CSC 466 Project Report:
NFL Projections and Patterns

Nathan Hill: nhill05@calpoly.edu
Dylan Li: dli59@calpoly.edu
Rachel Roggenkemper: rroggenk@calpoly.edu
Kirina Sirohi: kasirohi@calpoly.edu
Instructor: Dr. Alexander Dekhtyar
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Abstract

In our exploration of NFL team performance over a 20-year period, we applied K-Nearest Neighbors, Random Forest, Linear Regression, and K-Means Clustering to predict winning percentages, win-loss records, season point differentials, and to categorize teams by playing style. Our findings indicate that balanced offensive and defensive efforts are crucial for success, with our models showing significant accuracy in predicting team performances. The study emphasizes the effectiveness of data analytics in sports and contributes to the broader understanding of team strategies and their impact on game outcomes.

I. Introduction

In this project, our team embarked on an exploratory journey to analyze and predict various aspects of NFL team performances using historical data from the past 20 years. Our approach combines traditional statistical analysis with modern machine learning techniques, aiming to uncover patterns and relationships within the data. We focus on four key research questions, each addressing a different facet of team performance, from predicting winning records to understanding playing styles. Our methodology is rooted in rigorous data analysis, employing a blend of K-Nearest Neighbors, Random Forests, Linear Regression, and K-Means Clustering to extract meaningful insights from our datasets. This paper presents our findings, offering a comprehensive view of the effectiveness and applicability of these methods in sports analytics.

II. Dataset Description

We are using two primary datasets to obtain data from the NFL. The first dataset is sourced from Fantasy Data's NFL Team Stats, covering offensive and defensive statistics for all 32 NFL teams from 2002 to 2022. This dataset includes comprehensive data on total yards, passing, and rushing for each season. We have manually aggregated these records into two datasets (one for offense and one for defense) for analysis. The second dataset is derived from the NFL's official standings, providing win percentages for every team over the last 20 years. This dataset is crucial for correlating the statistical performances of teams with their overall success in terms of

win-loss records, thus enabling a more nuanced understanding of factors influencing team success in the NFL.

III. Research Questions

To investigate these various techniques to predict NFL season records, we asked the following research questions:

A. Can we predict the winning percentage for each team for a particular season?
We will use K-Nearest Neighbors to predict each team's winning percentage for a particular season. This method leverages similarities in team statistics to forecast outcomes, assuming teams with similar stats have similar records.

B. Can we predict whether or not a team will have a winning record given their statistics?
We will utilize random forests to help predict if a team will have a winning record based on their statistics. This approach uses multiple decision trees to enhance prediction accuracy and manage overfitting.

C. Can we predict a team's net point gains a season, given their statistics for that season?
To predict a team's net point gains a season, including the Super Bowl, we will employ linear regression. This technique models the relationship between team performance statistics and their success in crucial matches.

D. Can we group teams by their playing style, such as defensive or offensive, over the 20 year span?
We will employ K-means clustering to categorize teams into groups based on their playing style (offensive or defensive), by analyzing their statistical patterns over the 20-year span. This method will identify inherent groupings within the data, providing insights into the dominant strategies employed by different teams across seasons.

IV. Methods

A. K-Nearest Neighbors

The K-Nearest Neighbors (KNN) algorithm is a straightforward yet effective method for prediction tasks. It operates on the principle of proximity in feature space, classifying a new data point based on the majority value among its k nearest neighbors. In our experiment, we implemented Euclidean distance as our distance metric to measure the closeness of data points. The primary hyperparameter investigated in this method was the number of neighbors: k.

B. Random Forests

Random Forests are an advanced ensemble learning technique based on decision trees. By building multiple decision trees on different subsets of the dataset and averaging their predictions, Random Forests aim to improve predictive accuracy and control overfitting. In our analysis, the Random Forest classifier was constructed with specific attention to several hyperparameters: the number of trees in the forest, the number of attributes, and the number of data points.

C. Linear Regression

Linear Regression is a foundational statistical method used for modeling the relationship between a dependent variable and independent variables. It predicts the dependent variable's value based on the independent variables by fitting a linear equation to observed data. In our context, we employ it to predict the outcomes of NFL playoff games, including the Super Bowl, based on regular season performance metrics. This technique assumes a linear relationship between the input variables (team performance statistics) and the outcome (playoff results). Our implementation focuses on identifying the most significant predictors and quantifying their impact on the game outcomes. The simplicity and interpretability of Linear Regression make it a valuable tool for our analysis, allowing us to draw direct correlations between team performance and their success in high-stakes games.

D. K-Means Clustering

K-Means Clustering is a partitional algorithm, which means it simply separates the dataset into distinct clusters. In order to be able to use a k-means clustering algorithm the notion of the mean must exist for the domain of each attribute. The algorithm takes as input the dataset and an integer k which is the number of clusters to build. The algorithm has the following four steps: (1) select k initial cluster centroids, (2) on each step, for each data point, compute its distances from each of the cluster centroids and assign it to the closest centroid, (3) recompute cluster centroids, (4) steps 2 and 3 are repeated until the process converges. For our specific implementation, we are utilizing Euclidean distance as our distance measure. Additionally, to select our initial centroid, we are randomly picking k random data points from the data set.

V. Results

A. Can we predict the win percentage for each team for a particular season?

K-Nearest Neighbors is normally a categorical classification technique, and thus has no natural ordering as we would desire for winning percentage. Thus, to determine the effectiveness of our model, we used both mean absolute error and mean squared error to penalize any differences from the actual result. In tuning our k-value, we found that using the 50 nearest neighbors was most effective in predicting closest to the team’s actual winning percentage for defensive statistics, and 100 nearest neighbors for offensive statistics.

Figure 1: K-Nearest Neighbors Parameter Tuning Results (Defense)

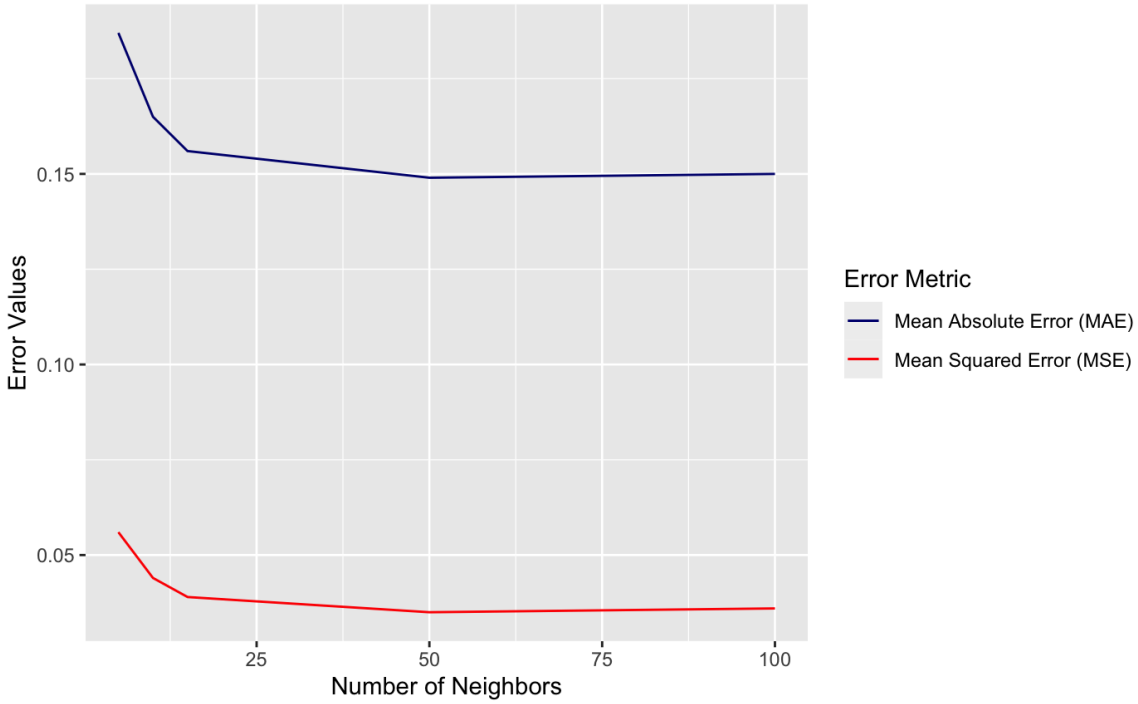
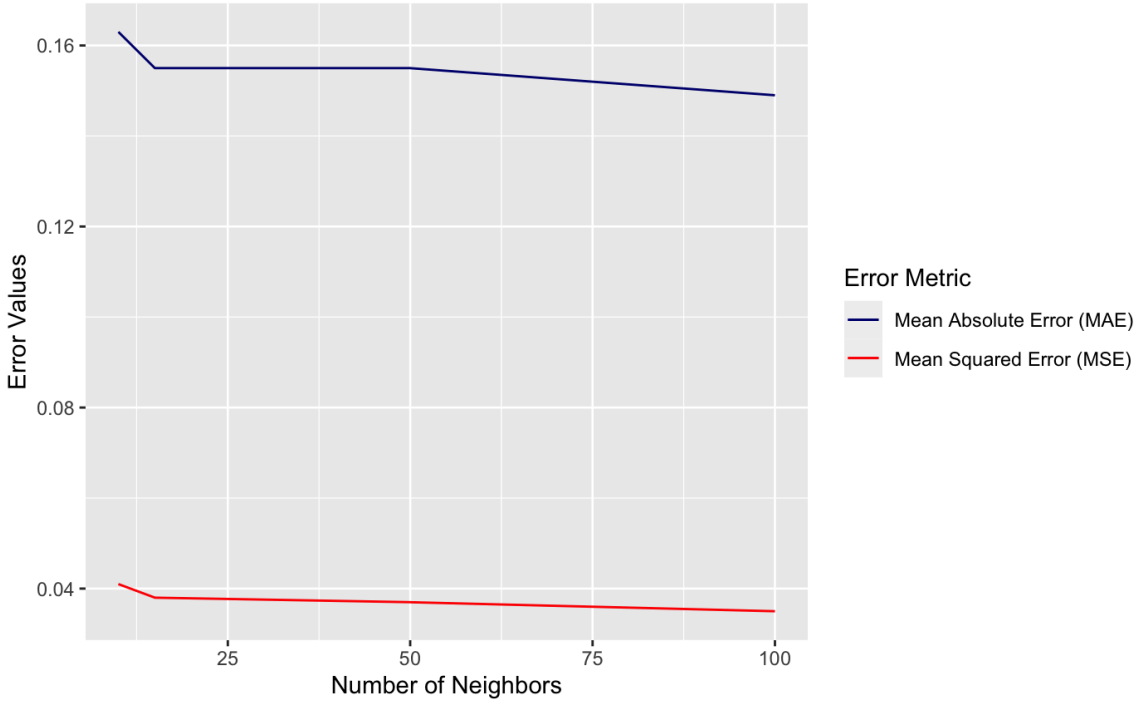


Figure 2: K-Nearest Neighbors Parameter Tuning Results (Offense)



Thus, with a mean absolute error of 0.149 for defense and 0.149 for offense, we can conclude that our model is somewhat effective at predicting the number of wins for a team in a season. On average, our model is 0.15 percentage points off the actual win percentage, which translates to about two and a half games in a seventeen game season. It was interesting to us that both offensive and defensive data were equally good at predicting the outcome of the team's season. This supports the idea that both sides of the ball are just as important as each other, and the best way to win is with a balanced team.

