Democrats Are Smarter Than Republicans

Our Team:

Three students investigated this proposition.

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Methods:

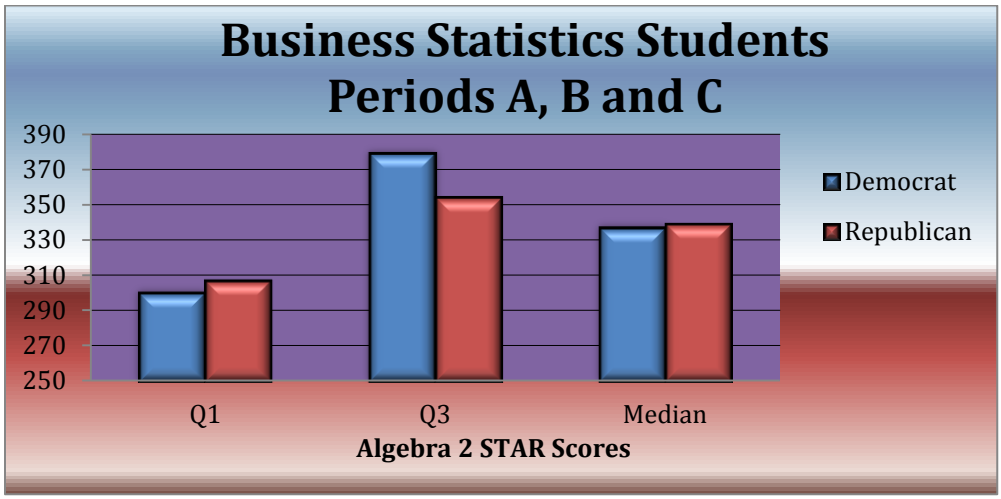
The data was gathered in a student survey administered to all Business Statistics students in the first week of the fall semester. Students completed the surveys at home, and were given assignment credit for their participation. No student was marked down for not answering individual questions. Our team used Excel's single variable data analysis functions and graphic displays to examine the data for patterns and relationships that would be most relevant to assessing the proposition. In the detailed distribution comparisons, hand-written parallel box plots were prepared to meet the remaining assignment requirements.

After completing our initial review of the data, we narrowed our investigations to the following three questions.

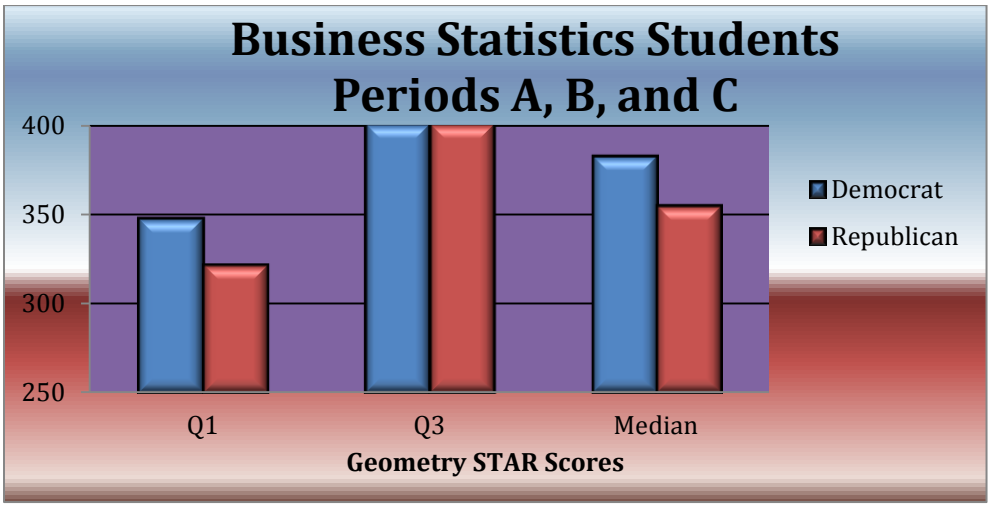
- #1 Among periods A, B, and C Business Statistics students, did Democrats score higher on the Algebra 2 STAR exam than Republicans?
- #2 Among periods A, B, and C Business Statistics students, did Democrats score higher on the Geometry STAR exam than Republicans?
- #3 Among periods A, B, and C Business Statistics students, did Democrats score higher on the Math Analysis STAR exam than Republicans?

