024 (NOAA, inches): 46.61, 48.67, 46.04, 40.78, 53.22, 34.10, 41.26, 34.57, 37.40, 34.67. Find the mean, median, sample SD, Q1, Q3 and IQR (median-of-halves method), and the 1.5 × IQR fences. Are there outliers?

10. Remove the wettest year from the Kansas City 2015-2024 list. How do the mean and the median change, and which is more resistant?

11. A spreadsheet's QUARTILE.INC gives different quartiles from your hand method for the same ten values. Which is correct, and what should your report say?

CHALLENGE

12. Show that the deviations from the mean always sum to zero, and explain why this is why variance squares them.

13. In the ten St. Louis values for 2015-2024 (mean 46.158 in, $s \approx 8.44$ in), replace 2015's 61.28 in with the mean, 46.158. Without recomputing everything, say whether s increases or decreases; then compute it.

REVIEW

14. Solve: $-6x - 2 = 16$

15. (Prerequisite: solving an equation) Four years at a station had 38, 41, 44 and 35 inches of rain. How much rain must a fifth year have for the five-year mean to be 40 inches?

Lesson 1.3 — Comparing Distributions Across Missouri

FLUENCY

1. For the data 9, 12, 16, 17, 17, 21, 25, 27, 28, 39: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)
2. For the data 2, 4, 8, 9, 13, 25, 29, 40: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)
3. For the data 9, 12, 15, 15, 19, 24, 30, 32, 40: find the mean, median, range and interquartile range. (Find the quartiles as the medians of the lower and upper halves, leaving out the overall median when the count is odd.)
4. A distribution is strongly skewed right with one high outlier. Which measures of center and spread should you report?

5. A distribution is roughly symmetric with no outliers. Which measures of center and spread are appropriate?

6. Compute the coefficient of variation for Kansas City precipitation (mean 38.72 in, SD 8.33 in) and for Springfield (mean 45.19 in, SD 7.96 in).

7. Station A has mean 20 in and SD 6 in; station B has mean 8 in and SD 4 in. Which has the larger absolute spread, and which is more variable relative to its mean?

8. Two box plots are drawn on different scales. Why is that a problem for comparison?

APPLICATION

9. Compare St. Louis and Columbia precipitation, 1973-2024 (NOAA): St. Louis mean 41.04, median 41.22, SD 8.40; Columbia mean 41.32, median 40.89, SD 8.27 inches. Write two sentences comparing center and spread in context.

10. A sample claim says: 'Kansas City's rainfall is more reliable than St. Louis's, because its SD (8.33 in) is smaller than St. Louis's (8.40 in).' Evaluate the claim using coefficients of variation: STL 0.205, KC 0.215, SGF 0.176, COU 0.200.

11. Annual mean temperature, 1973-2024 (NOAA): St. Louis mean 57.14°F, SD 1.85; Kansas City mean 54.68°F, SD 1.70. Both distributions are roughly symmetric. Compare them in two sentences.

CHALLENGE

12. How much does the single high year 2015 (61.28 in), the 75-year outlier, move St. Louis's mean and median? Use all 75 years: mean 38.81, median 37.67.

REVIEW

13. Solve: $5(x + 4) + 10 = 25$

14. (From Lesson 1.2) Kansas City precipitation, 2015-2024, has Q1 = 34.67 and Q3 = 46.61 in. A year with 66 inches is added. Using the old quartiles, would it be an outlier?

Lesson 1.4 — Standardizing, Transforming and Reporting

FLUENCY

1. St. Louis 2024: annual mean temperature 61.2°F; the station's 1973-2024 mean is 57.14°F and SD 1.85°F. Find the z-score.
2. Kansas City 2012: annual mean temperature 58.7°F; the station's 1973-2024 mean is 54.68°F and SD 1.70°F. Find the z-score.
3. Springfield 2024: annual mean temperature 59.7°F; the station's 1973-2024 mean is 56.63°F and SD 1.49°F. Find the z-score.
4. Columbia 2012: annual mean temperature 59.3°F; the station's 1973-2024 mean is 54.97°F and SD 1.73°F. Find the z-score.
5. Convert Kansas City's mean annual temperature (54.68°F) and its SD (1.70°F) to Celsius.

6. Convert St. Louis's mean annual precipitation (41.04 in) and SD (8.40 in) to millimeters (1 in = 25.4 mm).

7. Every value in a data set is increased by 3. What happens to the mean, median, SD and IQR?

APPLICATION

8. Using the four z-scores above, which station-year was the most unusually warm relative to its own station's record? Answer in a sentence with numbers.

9. A headline says: 'Record rain soaks St. Louis—wettest year ever!' List four pieces of information a reader needs to check the claim.

10. A student writes: 'St. Louis's 2015 rainfall had z = 2.41, so only 1% of years are that wet.' What is wrong with the reasoning?

CHALLENGE

11. Prove that a z-score does not change when every value is transformed by $y = a + bx$ with $b > 0$.

REVIEW

12. (From Lesson 1.2) For the data 4, 7, 7, 9, 13, find the mean and the sample standard deviation.

13. (From Lesson 1.1) Which display shows the five-number summary directly?

Unit 1 checkpoint

1. Which display is best for showing how a quantity changed month by month?
   A. Histogram
   B. Box plot
   C. Time plot
   D. Dot plot
2. A distribution has mean 24 and median 18. What shape is most likely?
   A. Skewed left
   B. Symmetric
   C. Skewed right
   D. Uniform
3. For the data 3, 5, 8, 10, 14, the mean is _____ and the median is _____.
4. True or false: The sample variance divides by $n - 1$ because deviations from the sample mean are slightly too small on average.

5. For skewed data with an outlier, which pair of summaries is most appropriate?
   A. Mean and SD
   B. Median and IQR
   C. Mean and range
   D. Mode and SD
6. With Q1 = 32.52 and Q3 = 43.70, the IQR is _____ and the upper fence is _____.
7. True or false: Removing one extreme value changes the median more than the mean.
8. Station A: mean 20 in, SD 6 in. Station B: mean 10 in, SD 4 in. Which is more variable relative to its mean?
   A. A
   B. B
   C. They are equal
   D. Cannot tell
9. A value of 61.28 in a distribution with mean 38.81 and SD 8.42 has z ≈ _____.
10. True or false: Converting temperatures from °F to °C changes the SD by subtracting 32 and multiplying by 5/9.
11. Which statement correctly compares two stations?
    A. SGF: 44.89, KC: 37.63
    B. Springfield's median year (44.89 in) is about 7.3 inches wetter than Kansas City's (37.63 in).
    C. Springfield is bigger.
    D. Kansas City has rain.
12. True or false: A descriptive comparison of two 26-year eras at one station shows that the climate has changed.

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