B. Can we predict whether or not a team will have a winning record given their statistics?
We fit a random forest with the combined offensive and defensive statistics, hoping to predict whether that team would have a winning record (1) or a losing record (0). The following table illustrates the confusion matrix results from using 10 columns, 32 rows, and 10 decision trees:

Table 1: Random Forest Confusion Matrix

	Predicted Losing Record	**Predicted Winning Record**
Actual Losing Record	297	71
Actual Winning Record	141	163

Thus, we were able to predict winning records with an accuracy of 68.5%. It appears that our forest is more likely to predict losing records than winning records. Our precision score is 53.6%, while our recall is 80.7%.

C. Can we predict a team's net point gains a season, given their statistics for that season?
We fit a linear regression model on a team's offensive and defensive statistics. These statistics include the number of plays a team's made, total yards traveled that season, number of yards traveled per play, number of first downs reached, etc. We then used these statistics to try and predict the net point gains of a team per season. Net point gains are defined as the number of points a team scores on offense, subtracted by the number of points that team allowed their opponents to score while on defense.

We used the years 2002 to 2015 as training data, and predicted the results of 2016 to 2022. Our results were measured in R-squared, which measures the percentage of the variation in our results that were explained by the predictors in our model. Our R-squared on this data set was 0.9417. In this case, it means that 94.17% of variation seen in net point gains are explained by the statistics of that team. Which also indicates that our model is very good at predicting net point gains a season for a NFL team.

D. Can we group teams by their playing style, such as defensive or offensive, over the 20 year span?

To try and group teams by similar playing styles, we used k-means with 10 different clusters. For k-means, it is important to standardize the data; however this makes the results quite difficult to interpret.

Our third cluster contained some of the worst teams, with high scores for points scored against them and yards gained against them, and low scores for points scored and yards gained.. These teams also all had very low winning percentages.

Similarly, the fourth cluster contained some of the best teams, with above average defensive statistics and higher points scored on offense. Nearly every single one of these teams had a winning record. Interestingly, there are a mixture of teams that are strong running teams and teams that are better at passing.

The other clusters are all somewhere in the middle, with some clusters favoring running teams, passing teams, and teams that have different defensive strengths. These teams all seem to have a wide range of records.

Overall, the best teams are strong on both offense and defense, while the worst teams are bad on offense and defense. This might sound intuitive, but we thought it was interesting that teams with good offenses and bad defenses and vice versa had such a wide range of outcomes.

VI. Conclusions

Our analysis utilizing a blend of statistical and machine learning techniques on NFL team performance data over the past two decades has yielded insightful results. The application of K-Nearest Neighbors provided a moderate accuracy in predicting a team's winning percentage, underscoring the significance of both offensive and defensive capabilities. Random Forests demonstrated a reasonable level of precision in forecasting winning records, while Linear Regression effectively captured the variance in teams' net point gains. K-Means Clustering revealed distinct groupings based on playing styles, validating the conventional wisdom that balanced teams tend to perform better. Ultimately, our results not only reinforced some existing beliefs about NFL team dynamics but also showcased the power of data-driven approaches in sports analytics.

VII. Appendix

A. K-Nearest Neighbors Results (Defense: k = 50, Offense: k = 100)

Defense MAE: 0.1487715133531158

Defense MSE: 0.03548816913946586

Offense MAE: 0.1489881305637982

Offense MSE: 0.03472488724035609

Defense Confusion Matrix:

	0.438	0.625	0.375	0.250	0.500	0.563	0.688	0.313	0.750	0.813	0.188	...	0.559	0.647	0.353	0.281	0.206	0.938	0.176	0.265	0.000	0.344	0.719
0.438	31.0	8.0	3.0	12.0	2.0	7.0	4.0	7.0	2.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.625	20.0	25.0	4.0	6.0	1.0	6.0	6.0	5.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.375	22.0	11.0	1.0	7.0	4.0	5.0	2.0	4.0	1.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.250	26.0	4.0	2.0	9.0	2.0	2.0	1.0	10.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.500	20.0	16.0	0.0	6.0	2.0	4.0	4.0	3.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.563	12.0	21.0	1.0	1.0	2.0	11.0	1.0	1.0	1.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.688	16.0	21.0	3.0	1.0	0.0	4.0	1.0	2.0	2.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.313	18.0	9.0	2.0	8.0	1.0	5.0	1.0	3.0	1.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.750	9.0	20.0	0.0	1.0	0.0	3.0	4.0	4.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.813	10.0	14.0	0.0	1.0	1.0	3.0	4.0	1.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.188	5.0	1.0	1.0	5.0	1.0	0.0	0.0	3.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.125	2.0	1.0	0.0	6.0	0.0	1.0	0.0	3.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.412	4.0	2.0	1.0	2.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.529	5.0	1.0	1.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.875	2.0	3.0	0.0	0.0	0.0	1.0	1.0	0.0	1.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.588	1.0	2.0	0.0	2.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.471	3.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.063	3.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.469	3.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.706	2.0	0.0	0.0	0.0	0.0	0.0	2.0	1.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.235	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.765	2.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.531	1.0	0.0	0.0	0.0	0.0	1.0	0.0	2.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.406	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.294	2.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.594	0.0	1.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000	0.0	2.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.656	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.824	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.559	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.647	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.353	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.281	0.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.206	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.938	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.176	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.265	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.000	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.344	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.719	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[40 rows x 40 columns]

Offense Confusion Matrix:

	0.438	0.625	0.375	0.250	0.500	0.563	0.688	0.313	0.750	0.813	0.188	...	0.559	0.647	0.353	0.281	0.206	0.938	0.176	0.265	0.000	0.344	0.719
0.438	21.0	15.0	10.0	5.0	11.0	4.0	0.0	0.0	1.0	9.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.625	9.0	31.0	5.0	2.0	5.0	10.0	0.0	0.0	2.0	9.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.375	22.0	13.0	9.0	0.0	8.0	3.0	0.0	0.0	0.0	2.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.250	29.0	10.0	4.0	3.0	6.0	3.0	0.0	0.0	0.0	1.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.500	6.0	20.0	8.0	1.0	10.0	6.0	1.0	0.0	0.0	3.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.563	12.0	11.0	8.0	0.0	7.0	8.0	2.0	0.0	0.0	3.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.688	8.0	21.0	0.0	1.0	7.0	8.0	0.0	0.0	1.0	4.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.313	20.0	4.0	8.0	3.0	8.0	4.0	0.0	0.0	0.0	1.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.750	3.0	18.0	1.0	0.0	6.0	8.0	0.0	0.0	0.0	5.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.813	2.0	17.0	0.0	0.0	9.0	1.0	0.0	0.0	1.0	4.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.188	8.0	2.0	3.0	2.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.125	3.0	2.0	4.0	3.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.412	2.0	5.0	1.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.529	0.0	6.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	2.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.875	1.0	3.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	3.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.588	0.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.471	1.0	3.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.063	2.0	0.0	1.0	0.0	0.0	1.0	1.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.469	0.0	3.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.706	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.235	2.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.765	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.531	1.0	1.0	0.0	0.0	1.0	0.0	1.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.406	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.294	1.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.594	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1.000	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.656	0.0	2.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.824	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.559	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.647	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.353	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.281	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.206	1.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.938	0.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.176	0.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.265	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.000	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.344	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.719	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	...	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

[40 rows x 40 columns]