Summary of Findings:

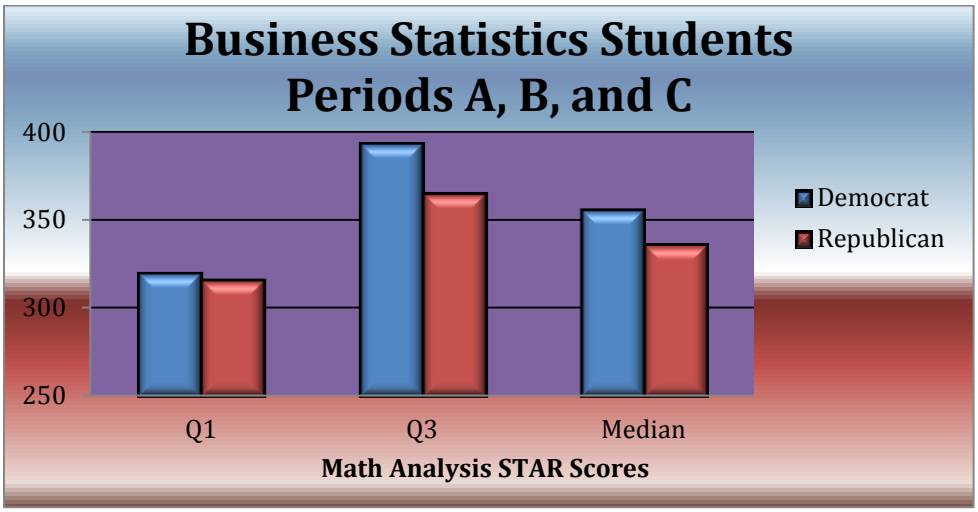
Question #1: Among periods A, B, and C Business Statistics students, the first quartile value for Algebra 2 STAR scores of democrats was only seven points less than the first quartile value for the Algebra 2 STAR scores of republicans. Among periods A, B, and C Business Statistics students, the third quartile value for the Algebra 2 STAR scores of democrats was 25 points more than the third quartile value for the Algebra 2 STAR scores of Republicans. Among periods A, B, and C Business Statistics students, the median for the Algebra 2 STAR scores of democrats was essentially the same as the median for the Algebra 2 STAR scores of republicans.



Question #2: Among periods A, B, and C Business Statistics students, the first quartile value for the Geometry STAR scores of democrats was 26 points higher than the first quartile value for the Geometry STAR test scores of republicans. Among periods A, B, and C Business Statistics students, the third quartile value for the Geometry STAR scores of democrats was essentially the same as the third quartile value for the Geometry STAR scores of republicans. Among periods A, B, and C Business Statistics students, the median for the Geometry STAR scores of democrats was 28 points higher than the median for the Geometry STAR scores of republicans.



Question #3: Among periods A, B, and C Business Statistics students, the first quartile value for the Math Analysis STAR test taken by Democrats was only four points higher than the first quartile value for the Math Analysis STAR test taken by Republicans. Among periods A, B, and C Business Statistics students, the third quartile value for the Math Analysis STAR test taken by Democrats was 29 points higher than the third quartile value for the Math Analysis STAR test taken by Republicans. Among periods A, B, and C Business Statistics students, the median for the Math Analysis STAR test taken by Democrats was 20 points higher than the median for the Math Analysis STAR test taken by Republicans.



Conclusion:

Based on these specific findings, we conclude the proposition is supported. Democrats are smarter than republicans. To varying degrees, democrats outperformed republicans in all three STAR exams.

Detailed Findings:

The report has been organized as follows:

Description of Distributions:

Algebra 2 STAR Scores in the population of Period A, B and C Democratic Business Statistic Students 5

Algebra 2 STAR Scores in the population of Period A, B and C Republican Business Statistic Students 6

Geometry STAR Scores in the population of Period A, B and C Democratic Business Statistic Students 7

Geometry STAR Scores in the population of Period A, B and C Republican Business Statistic Students. 8

Math Analysis STAR Scores in the population of Period A, B and C Democratic Business Statistic Students 9

Math Analysis STAR Scores in the population of Period A, B and C Republican Business Statistic Students 10

Comparison of Distributions:

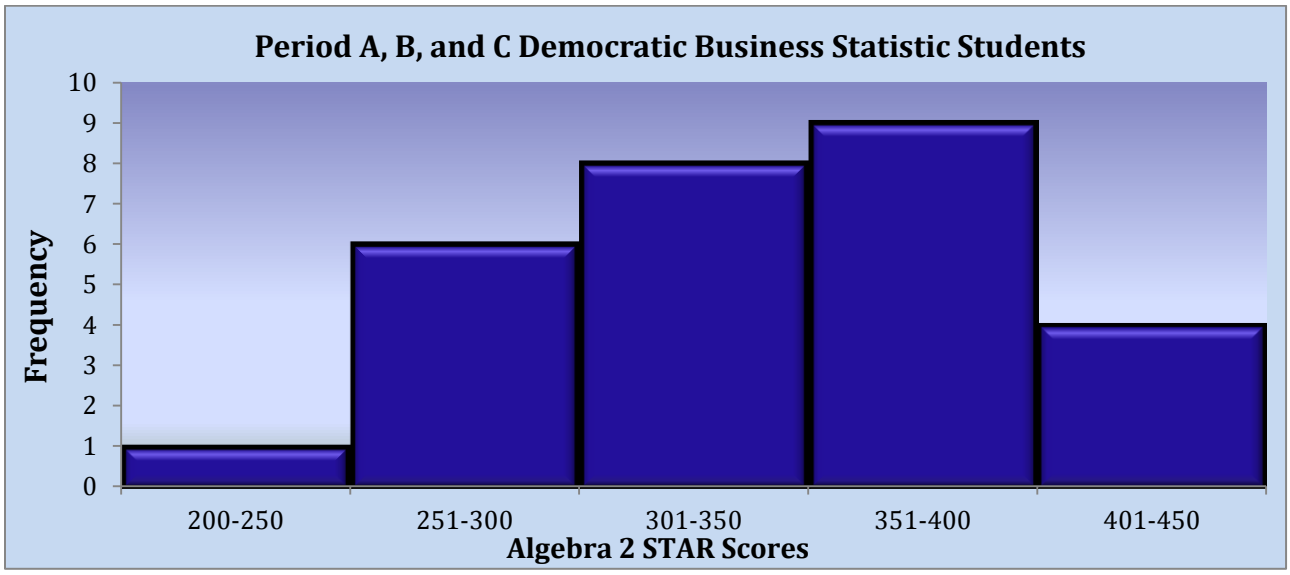
Table A. compares distribution of Algebra 2 STAR Scores in the population of Period A, B and C Democratic Business Statistic Students and the Algebra 2 STAR Scores in the population of Period A, B and C Republican Democratic Statistic Students 11

Table B. compares distribution of Geometry STAR Scores in the population of Period A, B and C Democratic Business Statistic Students and the Geometry STAR Scores in the population of Period A, B and C Republican Business Statistic Students 12

Table C. compares distribution of (Math Analysis STAR Scores) in the population of (Period A, B and C Democratic Business Statistic Students) and the (Math Analysis STAR Scores) in the population of (Period A, B and C Republican Statistic Students) 13

Population:	Periods A, B, and C Democratic Business Statistics Students
Variable:	Algebra 2 STAR Scores **Type:** Quantitative, Interval, Continuous

Shape: A histogram was examined to determine the shape of the distribution. The histogram was displayed using a bin width of 50 (points) increments.



This plot was found to be **uni**modal and nearly symmetric.

The Fisher skew statistic was **0.03**. This statistic fell near 0 indicating that the distribution's shape is nearly symmetric.

Center: Mean = **341** (points), Median = **337** (points), Mode = **316** **(**points)

The best measure of central tendency is the mean because the distribution is symmetric. This symmetric shape causes the mean to be nearly equal to the median.

Spread: Range = **180** (points), IQR = **80** (points), $\sigma =$ **50** **(**points)

The best measure of spread is the standard deviation because the distribution is symmetric.