B. Random Forest Results (10 decision trees, 10 attributes, 32 data points)

Data and Predictions:

```
    index  PTS_x  PLAYS_x   YDS_x  YDS/PLAY_x  1ST DWN_x  MADE_3rd_x  ATT_3rd_x  PCT_3rd_x  MADE_rz_x  ATT_rz_x  PCT_rz_x  PEN_x
PEN YDS_x  TO DIFF_x  TOTAL_PTS  COMP_x  ATT_x  PCT_x  YDS.1_x  YDS/ATT_x  YDS/COMP_x  TD_x  INT_x  1ST_x  SACKS_x  SACK YDS  QB
RATING_x  TOTAL PTS_x  ATT.1_x  YDS.2_x  YDS/ATT.1_x  TD.1_x  1ST.1_x  PTS/G  PTS_y  PLAYS_y   YDS_y  YDS/PLAY_y  1ST DWN_y
MADE_3rd_y  ATT_3rd_y  PCT_3rd_y  MADE_rz_y  ATT_rz_y  PCT_rz_y  PEN_y  PEN YDS_y  TO DIFF_y  PTS/G.1  TOTAL PTS_y  COMP_y  ATT_y
PCT_y  YDS.1_y  YDS/ATT_y  YDS/COMP_y  TD_y  INT_y  1ST_y  SACKS_y  QB RATING_y  PTS/G.2  TOTAL PTS.1  ATT.1_y  YDS.2_y
YDS/ATT.1_y  TD.1_y  1ST.1_y  win_record  predicted
0        2  417.0   1046.0  6020.0         5.8      335.0        90.0      212.0       42.5       33.0      56.0      58.9  111.0
969.0       10.0      417.0   335.0  535.0   62.6   3874.0        7.2        11.6  29.0   17.0  196.0     21.0     131.0
89.0        417.0    490.0   2146.0          4.4    17.0    117.0   16.4  262.0   1003.0  4563.0         4.5      274.0
99.0      230.0       43.0       22.0      40.0      55.0   76.0      617.0      -10.0     16.4        262.0   291.0  548.0
53.1   2740.0        5.0         9.4  18.0   22.0  148.0     41.0         61.0     16.4        262.0    414.0   1823.0
4.4    10.0     94.0         0.0        0.0
1        3  314.0   1002.0  5334.0         5.3      288.0        85.0      214.0       39.7       27.0      44.0      61.4  112.0
920.0      -12.0      314.0   285.0  514.0   55.4   3287.0        6.4        11.5  23.0   24.0  171.0     47.0     298.0
70.0        314.0    441.0   2047.0          4.6    12.0     97.0   25.1  402.0   1038.0  5535.0         5.3      317.0
90.0      215.0       41.9       28.0      60.0      46.7  105.0      931.0       12.0     25.1        402.0   268.0  479.0
55.9   3167.0        6.6        11.8  18.0   12.0  163.0     36.0         78.0     25.1        402.0    523.0   2368.0
4.5    23.0    124.0         1.0        1.0
2        4  354.0   1077.0  5353.0         5.0      316.0        95.0      236.0       40.3       25.0      53.0      47.2  104.0
874.0        1.0      354.0   360.0  573.0   62.8   3591.0        6.3        10.0  16.0   25.0  190.0     33.0     232.0
72.0        354.0    471.0   1762.0          3.7    17.0     95.0   19.8  316.0    947.0  4639.0         4.9      261.0
81.0      215.0       37.7       19.0      38.0      50.0  101.0      846.0       -1.0     19.8        316.0   262.0  479.0
54.7   2847.0        5.9        10.9  20.0   14.0  145.0     41.0         74.0     19.8        316.0    427.0   1792.0
4.2     9.0     90.0         0.0        0.0
3        5  397.0    999.0  5189.0         5.2      303.0        76.0      206.0       36.9       35.0      50.0      70.0  117.0
1053.0       12.0      397.0   281.0  495.0   56.8   3067.0        6.2        10.9  24.0   10.0  160.0     31.0     212.0
83.0        397.0    473.0   2122.0          4.5    20.0    107.0   23.7  379.0   1054.0  5591.0         5.3      355.0
90.0      212.0       42.5       31.0      58.0      53.4  112.0     1031.0      -12.0     23.7        379.0   377.0  612.0
61.6   3995.0        6.5        10.6  24.0   15.0  218.0     54.0         83.0     23.7        379.0    388.0   1596.0
4.1    17.0     90.0         0.0        0.0
```

Confusion Matrix:

	Predicted: 0.0	Predicted: 1.0
Actual: 0.0	297.0	71.0
Actual: 1.0	141.0	163.0

Overall accuracy: 0.6845238095238095

C. Linear Regression Results

R Squared: 0.9417206692058959

D. K-Means Clustering Results (k = 10)

Cluster 0:

Center:

```
0.358356509432697,0.595668460650839,0.15013299951053966,-0.1564688571445403,0.11419208413109706,0.45479671552919443,0.74601664161
12265,0.08513611371402822,0.08967469747471316,0.4256604563310005,-0.23546028311813014,0.08809916062265644,0.0032813172209569747,0
.6397997031501466,0.358356509432697,-0.24737619047370993,-0.327580813120686,-0.022943470679111105,-0.12276127587270996,0.11979979
049707726,0.15534278776826452,0.04440958633712967,-0.18764637379755603,-0.19753042297965315,-0.4709696158958576,-0.52531829984893
42,0.10975714193383837,0.358356509432697,1.0169722208848655,0.4362619883678263,-0.300027790210843,0.20476608281008868,0.381683907
7924927,-1.0034376457625565,-1.213660366736994,-1.2303884346481548,-1.1147148753031144,-1.3848843513323577,-1.1691078429983792,-1
.4017349944906101,-1.185557082622624,0.0330405078344117786,-1.2876574832224537,-1.165152711185518,-1.2483989324245743,-0.773268808
1249878,0.3176916273112445,0.269653618396751,-0.6402706810593908,-1.213660366736994,-1.2303884346481548,-0.7166555122816375,-0.36
414848377775466,-0.9643334388833895,-0.9445640238198401,-1.0820074557993737,-0.7099312256474676,-0.8482591090011841,0.56436871351
2296,-0.9743010527210394,0.7482597920609501,-1.080502154800067,-1.213660366736994,-1.2303884346481548,-0.8025392660907609,-0.8309
47232634985,-0.6097932743355229,-0.9196503579024058,-0.9935237675359513,-1.0034376457625565,
```

Max Dist. to Center: 9.97049336031924

Min Dist. to Center: 3.57177395974901

Avg Dist. to Center: 6.3980576132342435

SSE: 3096.049595834937

73 Points:

```
-0.9552099806941335,0.05802129976028349,-1.5031182630711257,-1.9897691404538795,-1.349191013098896,-0.5756765530179995,1.700524225
2438073,-1.45972951350144,-0.9775134029976976,-1.4529684516253778,-0.04026420527704914,-0.27692060993222542,-0.5492619789070928,0.
7481949621742967,-0.9552099806941335,-1.1531679814788443,-0.513152980150352,-1.475074279936071,-1.4001453058526796,-1.48797407978
```

21137,-0.6159362074766496,-0.9807025964611038,0.4597870932379638,-1.401294532307948,1.8492934424124359,1.5770644653757366,-1.3493386412897814,-0.9552099806941335,0.23930696708865626,-0.6262408667626079,-1.1989376870546198,-0.3196570672366678,-0.2414186086439 7666,-0.3271796887724092,-1.3788900242810844,-1.3890780040231523,-1.1824563895634708,-1.8538400635565617,-1.651350163337201,-1.94 86806117420385,-1.6251911428920855,0.8336207560336855,-2.0350531018294804,-1.0688442394627584,-1.2216028095604419,-0.596411457436 4595,-0.48155708460317076,-0.46107811401312393,-0.7486918032525143,-1.3788900242810844,-1.3890780040231523,-1.6160450793471166,-1 .3156276819485897,-1.529382883518 27,-1.4652143827923398,-1.0286687992407166,-0.09185338336296689,-1.1286764182882454,1.4982998702 852188,-1.6923205204954015,0.6652146647332837,-1.7311698438191165,-1.3788900242810844,-1.3890780040231523,0.28956805612004916,-0.7507689143779664,-1.5801428081393556,-0.48605034755815113,-0.8402412042351344,-0.3271796887724092,0.3694325096185529,1.4336442656314092,0.3015803845982011,-0.3316869373192379,0.4706347692005664,0.234278209877777,1.3845194469890298,-0.46643567413390036,-0.055563919749342744,1.390648915177585,-1.2204601946649298,0.9540292141401482,0.6439623200979706,0.7481949621742967,0.3694325096185529,-0.05460879191328175,0.03574362411081555,-0.1418355615973127,-0.16425095633902387,-0.176605448157 74576,-0.24953685832559452,0.09089438698907822,-1.2058567162278668,-0.05006777709064 11,-0.22822925265292648,0.19322900848890948,0 .3967923779778291,0.3694325096185529,1.4643919603522029,0.759158409631813,-0.2513503589738161,-0.10697434527326101,0.577665731689 6775,-1.3151469233618047,-1.0407096971581322,-1.0680662124802351,-1.002996007026962,-1.6709333917426705,-1.651350163337201,-1.379 0342684827688,-1.016375411733021,-0.17899435988173246,-1.0126697619259595,-0.557533807771017,-1.112929644611459,0.430832322692929 5,-0.4200115614283266,0.07912569329462495,-0.7486918032525143,-1.0407096971581322,-1.0680662124802351,-0.5332717324901753,-0.0383 5102090315075,-1.046808622445695,-0.8887318656838588,-1.288250261159516,-0.9658423903705896,-0.1982008011084509,0.666873352670299 8,-0.9594605287670406,0.6652146647332837,-0.9022214791002577,-1.0407096971581322,-1.0680662124802351,-1.0672684176210738,-1.45441 03303384686,-1.5801428081393556,-1.0686172326219043,-0.9849346583854746,-1.3151469233618047,-0.49072495162345126,1.2831855037392548,-0.33570382536003,-1.0422935958055124,-0.7106556508885584,0.9429886274115775,2.6485385600081393,-0.3695289580980432,-0.8238551557896385,-0.16041510307857648,-1.1459215005983268,1.1712556536823369,0.4333933261559006,0.4 2740358749471735,-0.49072495162345126,-0.0807649630934142,0.6285519567128766,-0.9260936312083468,-0.35067077442208927,-0.99621084 29229759,-0.4938030910929631,-0.2663046074943158,0.8761980456044215,-0.36535401997467937,-1.5725086435775728,-1.7013076289156752,-0.9384842838150494,-0.49072495162345126,0.9612320524046748,-0.08583689370095432,-0.9620408550344194,-0.7450225111634814,-0.51444 6722088528,-0.9840727968770605,-1.9425239028193384,-1.9613164150344395,-1.4217368996121493,-1.7027432477010304,-1.4535766274679096,-1.9745736273447325,-2.842822605210215,-0.3236536621553636,-2.939469133282596,-2.2192927107691762,-2.6343539538972194,-1.7870803844046155,0.19544367032011556,0.8313082097990854,-0.42782388757286527,-1.9425239028193384,-1.9613164150344395,-1.6751054437211317,-1.2024512689445637,-1.8740787842843947,-1.5830945613607408,-1.288250261159516,-0.3103506351148721,-1.2616015064567874,0.2511600938628403,-1.8197744321003337,1.5978753254901514,-1.4824853344034588,-1.9425239028193384,-1.9613164150344395,-0.27254991157270175,-0.2622905760252213,-0.2265979170371948,-1.262806194309822,-0.5990854473179009,-0.9840727968770605,