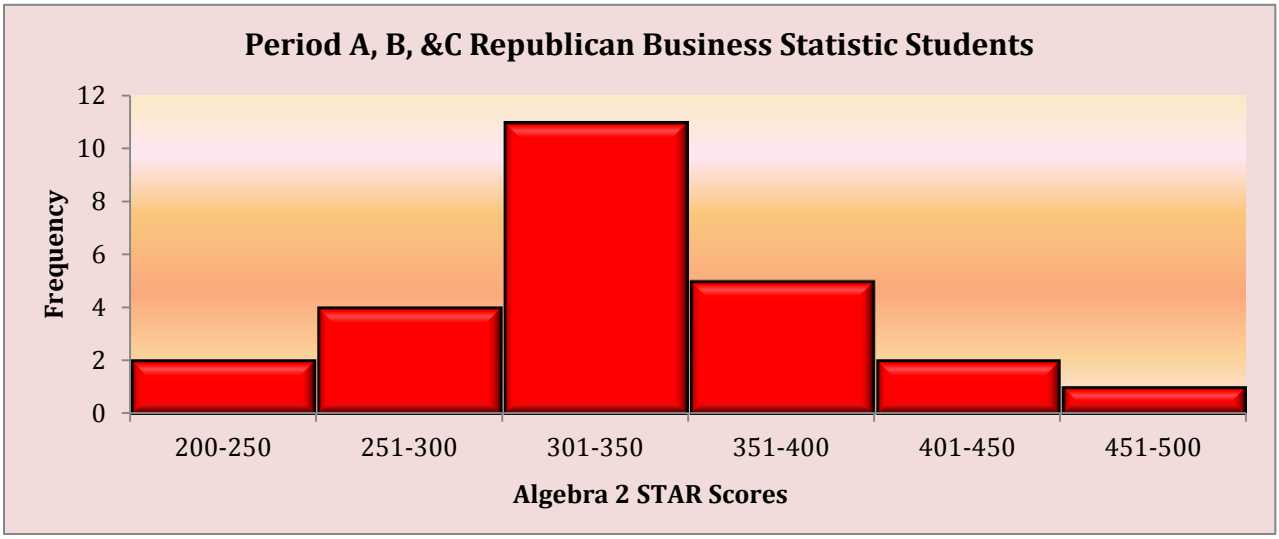
Outliers: IQR Method: Adding 1.5 times the IQR to the third quartile value of **379** **(**points) results in an upper outlier threshold of **499** **(**points). Subtracting 1.5 times the IQR from the first quartile value of **300** **(**points) results in a lower outlier threshold of **181** **(**points). Examination of the data found no outliers that exceeded these thresholds.

Standard Deviation (σ) Method: Adding and subtracting three standard deviations from the mean of **341** **(**points) establishes an upper outlier threshold of **490** **(**points) and a lower threshold of **191**(points). Examination of the data found no outliers that exceeded these thresholds.

The best measure of outliers is the IQR Method because the distribution is symmetric.

Population:	Periods A, B, and C Republican Business Statistics Students
Variable:	Algebra 2 STAR Scores **Type:** Quantitative, Interval, Continuous

Shape: A histogram was examined to determine the shape of the distribution. The histogram was displayed using a bin width of 50 (points) increments.



This plot was found to be **uni**modal and nearly symmetric.

The Fisher skew statistic was **0.1**. This statistic fell near 0 indicating that the distribution's shape is nearly symmetric.

Center: Mean = **332** (points), Median = **339** (points), Mode = **340** (points)

The best measure of central tendency is the mean because the distribution is symmetric. This symmetric shape causes the mean to be nearly equal to the median.

Spread: Range = **253** (points), IQR = **46** (points), $\sigma =$ **55** (points)

The best measure of spread is the standard deviation because the distribution is symmetric.

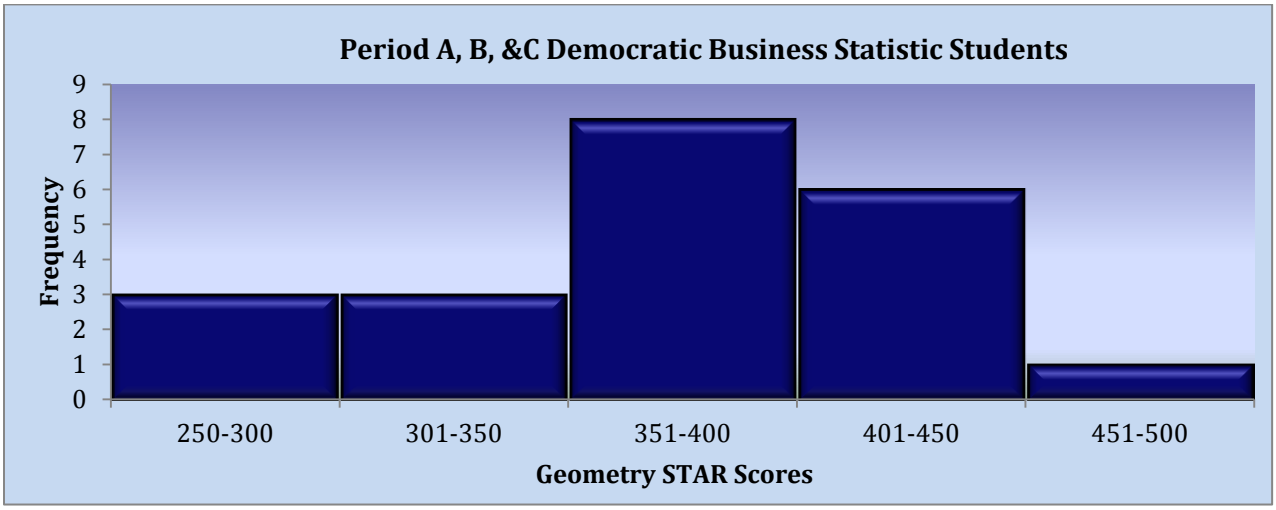
Outliers: IQR Method: Adding 1.5 times the IQR to the third quartile value of **354** (points) results in an upper outlier threshold of **423**(points). Subtracting 1.5 times the IQR from the first quartile value of **307** (points) results in a lower outlier threshold of **238** (points). Examination of the data found 3 outliers that exceeded these thresholds, 220, 220, 473.

Standard Deviation (σ) Method: Adding and subtracting three standard deviations from the mean of **332** (points) establishes an upper outlier threshold of **496** (points) and a lower threshold of **168** (points). Examination of the data found no outliers that exceeded these thresholds.

The best measure of outliers is the Standard Deviation Method because the distribution is symmetric.

Population:	Period A, B and C Democratic Business Statistic Students
Variable:	Geometry STAR Scores **Type:** Quantitative, Interval, Continuous

Shape: A histogram was examined to determine the shape of the distribution. The histogram was displayed using a bin width of 50 (points) increments.



This plot was found to be **uni**modal and nearly symmetric.

The Fisher skew statistic was **-0.01**. This statistic fell near 0 indicating that the distribution's shape is nearly symmetric.

Center: Mean = **374** (points), Median = **383** (points), Mode = **392** (points)

The best measure of central tendency is the mean because the distribution is symmetric. This symmetric shape causes the mean to be nearly equal to the median.

Spread: Range = **187** (points), IQR = **53** (points), $\sigma =$ **51** (points)

The best measure of spread is the standard deviation because the distribution is symmetric.

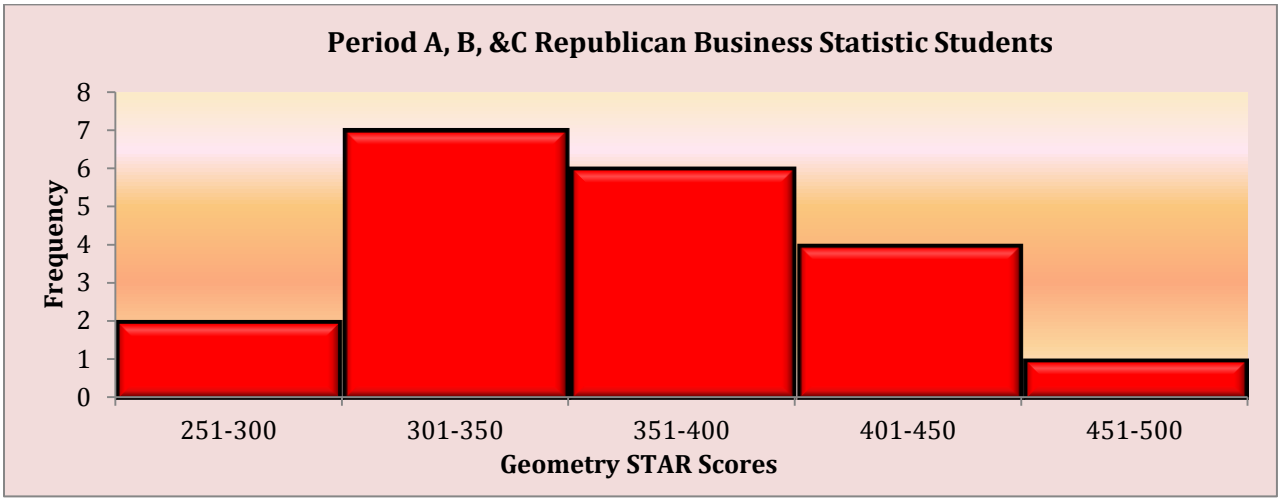
Outliers: IQR Method: Adding 1.5 times the IQR to the third quartile value of **401** (points) results in an upper outlier threshold of **481** (points). Subtracting 1.5 times the IQR from the first quartile value of **348** (points) results in a lower outlier threshold of **-269** (points). Examination of the data found no outliers that exceeded these thresholds.