…

Cluster 1:

Center:

0.8797926032888087,0.056694502918201016,0.8617889231455546,1.0456617711047758,0.7765010908519381,0.2792756967053199,-0.6256220591316367,0.6770037561287021,0.7848139014009068,0.5002232750675664,0.7126379535150379,0.19954725951625016,0.3249796603219862,0.34951596977416105,0.8797926032888087,0.5950975835734648,0.28078191065506025,0.7030976179260146,0.9250590551940598,0.928344047007231,0.5360354087842789,0.8648255417030987,-0.5503950319473316,0.8118258322043 49,-0.3896634780501624,-0.34309875456378947,0.9636192230124131,0.8797926032888087,-0.1523097084475303,0.18499182396211755,0.4739633983226034,0.38928533930802145,0.22508868642671362,-0.252829120684712 4,0.41638825550742686,0.40845018136370365,0.5107240097316018,0.7338328122697215,0.6315912692280847,0.7988560438771662,0.41815336574230566,-0.24150146580243725,0.562412263865578,0.48875883485745375,0.43801083293204995,0.4342910559593584 6,0.1187017216700012,0.08689233656268446,-0.34991768582348554,0.41638825550742686,0.40845018136370365,1.088822390275981,0.9948079098002705,0.6885862952385723,1.0558823975118283,0.5544576475233172,0.20487127950999223,0.6814022514636299,0.05100185814073013,1.099864246701 5418,-0.009525023172302177,0.5550902139363533,0.41638825550742686,0.40845018136370365,-0.6941982125836116,-0.5596923274400136,-0.19317705552849873,-0.13842813219089095,-0.3329209452388803,-0.2528291206847124,

Max Dist. to Center: 9.155984869336432

Min Dist. to Center: 4.3389087617521165

Avg Dist. to Center: 6.404187210706673

SSE: 3435.803634940949

81 Points:

0.6790891956656744,-0.43634320359965234,-0.4823355904831628,-0.3316869373192379,-0.327534433562355573,-0.67692089837996666,-0.5115092225396338,-0.4906623531428651,1.1737020579151305,-0.031159768223896364,1.972280534521232,1.0988468405016072,1.5642268121410916,1.282847253306929,0.6790891956656744,-1.4670420356404337,-1.105961312752413,-1.292080730360164,-1.2298358424187768,-0.6683686850168835,0.2389956072091449,0.09089438698907822,-0.9976512400446381,-1.1760900731050634,-0.7170581220800706,-0.4657402566952939,-0.1167755688655857 2,0.6790891956656744,0.7862199105098824,0.9098164869702134,0.6962369691069897,1.3818047084705865,0.4138488636229467,-0.0013607071525021546,0.3345569664752061,0.29972316018089057,0.6919076058178439,0.23129599512179708,-0.06916187638286442,1.0808022137731683,0.6361244299844399,-0.034335057608101335,0.6978562106049334,0.46508705561246566,0.8431873244702331,-0.047769893049172 5,0.6262623325440251,1.2210755138059421,-1.2834716627185958,0.3345569664752061,0.29972316018089057,0.7857430718628258,1.0772450501365365,-0.012720920147320664,0.6356364708719008,-0.12013368252491981,-0.09185338336296689,0.06764937522863321,0.043303464459110 49,1.0160751011094102,1.5978753254901514,-0.07327311438139895,0.3345569664752061,0.29972316018089057,-0.9509681484432633,-0.7216928228093507,-0.2265979170371948,0.6790834225693554,-0.4543919931675609,-0.0013607071525021546,1.3328088662095976,-1.2746134484273695,1.1118148816247426,2.273870810463769,0.43870800109004954,-1.183142625189824,-2.170534308377215,-0.12726216800839948,1.0200438107070713,0.48586157119482415,1.1026624370775304,1.0988468405016072,0.8155370559026203,0.6412645039477702,1.3328088662095976,-0.6562007290563279,-0.513152980150352,-0.5078226607491301,1.3846445692153342,2.446131815090993,3.4144566331849475,1.5196903649226543,-0.37303481149495155,0.17513668211224337,0.5050140514877897,1.1602805452296993,1.2185010929272928,1.3328088662095976,-0.8763954374906451,-0.03343408419194549,0.9331338011271901,0.9564392645437729,-0.1322073632661561,-0.3271796887724092,1.8000050506746654,1.751254739331473,1.3898090934598228,1.9872000445351519,1.5130264105714721,2.1942018846890137,0.7230981058643062,-1.408598429207597,1.6219334601331172,1.6155355269188838,0.951860489419216,1.6331744744352825,0.9339899484182461,0.7560899581486393,-0.6417358313592979,1.8000050506746654,1.751254739331473,0.6479355549901242,0.2526740411072024 3,0.9883870554333116,1.2993180241816649,1.6969365509066738,1.3283787530244227,0.4664246397342594,0.45901672326657006,1.3347098801217412,-0.4539781281749577,0.7556752503374599,1.8000050506746654,1.751254739331473,1.1424366967573265,1.293280322895723,0.9013561588812732,3.3977288862002037,1.8607032732378805,-0.3271796887724092,0.6446828972159943,-0.027955135606661873,0.8580291342962435,1.089526379653311,1.1730236676319379,0.7404999366876346,-1.3015211681 76577,1.6897387576639284,1.4810185523312487,1.6491595848869454,0.5684684629335427,0.5919851482365004,0.9481175335698496,-0.10724870363791493,0.6446828972159943,0.023859721627115568,-0.03012396840052455 2,0.09344185928599714,0.6780904438881605,0.970842104513576 8,0.9717943055112529,1.1624913704392603,-0.7894457638614093,1.5263634373295503,0.2605996167742176,-0.10330716084398205,1.0130073914189927,0.6446828972159943,-0.045087763490381315,0.5298961180298994,0.9331338011271901,0.3183910986535526,0.5776657316896775,-0.

0013607071525021546,0.6952826487396887,0.6626060549685362,-0.6839553269620573,1.42098460831128 03,2.10634701817935,0.9772301513623 92,1.6798085405428362,-1.263939126933966,2.6246555819615702,0.7207422714583364,0.8431873244702331,0.3607929740477437,0.9339899484 182461,0.2158861508408905,0.10695597189321632,0.6952826487396887,0.6626060549685362,0.8448034362368407,0.10716151010202585,1.6418 194035300773,1.4769456905176113,2.086308743784871,1.3283787530244227,2.061525697756764,-0.5802664237520788,1.239119446418042,0.85 17467968846573,1.999097797415748,0.6952826487396887,0.6626060549685362,-0.9703515266395649,-0.06166554420177242,1.126946974064968 ,-1.0686172326219043,-0.06854278209998732,-0.0013607071525021546,

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Cluster 2:

Center:

-0.33540509005060937,0.4286411479313658,-0.03795540412922901,-0.27754547762504594,-0.03472036032018661,0.06650186613508137,0.5550 069040702394,-0.23316736481901487,-0.3343438825411072,-0.1124059787039 81,-0.37107402846787735,0.1689107969376663,-0.01648900058382 3576,-0.20195853806712408,-0.33540509005060937,0.364263606557125,0.5479425696870938,-0.05780791128184566,0.20408435618030268,-0. 21875658274567192,-0.2111521646050079,-0.1642477519276318,0.3794792667101469,0.23433328281700158,0.14013821680824282,0.0837930412 351043,-0.285519322828422,-0.33540509005060937,-0.13478148621146235,-0.35655355068231603,-0.454404786419702,-0.42903675281784837, -0.31084575749130544,0.0005161302992253686,-0.18978357881638047,-0.1835890029868308,-0.37061180189831167,-0.3212866456873747,-0.1 9065133413114357,-0.4110053851649061,-0.43613674550591264,-0.09736518217018347,-0.4267654632889406,-0.2635303095482658,-0.3134056 4534394205,-0.05810903499203305,-0.08502807100524591,-0.0913364484326846,0.2016884041414936,-0.18978357881638047,-0.1835890029868 308,-0.8184489204675619,-0.7964020157586896,-0.4966083084609094,-0.6965710266476984,-0.27773671297561914,0.06421608217410915,-0.5 229178022058895,-0.013114763521901872,-0.7327746431268397,0.06298235235884904,-0.4060366722185408,-0.18978357881638047,-0.1835890 029868308,0.5814263506757928,0.6668982359604002,0.4952926915506254,0.32122090745876414,0.41859184687282425,0.0005161302992253686,

Max Dist. to Center: 8.615853422347058

Min Dist. to Center: 4.359115752421403

Avg Dist. to Center: 6.222380089866412

SSE: 2779.383217238254

70 Points:

-0.06064622100244917,1.2401972860557822,-0.17403290483965278,-0.8054247096434215,0.08751355187436377,1.246721663497492,1.85852661 43711958,0.33304473316192323,-0.3628804141654611,0.356606236340144,-0.8601898400096814,0.15753226915212312,0.16823237082144207,0. 10661221281513798,-0.06064622100244917,0.5992954875900293,0.6065960925424299,0.276435408861904,-0.023860722967826466,-0.504447606 0638381,-0.8602024402440183,-1.3379015909444978,2.1254309027037945,0.17513668211224337,-0.47264368736649853,-0.13625562410319222, -1.2466250519210984,-0.06064622100244917,0.7424668750361844,-0.2692467269824852,-1.1989376870546198,0.7437565425803662,-0.2414186 0864397666,-0.3271796887724092,-0.5447118840444692,-0.5795700079584045,-1.441676942116206,-1.2828531489375452,-0.8602560198600319 ,-1.3531412528800748,-0.14663865293435743,0.18265389580234537,-0.24588225699831692,-1.0688442394627584,-1.3302759745094248,-0.444 6595353718909,-0.05073842237926128,-0.043958718497014035,-0.10695597189321632,-0.5447118840444692,-0.5795700079584045,-1.47823756 2474415,-1.0731067969399621,-1.5983220636714943,-1.2181504468887052,-0.8988780682813164,0.23589249426489284,-0.46405097744553503, -0.16455316494461927,-1.3099587856806045,0.38541646650622335,-0.8193266426283718,-0.5447118840444692,-0.5795700079584045,-0.19501 639878749472,-0.15180142806448135,-0.001007101853500006,-0.8744282709339867,-0.4543919931675609,-0.3271796887724092,
-0.7315690407712124,0.48790347659501027,-0.20787100448345266,-0.5685558234813307,0.3429276967584989,0.031789519153834,-0.03750205 5157467885,0.06655126406331653,-0.2092221669574019,0.356606236340144,-0.6241506421321054,-0.421738236293713 26,-1.0561873346935577 ,-1.2834837441297058,-0.7315690407712124,-0.6038883866960 63,-0.5790205726616922,-0.3248291111732214,-0.7764444330068683,-0.504447 6060638381,-0.3716699747092788,-0.8021030992194068,-0.16482933531172272,0.08505489843108958,-0.10602203529614046,-0.2680494771400 329,-0.4249163369716346,-0.7315690407712124,1.0924911158825769,0.7427825316602478,0.22244330506658685,0.10570837669014578,0.686876 9770674981,-0.6582538152571534,-0.38689439805375836,-0.41208559497949115,-1.2023964320675273,-0.9456686756806327,-0.4647089481214 49,-0.9906390344423578,-1.016375411733021,-0.3959833132921792,-0.9143636715506208,0.08160423184365968,0.08247516982735287,0.12732 84785637916,-0.7892847004773919,-1.1448804017444516,1.2834716627185958,-0.38689439805375836,-0.41208559497949115,-1.3601168337263 851,-1.3479637999497402,-0.8399910819860205,-1.3554081890573912,-0.7690873373219174,-0.4195992609908247,-0.7299011537826191,-1.20 38363119632682,-0.9594605287670406,0.4786825325819101,-0.32195762379705656,-0.38689439805375836,-0.41208559497949115,0.3477181907 0895443,0.7117584915234074,0.9013561588812732,1.067461345945191,0.2690752775841395,-0.6582538152571534,
0.1629947189204719,0.788821000379319,1.106175198350776,0.8526574934912202,0.4067812329795326,0.031789519153834,0.4365051122246980 7,-0.19994220503529192,0.2517525746667756,-0.16041510307857648,0.6305840413223786,0.08512345597139356,0.012255338271760563,-0.321 1096200909679,0.1629947189204719,0.9916380552920159,1.3530954743376178,0.015016052324892622,1.596380658889927,0.8069210255605298, 0.9717943055112529,0.44809338147247224,0.4597870932379638,0.8507500597208968,0.2605996167742176,-0.15272985573279 73,0.19136519924 04632,0.1629947189204719,-0.5920007069116074,-0.3445757656516854,-0.014453526953613549,0.3183910986535526,-0.45984109939961776,-0 .0013607071525021546,-0.31925833262916775,-0.34230042290494395,0.1734665007123739,-0.191775089247725,-0.26693541225215583,-0.0067 04441539982867,-0.40755968057395653,-0.17899435988173246,-0.36384956544872354,0.33725944768953037,-0.13487116007061292,0.86274163 93382412,-0.1122839455541055,-0.3243176564668584,0.32086791567964895,-0.31925833262916775,-0.34230042290494395,-0.257656698744772 15,-0.11919131590602663,-0.33443709419570344,-0.6675046812472708,-0.8988780682813164,-0.9658423903705896,-0.8628262419511612,0.25 11600938628403,-0.6408257497547099,-1.200106656780452,-0.736431806156486,-0.31925833262916775,-0.34230042290494395,0.560935350868 2737,0.8513237310527632,0.9013561588812732,1.067461345945191,0.8478490941854998,-0.0013607071525021546,

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Cluster 3:

Center:

-0.9273572629015353,-0.2459668110014162,-0.4438425141687873,-0.3768048203977317,-0.19678671653833424,-0.43104177392946436,-0.2857 9152378622147,-0.3522241873773539,-0.44336806746492063,-0.3696856452242 49,-0.29464228820275734,-0.10796671251055187,-0.06721867355117242,-0.8863134707168934,-0.9273572629015353,0.6304337866139965,0.7404223122480097,0.15319485506588487,-0.0010651191105203845, -0.6527571536880222,-0.889281753668705,-0.4278946288082322,0.14252160572066272,0.21588796520609868,0.8483581383473313,0.906327891 8846723,-0.3222027476029517,-0.9273572629015353,-1.1399553892726835,-0.7717522395956591,-0.08213833610224282,-0.5525952865299228, -0.6444601094430763,1.0193886215937351,1.2578429389378694,1.2707339830467335,0.15637503570889683,0.7974356935933649,0.90087022811 89022,0.8009110451154752,0.6609740516644016,-0.5371983464640572,0.9993282210893052,1.3720543689704354,1.0501838291349623,1.138452 0911478606,-0.182621686325356,-0.12341003192865402,0.8862066242580 78,1.2578429389378694,1.27073398304673 35,-0.38796448680807505,-0.9314438037920657,0.768589788255895,-0.0041307083121144995,1.0232608521174094,0.7561240460551445,0.5677008973864818,-1.085061095 1611368,-0.09459470001928558,-0.6493927428097299,1.1622546863662333,1.2578429389378694,1.2707339830467335,1.403650793402726,1.465 2446358872508,0.8906137391106219,1.7887346322145998,1.5873934153983493,0.0193886215937351,

Max Dist. to Center: 8.031241599192779

Min Dist. to Center: 4.174703859274756

Avg Dist. to Center: 6.1714447352404935

SSE: 819.9968852021509

21 Points:

-0.7659753392208926,-0.608296074333543,-0.16087364386706396,0.14205083500494575,0.2152206243164313,-1.3856313159137672,-1.3015211
68176577,-0.9025158962952584,-0.055563919749342744,0.48586157119482415,-0.5123426010322011,0.5195763350557708,0.682956578235391,-
1.6042751188092852,-0.7659753392208926,0.9131695417516186,1.3530954743376178,-0.11569362594361306,1.0394226838763243,0.1512367097
483466,0.2389956072091449,-0.8021030992194068,1.709019950337337,0.6255456005180123,-0.9614725567936426,-1.61893647076765,-0.83577
06944463665,-0.7659753392208926,-1.795209182438305,-1.759451622394924,-1.1989376870546198,0.3183910986535526,-1.1151085716665412,
1.3124255090568004,1.2814618824194721,1.2348444659798234,-0.4646148594174354,0.15336184800109565,0.5241587312250116,0.38169079250
042826,1.2449401611435045,-0.3236536621553636,1.5039661516827105,2.126845958610625,1.3865531492151475,1.8666389699192347,0.380080
2398446482,0.154343944945071,1.6043395783982448,1.2814618824194721,1.2348444659798234,-0.9663810712329519,-1.5419805079566422,0.5
387925210784786,-0.3946039938765893,1.1777736270690753,1.1098815012725156,0.7322748160713435,-1.4116929413669979,-0.83200661716221
083,-1.4799048550075122,1.4188339421125469,1.2814618824194721,1.2348444659798234,1.7045546644500773,0.990888970582119,-0.00100710
1853500006,2.0384061543847793,1.5230852135537536,1.3124255090568004,
-1.901383188060338,-1.425072210319524,-1.0011864516880942,-0.3316869373192379,-1.41304454931993,-0.6769208983799666,-0.4325080279
759395,-0.5391157111607928,-1.284829897413816,-1.4529684516253778,-0.6738431048431739,1.2436644668630663,0.035651893154212785,-1.
2834837441297058,-1.901383188060338,0.15464057752777777,-0.7985792143661591,1.4789644489321583,-1.0365115866289225,-0.66836868501
68835,-1.837267371313497,-1.159302093702801,0.6679925694211927,-1.040967397583333,1.1160501382717198,1.280528296042845,-0.4249163
369716346,-1.901383188060338,-0.854518919753796,-0.2692467269824852,0.4593401370867894,-0.9577052331268882,-0.45984109939961776,1
.9693186171614518,1.1687351067118212,1.1371452250754572,-0.38485468940120926,0.5621184971851828,0.9197058029635962,1.287946338594
721,0.7230981058643062,-1.8425763360284904,1.916851731259133,1.2320527031500776,1.1692068193171818,0.8043755154672532,-0.48155708
460317076,-1.1106902873578852,1.2834716627185958,1.1687351067118212,1.1371452250754572,0.195139428122676,-0.49105667291925575,1.3
201032294816961,0.7987309645076336,1.826727281866073,1.21913012714847,0.9981249924084276,-0.7881230531558086,0.9842116232081772,-
1.5731709210831 99,1.5846236150563187,1.1687351067118212,1.1371452250754572,0.541551972671972,-0.41057864302516184,-1.128961177771
968,0.873272384257273,0.7996179428020531,1.9693186171614518,
-1.488507606664176,0.4664093677532739,-0.7079229214418287,-1.0422935958055124,-0.5829485784464908,0.6392555913256 63,1.70052422524
38073,-0.22416888404425664,-1.284829897413816,-0.41892577278793675,-1.7049617060978492,1.5332997195859845,0.4411921777833847,-1.0
69622827676653,-1.488507606664176,-0.15923347663381152,0.5626843642015364,-0.9783775025157497,-0.09750805850681526,-0.66836868501
68835,0.11686249082546059,-0.9807025964611038,0.251581617054735,0.35530024947455097,1.604879007698864,1.0169405899691637,-0.93848
42838150494,-1.488507606664176,-0.373235529543117,-1.0945909767493742,-1.4358345190748212,-1.8084361209805153,-1.1697141943554514
,1.6434996355415443,1.3490979478440626,1.31858667246928,0.013946160679921576,0.7466156617974555,0.9197058029635962,1.236160307389
3328,-0.5815070323336893,-1.4809280803444127,0.12768088642796963,1.9990183506876897,1.0605336543681 99,2.088430240628 99,-0.4815570
8460317076,-0.043958718497014035,1.0695597189321633,1.3490979478440626,1.31858667246928,-0.5923320968641904,-1.153947091942838,0.
7226303348204112,-0.2315095002408565,0.918192165150276,0.6728869977687052,0.20057446339717527,-0.9959796825595384,0.1876246756773
5028,-0.9203084585533916,0.9214649232812315,1.3490979478440626,1.31858667246928,1.5882543952722668,1.7817586612484682,1.126946974
064968,3.009350962824368,2.053627878771667,1.6434996355415443,