Standard Deviation (σ) Method: Adding and subtracting three standard deviations from the mean of **374** (points) establishes an upper outlier threshold of **527** (points) and a lower threshold of **221** (points). Examination of the data found no outliers that exceeded these thresholds.

The best measure of outliers is the Standard Deviation Method because the distribution is symmetric.

Population:	Period A, B and C Republican Business Statistics Students
Variable:	Geometry STAR Scores **Type:** Quantitative, Interval, Continuous

Shape: A histogram was examined to determine the shape of the distribution. The histogram was displayed using a bin width of 50 (points) increments.



This plot was found to be **uni**modal and slightly skew right.

The Fisher skew statistic was **0.6**. This statistic fell inside the computed range of **-1.1 to +1.1** indicating that the distribution's shape is slightly skew right.

Center: Mean = **364** (points), Median = **355** (points), Mode = **312** (points)

The best measure of central tendency is the median because the distribution is skewed. This skew right shape causes the mean to be greater than the median.

Spread: Range = **228** (points), IQR = **78** (points), $\sigma =$ **57**(points)

The best measure of spread is the range and interquartile range because the distribution is skewed.

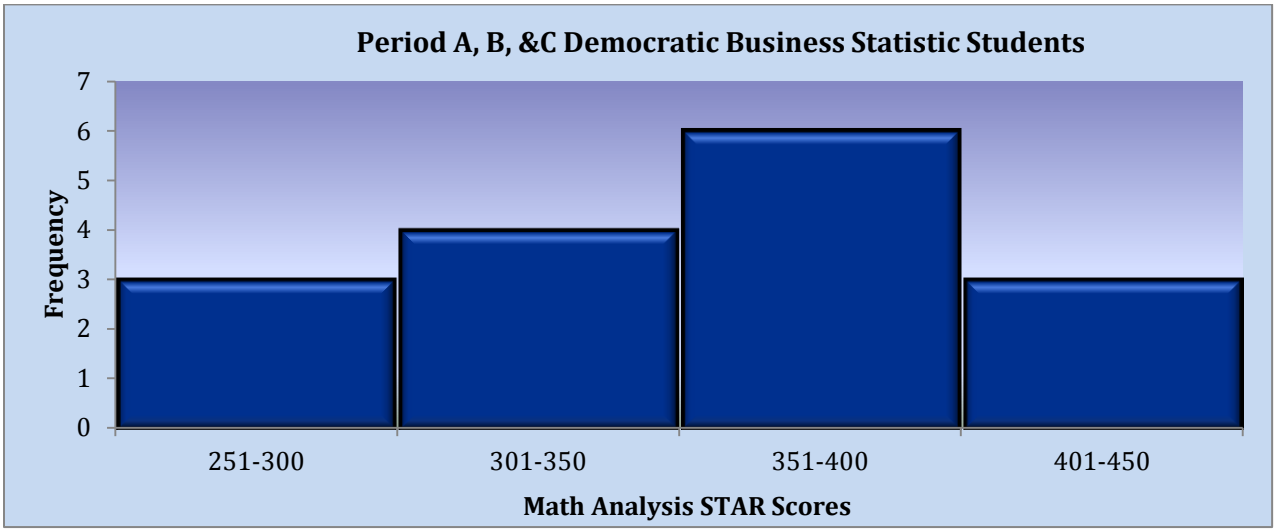
Outliers: IQR Method: Adding 1.5 times the IQR to the third quartile value of **401** (points) results in an upper outlier threshold of **518** (points). Subtracting 1.5 times the IQR from the first quartile value of **322** (points) results in a lower outlier threshold of **-205** (points). Examination of the data found no outliers that exceeded these thresholds.

Standard Deviation (σ) Method: Adding and subtracting three standard deviations from the mean of **364** (points) establishes an upper outlier threshold of **535** (points) and a lower threshold of **193** (points). Examination of the data found (no) outliers that exceeded these thresholds.

The best measure of outliers is the IQR Method because the distribution is skewed.

Population:	Period A, B, & C Democrat Business Statistic Students
Variable:	Math Analysis Star Scores **Type:** Quantitative, Interval, Continuous

Shape: A histogram was examined to determine the shape of the distribution. The histogram was displayed using a bin width of 50 (points) increments.



This plot was found to be **uni**modal and nearly symmetric.

The Fisher skew statistic was **-0.1**. This statistic fell near 0 indicating that the distribution's shape is nearly symmetric.

Center: Mean = **355** (points), Median = **356** (points), Mode = **289** (points)

The best measure of central tendency is the (mean) because the distribution is symmetric. This symmetric shape causes the mean to be nearly equal to the median.

Spread: Range = **163** (points), IQR = **74** (points), $\sigma =$ **47**(points)

The best measure of spread is the standard deviation because the distribution is symmetric.

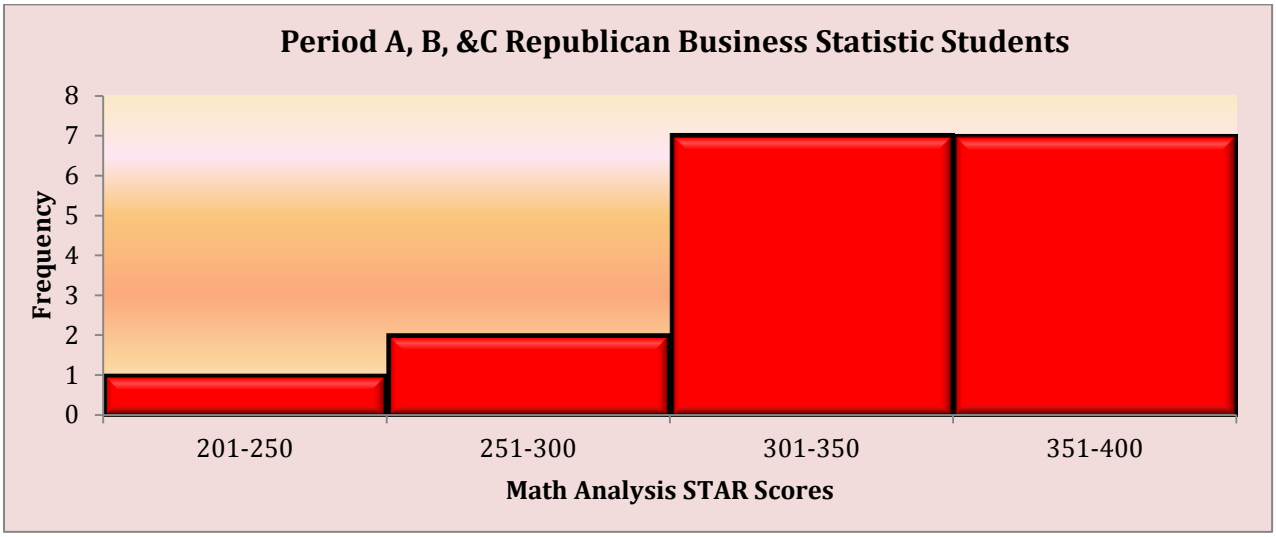
Outliers: IQR Method: Adding 1.5 times the IQR to the third quartile value of **394** (points) results in an upper outlier threshold of **504**(points). Subtracting 1.5 times the IQR from the first quartile value of **320** (points) results in a lower outlier threshold of **210** (points). Examination of the data found no outliers that exceeded these thresholds.

Standard Deviation (σ) Method: Adding and subtracting three standard deviations from the mean of **355**(points) establishes an upper outlier threshold of **495**(points) and a lower threshold of **214** (points). Examination of the data found no outliers that exceeded these thresholds.

The best measure of outliers is the Standard Deviation Method because the distribution is symmetric.