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Cluster 4:

Center:

0.3044906212947816,1.0338538411751135,1.014389353066969,0.6453972180993898,1.223308327406002,0.38361361928668497,-0.1816792352362
1005,0.5377601707876729,0.7012029477503485,0.398614220167915 03,0.7166141173909159,-0.027110204458737 24,0.017714534410999416,-1.00
011180298294108,0.3044906212947816,1.2813176511119826,1.2894234682433223,0.5633431526612747,1.2161187521890076,0.380726220282610 77
,0.028315981447288217,0.6043679415589571,0.34527408133718795,1.333813624711084,0.12311649724783331,0.2257656159573796,0.330028544
88818517,0.3044906212947816,-0.2545554208207109,0.036656473526353 79,0.370503825079213,0.20141560157367885,0.4561682212068522,0.80
26764571675908,1.3457161445728332,1.4232644305811009,0.4496360839335 5704,1.2574819486376454,1.3103085363054485,1.1785483476733385
,0.21430210196708796,-0.8480436328972765,0.6904832538267831,1.3726630718653066,1.1474721863273853,1.0398828252866896,-0.352311485
9359979,-0.2485865531006138,1.0000383372015726,1.3457161445728332,1.4232644305811009,0.5204636018828752,0.14717745612844943,0.896
1272715393612,0.9355042675863124,1.23942422427479,0.929621268577194,1.3370839672382098,-0.944015525208606,0.8432157334952208,-0.3
257372873208884,1.4022549748181696,1.3457161445728332,1.4232644305811009,0.32833481251265273,0.6143535847685445,0.703964195595541
9,0.7713231793711162,0.7767081458949161,0.8026764571675908,

Max Dist. to Center: 9.295953448044502

Min Dist. to Center: 4.685853084715728

Avg Dist. to Center: 6.6170199616990475

SSE: 1807.3062574285868

40 Points:

0.7134954941153546,1.3261737214227276,1.5084726052270634,1.089526379653311,1.7157787255107249,0.43676690060172,-0.590510417103328
2,0.8418049923501754,0.5590690690828939,1.2613935803229048,-0.3011496345101589,-0.13210298357079509,-0.19831365567030945,-1.71120
55770358117,0.7134954941153546,1.7240108483357242,1.550698251871638,0.9561257358581357,1.3340120260322794,0.31515778870139205,-0.
3716699747092788,0.6266928787141692,0.6679925694211927,1.8416496802135884,-0.3504364700097125,-0.41631756180647866,0.294078788609
14616,0.7134954941153546,-0.1325938344377775,0.7296818292829956,1.4069274651675931,1.1691219865071798,1.1237219585787803,-0.00136
07071525021546,1.574551499259364,1.5279421886929219,-1.0827561770431882,0.8818075496598968,1.7107999464407653,0.7700860265408394,
-0.4945333564538229,-1.9872356383021217,0.5209052479293241,1.8711907427647543,1.4952263141641304,1.3763635294029348,-1.6509220249
252108,-1.0423100585847525,1.711295550291461,1.574551499259364,1.5279421886929219,-0.8876339187342652,-1.1054429149411125,-0.1046
3982701828695,0.033317202296372916,1.3075643580284744,1.8746218824041876,0.4664246397342594,-0.37240979434834903,-0.2266005370386
7977,-1.0135745246290784,0.672780413865574,1.574551499259364,1.5279421886929219,0.48340183808306675,1.5520575378564037,2.02931023
4799741,2.426784077760615,1.957165576004774,-0.0013607071525021546,
-0.11225566867696943,0.48790347659501027,0.9087862837619434,0.8526574934912202,0.5664150735321171,0.841744282049606,0.35750391766
100376,0.7206715973053536,-0.8238551557896385,-0.5481811076426168,-0.7856511459430 79,1.0264380273208777,0.19162892570389428,-2.03
1996951715391,-0.11225566867696943,0.7039201723105 59,0.2553022658152826,0.9561257358581357,0.6688845269457869,0.6429999466074844,
-0.005270625558225895,0.44809338147247224,0.8761980456044215,1.0309136270832044,0.9938429209149338,1.642961391894157,0.2940787886

0914616,-0.11225566867696943,0.06429482519386391,0.631426561453604,0.9331338011271901,-0.3196570672366678,0.19542637286730558,1.3124255090568004,2.3410935740713894,2.2955790815129413,-1.0229360495310185,1.6372916288911863,2.699667625787226,1.702234588237826,-1.1033490876128875,-3.5061583121752484,0.7371786467550694,1.8711907427647543,1.8212458090110792,1.0378400109512054,0.19544367032011556,-0.3516697479761115,2.03216346597111,2.3410935740713894,2.2955790815129413,0.31326015687070596,-0.29703996491235357,1.228184322610728,1.6497289659534866,2.865053129541 27,2.639362263535858,3.6566267557792687,-0.9959796825595384,1.6533446591340 72,-2.13276731753732,2.9109409986064927,2.3410935740713894,2.2955790815129413,-0.19501639878749472,0.022655121347213352,0.22458371333019278,-0.6802393092460689,-0.2614673876337741,1.3124255090568004,
-0.18106826557632977,0.4664093677532739,0.28842112362561223,0.14205083500494575,0.8218292184162521,0.1330338645158055,-0.4325080279759395,0.4057247701888174,0.09809432745871641,0.356606236340144,-0.1644953620547208,-1.7250968735468453,-1.1263769993409145,-0.4280400783174943,-0.18106826557632977,1.9332602177767837,1.3091837459967244,1.6096741272006 64,0.8207821564949513,-0.17660544815774576,-1.3487349057787577,0.26949388423077525,0.04337614087150613,1.211077194445512,-1.0836797741504287,-1.7836787870637008,0.4995059673465121,-0.18106826557632977,-0.6357537423853056,-0.6655429738943645,-0.4882471909940165,-0.5323397892000745,-0.07760174057724582,0.9866065274368931,1.1687351067118212,1.1371452250754572,-1.9002979197095062,0.22016254553312545,1.3152528747021808,-0.31742062877231175,0.5491507541045735,-1.3362687780707816,1.366337625157236,1.2320527031500776,1.6038994791131134,0.3607929740477437,-0.4200115614283266,-0.7140849604737152,0.42782388757286527,1.1687351067118212,1.1371452250754572,-0.49389815624083205,-1.0892748559405374,0.8375289684091195,0.41440928643531283,1.956518012825472,1.8746218824041876,1.3969002569140538,-0.7881230531558086,0.1557611977761172,-1.1068405907047651,1.6675184515282044,1.1687351067118212,1.1371452250754572,-0.31131666796530527,-0.34370363241734553,-0.2265979170371948,-0.09767242418231564,-0.35792969040066747,0.9866065274368931,

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Cluster 5:

Center:

-1.4738616823241095,-0.8264322329841375,-1.456756001922526,-1.3623866852137452,-1.3453080277881575,-0.7275430710609524,0.25288071404962476,-0.9591539431675676,-1.3180533022155585,-1.4302614333400963,-0.7754104695060003,-0.0958985769804303,-0.0851249171849324 8,-0.8283067935708432,-1.4738616823241095,-0.5671283623347957,0.013787759940368861,-1.059276195281933,-0.9756156900979512,-1.2974712042420875,-0.7446711139351271,-1.024145717411787,0.8424349954125466,-0.8766290084352819,0.7097937130045662,0.6754342207824854,-1.3646068775472884,-1.4738616823241095,-0.9819348541400383,-1.1496050749079032,-0.9332290781670973,-1.0008165956870378,-1.1962790918797859,0.8473451885187071,0.36807033222612945,0.3359360062303854,0.10340689191433741,-0.004354856789777812,-0.042435722887013694,-0.0703872636979602,0.2847037666320068,0.3224260594856511,0.13193196060636234,0.13515363516272 72,0.32331840025482844,-0.04713890792624273,-0.03743128223334902,-0.04303466135143117,0.8310768086297213,0.36807033222612945,0.3359360062303854,-0.6386226527249047,-0.7440649475498782,-0.16177860696510457,-0.3902833209116608,0.19031171449958986,0.39386010195039206,-0.08323856269241453,-0.3583654274967457,-0.4061555408875202,-0.2989548021302351,0.11155996694104928,0.36807033222612945,0.3359360062303854,1.0546876197875819,0.6947843407698371,0.06606043779570575,0.3746791042477545,0.5877919401044832,0.8473451885187071,