Population:	Period A, B, & C Democrat Business Statistic Students
Variable:	Math Analysis Star Scores **Type:** Quantitative, Interval, Continuous

Shape: A histogram was examined to determine the shape of the distribution. The histogram was displayed using a bin width of 50 (points) increments.



This plot was found to be **uni**modal and slightly skew left.

The Fisher skew statistic was **-1**. This statistic fell inside the computed range of **-1.9 to +1.9** indicating that the distribution's shape is slightly skew left.

Center: Mean = **331**(units), Median = **336** (units), Mode = **330** (units)

The best measure of central tendency is the median because the distribution is skewed. This skew left shape causes the mean to be less than the median.

Spread: Range = **169** (units), IQR = **49** (units), $\sigma =$ **47**(units)

The best measure of spread is the range and interquartile range because the distribution is skewed.

Outliers: IQR Method: Adding 1.5 times the IQR to the third quartile value of **365** (units) results in an upper outlier threshold of **439**(units). Subtracting 1.5 times the IQR from the first quartile value of **316** (units) results in a lower outlier threshold of **243**(units). Examination of the data found (1) outliers that exceeded these thresholds, 229.

Standard Deviation (σ) Method: Adding and subtracting three standard deviations from the mean of **331**(units) establishes an upper outlier threshold of **472** (units) and a lower threshold of **189** (units). Examination of the data found (no) outliers that exceeded these thresholds.

The best measure of outliers is the IQR Method because the distribution is skewed.

Variable: Algebra 2 STAR Scores in the population of Periods A, B, and C Democratic Business Statistics Students

Variable: Algebra 2 STAR Scores in the population of Periods A, B, and C Republican Business Statistics Students

	Democratic	Republican	Comparison
Shape	Near symmetric	Near symmetric	The distributions have the same shape.
Center	Mean = **340** points Median = **337** points	Mean = **332** points Median = **339** points	Since both distributions are nearly symmetric, the best measure for comparing central tendencies is the mean.
Spread	Range = 180 IQR = 80 $\sigma = 50$	Range = 253 IQR = 46 $\sigma = 55$	Since both distributions are nearly symmetric, the best measure for comparing spread is the standard deviation. Examination of these statistics shows both distributions have similar spreads.
Outliers	None	220, 220, 473 using the IQR Method.	The distribution for Republicans has **3** outliers while the distribution for Democrats has none.

Variable: Geometry STAR Scores in the population of Period A, B and C Democratic Business Statistics Students

Variable: Geometry STAR Scores in the population of Period A, B and C Republican Business Statistics Students

	Democratic	Republican	Comparison
Shape	Nearly symmetric	Slightly skew right	The distribution for Democrats is nearly symmetric while the distribution for Republicans is slightly skew right.
Center	Mean = **374** (points) Median = **383** (points)	Mean = **364** (points) Median = **355** (points)	Since the distribution for Republicans is skewed, the best measure for comparing central tendencies is the median. The center of the distribution for Democrats is about 28 units higher than the distribution for Republicans.
Spread	Range = 187 IQR = 53 $\sigma =$ 51	Range = 228 IQR = 78 $\sigma =$ 57	Since the distribution for Republicans is skewed, the best measure for comparing spread are the range and interquartile range. Examination of these statistics shows the distribution for Republicans has more spread than the distribution for Democrats.
Outliers	None	None	Neither distribution has outliers.

Variable: Math Analysis Star Scores in the population of Period A, B, & C Democrat Business Statistic Students

Variable: Math Analysis Star Scores in the population of Period A, B, & C Republican Business Statistic Students

	Democratic	Republican	Comparison
Shape	Near symmetric	slightly skew left	The distribution for Democrats is nearly symmetric while the distribution for Republicans is slightly skew left.
Center	Mean = **355** (points) Median = **356** (points)	Mean = **331** (points) Median = **336** (points)	Since the distribution for Republican is skewed, the best measure for comparing central tendencies is the median. The center of the distribution for Democrats is about 20 points higher than the distribution for Republicans.
Spread	Range = **163** IQR = 74 $\sigma = 47$	Range = **169** IQR = 49 $\sigma = 47$	Since the distribution for Republicans is skewed, the best measure for comparing spread are the range and interquartile range. Examination of these statistics shows the distribution for Democrats has more spread than the distribution for Republicans.
Outliers	None	(229) using the IQR Method	The distribution for Republicans has **1** outlier while the distribution for Democrats has none.