Max Dist. to Center: 10.410757533328567

Min Dist. to Center: 4.147210189549247

Avg Dist. to Center: 6.264034271613067

SSE: 2991.397234046991

74 Points:

-0.9724131299189736,-0.9736959246430608,-1.4843193188245702,-1.279162481967605,-0.9022162595516597,-1.4868756612757386,-0.9065151953581054,-1.241689402420761,-1.4384881446218751,-0.8066917773519772,-1.6428461277090134,0.3023498955135822,-0.20611250729779354,-0.0003182454113884715 6,-0.9724131299189736,-1.127011810298712,-0.5570647084912455,-1.3705065373212668,-1.1492840691729 99,-0.9962108429229759,-0.1274037419419102,-0.6235036019777098,1.2926089979708792,-1.0860082894239098,1.2382573556285057,1.428796380709291,-1.4520522306584644,-0.9724131299189736,-0.6576302601221545,-0.9504832505996,-0.9620408550344194,-0.9577052331268882,-0.7328692128441692,0.3297134193322418,0.31201161133367644,0.28576612576598115,-0.18545426436064383,-0.08521207175615365,-0.06916187638286442,0.1227606364734875,-0.5815070323336893,-0.9746205223867037,-0.1475761666229783,1.1042250952271424,0.6258409945722673,1.2246116073383664,0.07235262397042715,0.04493557890805857,0.0,0.31201161133367644,0.28576612576598115,-1.30105646935237,-1.4611402129537665,-0.4723154545021537,-1.148714177321017,-0.24992441348431887,0.01739524251298571,-0.7299011537826191,0.04330346445911049,-0.9913240066682737,-1.1068405907047651,-0.48774729674082834,0.31201161133367644,0.28576612576598115,1.8014715554315 86,1.9126010733072394,1.1269469740649 68,2.0384061543847793,1.9089344246213271,0.3297134193322418,
-2.0046020834093787,-0.22140211518228892,-1.3000896652083265,-1.516031368129696,-1.3172642449883791,-1.6893643519996817,0.04149913940622644,-1.9200364146717628,-1.7458046390379933,-1.582223786480058,-1.493768739575807,0.7368027745979595,0.9091232754324292,-1.4973446605827587,-2.0046020834093787,-0.10692113427354664,0.3870374508379628,-0.6908162103250369,-1.1676959030577463,-1.815816237688206,-1.7151342549298105,-0.9807025964611038,0.04337614087150613,-1.1760900731050634,2.3381223118395797,1.7747552449309976,-1.0411978731837324,-2.0046020834093787,-1.0295310616485884,-0.6033146376024165,0.22244330506658685,-1.8084361209805153,-0.8966860809109,1.3124255090568004,0.8305547795888691,0.8021763991176306,1.0707684133949182,0.25197240150075867,-0.26693541225215583,-0.05849047274537102,0.6361244299844399,1.3399283139913944,0.009713577977562969,-0.04622337607927566,0.7345141595212502,-0.7481633795010288,0.5647168093691809,0.3047804482459631,1.4973836065050286,0.8305547795888691,0.8021763991176306,-0.37577742749280213,0.04248927409972514,-0.8399910819860205,-0.35100447577594784,-0.5095058754031181,-0.09185338336296689,0.4664246397342594,-0.7881230531558086,-0.704552705557176,-0.08091386387221056,0.009621722090486921,0.8305547795888691,0.8021763991176306,1.0067530493832142,1.0926552910722742,0.6757653436975803,0.29070549919351985,1.1854671538696266,1.3124255090568004,
-0.21547456402600992,-0.8017430539091701,-1.1478182168111227,-1.0422935958055124,-1.0937768682147 61,1.5504546995834065,0.9895134741705583,1.1325251404577485,-0.6701969085815793,-1.1944577819160176,0.2454674553115962,0.3023498955135822,0.581571507078098,-0.00031824541138847156,-0.21547456402600992,-0.028452620733149313,0.6065960925424299,-0.8215258885935426,-0.32535450283056183,-0.9962108429229759,-0.4938030910929631,-0.8021030992194068,0.8761980456044215,-0.36535401997467937,1.6048790076988 64,1.1981571378948197,-1.1439114625524154,-0.21547456402600992,-1.7077031114909087,-1.5367396819816364,-0.9620408550344194,0.5310738206169593,-1.2243198170443617,0.8184418917621028,0.4923744524659 17,0.45325053874489446,1.5493294334922751,0.8054638953375 77,0.12861165948642875,0.7700860265408394,0.9840191335039054,0.7612911048968699,0.6388725563797308,0.08160423184365968,1.1692068193171818,-0.9232617511139929,-0.7277391773025477,-0.9602537840569931,0.0,0.4923744524659 17,0.45325053874489446,0.2541997924966 91,0.09099345110145067,0.42389388748977036,0.3724245653013618,0.5288199722720778,0.23589249426489284,0.3334995515657173,1.4982998702852188,0.4425324988872149,-0.2674459960235841,-0.07327311438139895,0.4923744524659 17,0.45325053874489446,1.4525707478981547,0.8018943753861163,-0.2265979170371948,0.29070549919351985,0.9443113969523933,0.8184418917621028,

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Cluster 6:

Center:

-0.4161176097220395,-0.23927616358752224,-0.4754294520178494,-0.45136805874850566,-0.4932175564937749,-0.2559575676644008,0.21530176744635393,-0.40599648544837863,-0.5521226765164392,-0.3645024739017556,-0.48710406076052687,0.10417840680842769,0.017509301473 43403,0.22479850874971988,-0.4161176097220395,-0.39601565784343146,-0.3643153325106921,-0.23814795611094924,-0.5515535725435678,-0.40264398860878 82,-0.29196204612203236,-0.5276238718795356,-0.20427879395696613,-0.5407764408274526,0.19370724516839788,0.093343 14092414601,-0.2919292686311293,-0.4161176097220395,0.084789668126280 37,-0.04339751310517151,-0.15160432443899366,-0.2345839784513 0513,-0.15232522425680725,-0.17090827568646064,-0.7174805002869318,-0.7134106221897994,0.10189224288202357,-0.5459024963147663,-0.7041190178579599,-0.4177219944753794,0.02547767407000968,0.6569841343100938,-0.29948494627665995,-0.6517225715037063,-0.5100795 611576276,-0.5719591234357722,0.019876967368717875,-0.004154227432232519,-0.22517046714361333,-0.7174805002869318,-0.713410622189 7994,0.05256563623031704,0.17013184515689755,-0.13197360721939072,-0.28394790700127703,-0.5614221677868784,-0.6472963970270222,-0 .5046281096233005,0.13301000978072022,-0.19809110944283964,0.2607344623839894,-0.41968627311127993,-0.7174805002869318,-0.7134106 221897994,-0.15910614023434622,-0.48669679011058,-0.6516585056464694,-0.6679747432447267,-0.48028450601551664,-0.1709082756864606 4,

Max Dist. to Center: 8.744292140608358

Min Dist. to Center: 3.9098664819774474

Avg Dist. to Center: 6.104253126394358

SSE: 3632.863145813882

95 Points:

-0.645553294647012,0.10100951744375616,-0.18343237696293055,-0.3316869373192379,-0.6787288827780414,0.841744282049606,1.068514668 7342526,0.33304473316192323,-1.284829897413816,0.6151169060495043,-2.437925531086112,-0.7113734890166314,-0.9859976700462011,0.21 354267104166444,-0.645553294647012,-0.9962309543980497,-0.7107557576843723,-0.899951695554647,-0.7649370368289012,-0.340526527110 7912,0.2389956072091449,-0.6235036019777098,0.4597870932379638,-0.9959265057427559,-1.0836797741504287,-1.1247095218794974,-0.835 7706944463665,-0.645553294647012,1.0049850878783728,0.7689839364147523,0.22244330506658685,-0.3196570672366678,0.468454486311857, 0.3297134193322418,-0.1614408466384569,-0.18877304434094003,-0.5244349869296 05,-0.6657419431654603,-0.4647089481214 49,-0.8870669720315815,0.6361244299844399,0.6889614537600544,0.3046318491035789,-0.557533807771017,-0.7869101497645102,-0.03609666827497473,0.3 18534716669804,-0.05079674137432731,-0.21391194378643263,-0.1614408466384569,-0.18877304434094003,0.01795833500063108,0.107161510 10202585,-0.10463982701828695,-0.305790160708616,-0.5095058754031181,-0.6380965127427318,0.4664246397342594,1.4982998702852188,-0 .4815083602485444,-0.17417992994789736,-0.40485246026894245,-0.1614408466384569,-0.18877304434094003,-0.6020673409098316,-0.66644 82488289807,-0.45218873222088757,-0.6802393092460689,-1.081396961152368,0.3297134193322418,
0.1974010173701521,-1.618519189895151,-0.7906382761266728,-0.09481805115714712,-0.9979965638832103,-1.183142625189824,-1.22251997 36128827,-0.7087024642235441,-0.5165386613735202,-0.16041510307857648,-0.6365737578098728,-0.20451179675152464,-0.759830972849162 9,2.031360460892614,0.1974010173701521,-1.1793241526589768,-1.8524606945476008,0.40714508713040964,-0.9030257909645052,0.64299994 66074844,0.3611287235928292,-1.516501088186195,-0.5812402876781804,-1.7165807751919862,0.1383923994174316,-0.0044617710663515334, -0.014061979496902749,0.1974010173701521,0.17367741387810914,-0.09238724488958042,-0.2513503589738161,0.5310738206169593,0.304637 61824512614,-0.3271796887724092,-0.5447118840444692,-0.5795700079584045,0.09370633069614774,0.1804002255735839,0.1286116594864287 5,0.04508158966540528 5,-0.14663865293435743,-0.4683129644289947,0.06869723220276559,0.081604231843659 68,0.08247516982735287,0.127 3284785637916,1.1186265179427788,0.4552169515468552,-2.03216346597111,-0.5447118840444692,-0.5795700079584045,1.3960335037276472, 1.4491104071497656,0.607731701231703,0.8923891885756782,-0.12013368252491981,-0.5288478868667792,0.06764937522863321,2.5375830173 03868,1.0479385790106435,0.8517467968846573,-0.48774729674082834,-0.5447118840444692,-0.5795700079584045,-1.8232201672768422,-1.2 7704617176991 22,-0.2265979170371948,-0.48605034755815113,-1.1296281125358145,-0.3271796887724092,
-1.3508824128654555,-0.7372607273839611,-0.9335102524004946,-0.8054247096434215,-1.5088248536514806,-0.17069917157010903,0.752509 8904794754,-0.5875690691787222,-0.9775134029976976,-0.8066917773519772,-0.7980742616208455,1.316073280043796,0.34760595825357576, 0.21354267104166444,-1.3508824128654555,-0.6823569002364603,-0.09599156091186466,-1.1090871807842555,-1.1101589221679111,-1.32405 30008290683,-0.8602024402440183,-1.1593020937028 01,-0.7894457638614093,-1.0860082894239098,0.016185182060645 56,0.1602805452296993,-0.8357706944463665,-1.3508824128654555,-0.6576302601221545,-0.0465347865691977,0.6962369691069897,-0.3196570672366678,-0.678263 5901552589,0.6555324009521492,-0.4996211737614091,-0.5237418702987667,0.7916078183381267,0.6050618027414877,0.3263851953557202,0. 2522257144869579,0.11428237470524166,0.037994593528714225,0.0883584502778336,-0.6853614156939524,0.951860489419216,-1.92715908169 4987,0.6878078557188693,0.7013857751301331,-0.21391194378643263,-0.4996211737614091,-0.5237418702987667,0.01795833500063108,0.058 657333100300316,-0.012720920147320664,0.5645854043375222,0.788401434190877,1.1098815012725156,-0.5969760656140771,-0.164553164944 61927,0.2832151093810495,-1.200106656780452,0.009621722090486921,-0.4996211737614091,-0.5237418702987667,0.9486029147943089,0.089 53013195502965,-0.6777795474045814,0.0965165375056021,-0.21323623625032742,0.6555324009521492,

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Cluster 7:

Center:

1.2129358583131054,0.09666496352893712,0.6807190920728808,0.7871405675314925,0.5667547200013778,0.4023007404784957,-0.29971878604 97299,0.6250535344082 71,0.9922545532332734,0.8516266676984935,0.6753865542453895,-0.20374149022832538,-0.1592364310262137,1.01097 08754756541,1.2129358583131054,-0.2274064759862844,-0.7252372851159433,0.5893043196109875,0.19255177664291886,0.9725859457790341, 0.6976444378840458,0.7292925898955698,-0.6964177851412431,0.1406372755960 5685,-0.6442538223781555,-0.5899980250505068,1.0152593097084095,1.2129358583131054,0.9363300588106018,0.9119418668771614,0.4921024649193 6943,0.9134502037213821,0.8140964597150657,-1.0153800428803461,-0.8569890371750253,-0.8425264754988793,-0.1877876735898419,-0.4617697018410887,-0.4562930529780 7415,-0.43641831749 95867,-0.4704768078062003,0.07954566971369337,-0.5458204135903082,-0.6744824703388089,-0.6400857673334377,-0.4964439474021 0795,0.1286602302793 2716,0.07570668185596834,-1.0115304150326 52,-0.8569890371750253,-0.8425264754988793,-0.1826793567380 4395,0.0939174617717 6746,-0.5248754677395416,-0.39982631598163065,-0.6613886456747563,-0.47887245162565095,-0.6266720959496025,0.6867745193153376 ,-0.3703251607633907,0.5272999500043426,-0.7743517845425614,-0.8569890371750253,-0.8425264754988793,-0.4047280543793977,-0.124241 00509891044,0.26538205224639305,-0.4096142668937579,-0.21785411244661482,-1.0153800428803461,

Max Dist. to Center: 10.318598845837979

Min Dist. to Center: 4.630422880676113

Avg Dist. to Center: 6.716324886853627

SSE: 4380.232315748691

94 Points:

1.6940749999312392,-0.9307077069595882,-0.33946361420934107,0.14205083500494575,0.05558678376384688,0.031789519153834,-1.06451758 44854942,0.6722182392874259,0.712727316290953,1.0028829106135446,0.1336594142116919,-0.05969417039006553,0.11364040942905354,1.60

36386279865085,1.69407499999312392,-1.3101050085596389,-2.0061517437407277,0.38100315147671,-0.7810473914780055,0.9708421045135768,
0.8496611891275686,1.1624913704392603,-1.2058567162278668,-0.1851904526123718,-1.5725086435775728,-1.437719922841994,1.4239282716
646589,1.69407499999312392,1.3331328539311085,0.5200705912469603,-0.4882471909940165,0.5310738206169593,0.25003199555621586,-1.972
0400314664561,-1.085800407441193,-1.095980281310054,0.6919076058178439,-0.38104373225514276,-0.8602560198600319,0.045081589665405
285,0.37520340234484073,0.7612911048968699,0.0097135779777562969,-1.0688442394627584,-0.89558331471349332,-1.0049743245333758,-0.17
382946872894972,0.2158861508408905,-1.6043395783982448,-1.085800407441193,-1.095980281310054,0.2541997924966691,0.7377158111244578
,-0.56423436137312,-0.20244315484042888,-0.8988780682813164,-0.856593764494637,-0.8628262419511612,1.4982998702852188,-0.00355619
17300482053,0.012352202203476216,-1.1509059885159154,-1.085800407441193,-1.095980281310054,-0.21439977698379648,-0.33207319578989
92,-0.2265979170371948,-0.09767242418231564,0.2690752775841395,-1.9720400314664561,
1.4532309107834782,-1.2101311219021604,0.6080031758170555,1.5632641519774946,0.05558678376384688,-0.7781652437419381,-1.538524751
8676601,-0.006128772963577624,0.40541082187483474,0.356606236340144,0.30758303370043205,-0.13210298357079509,-0.2217102105527617,
1.9244300026660879,1.4532309107834782,-0.054608791918328175,-0.07403569674141795,0.015016052324892622,1.1544966456559942,1.6265264
2032576,1.8267261201970453,1.6982898621643514,0.251581617054735,0.5354638168368585,-1.20588699150721 46,-0.7128537311393702,0.9103
60324821244,1.4532309107834782,-0.9420249907011922,-0.5836635840365382,-0.014453526953613549,0.3183910986535526,-0.8966860809109,
-0.6582538152571534,0.492374452465917,0.45325053874489446,1.210348710923314,1.187182166949176,0.7219322670943048,0.951337135759697
9,0.8100717817441726,-0.251324011018548,0.9927744817309493,1.1042250952271424,1.4952263141641304,0.279080400628361,2.16490041191
51303,1.959581984555776,-1.9252074940778938,0.492374452465917,0.45325053874489446,-0.0017284531240405801,0.2041698641054769,-0.28
847764076022114,0.1350494111978696,0.009657048434479 24,0.23589249426489284,-0.5969760656140771,1.7061564996889487,0.1557611977761
172,1.1315449951117176,-0.8193266426283718,0.492374452465917,0.45325053874489446,0.696618998242386,1.9271391190915472,2.480491865
167129,2.426784077760615,1.9089344246213271,-0.6582538152571534,
1.625262403031879,-0.5653078566500703,0.10983115328333508,0.37891972116703654,0.4067812329795326,0.9429886274115775,-1.0645175844
854942,1.7624187946908225,1.4810185523312487,1.2613935803229048,0.9411619332665576,-1.1458263681010088,-0.767629824476647,1.38977
77115334555,1.625262403031879,-0.6823569002364603,-1.0620495844115196,0.22415153755450282,-0.028463681439013264,0.970842104513576
8,0.9717943055112529,0.9838918731975632,-0.37303481149495155,-0.095108668931218,-1.9391302956479308,-2.360276894099879,0.91036032
4821244,1.625262403031879,0.8299729459835805,0.23185513894741172,-0.4882471909940165,0.7437565425803662,1.1237219585787803,-1.315
1469233618047,-1.8297971271116877,-1.8496601397151642,-0.7637154969782836,-1.5198365758964127,-1.4535766274679096,-1.482606330893
545,0.027308698825375295,0.6889614537600544,-0.30486591122352097,-1.1966718473856937,-0.7869101497645102,-1.390190742081897,-0.23
537499190379393,-0.6251906630686426,-1.3904276346111812,-1.8297971271116877,-1.8496601397151642,-0.671079249362877,-0.183863551908
32734,-1.1387275293166612,-1.0372931866193777,-1.418040992118915,-0.9658423903705896,-0.7299011537826191,1.4982998702852188,-1.24
62318298781383,0.6652146647332837,-1.399590497931573,-1.8297971271116877,-1.8496601397151642,-0.6602174754987369,-0.9106874180053
534,-0.9033703625882752,-1.6511841176856576,-0.9367035070020279,-1.3151469233618047,

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Cluster 8:

Center:

-0.2793127563302357,-0.40733910492164666,-0.19978519352439206,-0.0034951070946535 59,-0.279836611324957,-0.0743340717677506,-0.293
5420712735375,0.07705922122383045,-0.14812912891082414,-0.13705570521327282,-0.0583750124699 3823,-0.3702669112616284,-0.281282161
538604,-0.5504303618297836,-0.2793127563302357,-0.5544122556685834,-0.38882459267914776,-0.4870350974582344,-0.44464322176457166,
-0.23980393642879966,0.1227484241451553,-0.3717428649020646,0.5149740869250846,-0.4885381458519198,-0.14135906200171716,-0.139629
8643164848,-0.5424800838394042,-0.2793127563302357,-0.0018618730223904307,0.28469200787253435,0.47931938798005863,0.15183234048 94
388,0.2677952704068252,0.5999418323819433,0.6545380310140316,0.645285879730757,0.21646972490786937,0.493574006344084,0.5003305943
732903,0.43534860796625213,0.64031593243648 15,-0.03346361602813968,0.6926448034043131,0.5128298971258511,0.631078255533664,0.2595
312651631381,-0.33770369308606507,-0.3366755291367016,0.5502433734747395,0.6545380310140316,0.645285879730757,0.2703287273458196,
0.13423813903069992,0.3729508788624876,0.40460377232432526,0.47721642863761765,0.3569873566816115,0.37353722872491674,-0.20963050
626109078,0.3722792885748577,-0.6461286980417341,0.4500629616579769,0.6545380310140316,0.645285879730757,0.18377684741011308,0.17
378073463276575,0.08868563189423308,0.5316869817700924,0.2806972417729219,0.5999418323819433,

Max Dist. to Center: 9.732789125313404

Min Dist. to Center: 4.635664739498042

Avg Dist. to Center: 6.437607235657886

SSE: 3537.233380810226

83 Points:

-0.7487721899960526,-0.3718608770744433,-0.20975089890810822,-0.09481805115714712,-0.8064359552200109,0.2342782098777777,0.12050033
396992077,0.1876846591081384,-0.05556391974934274 4,-0.8066917773519772,0.9038925862332556,0.7368027745979595,0.5269795456857095,-
1.2834837441297058,-0.7487721899960526,-1.3624173509199038,-0.6887998935139256,-1.6580678295119795,-0.7235104105882201,-0.3405265
271107912,0.9717943055112529,-0.08770511025261879,1.9172254265205657,-0.6806402628587176,1.2382573556285057,0.9510436634507434,-1
.4520522306584644,-0.7487721899960526,0.08617134293071295,0.6641783173967346,0.9331338011271901,-0.3196570672366678,-0.1322073632
661561,0.4926229101421955,0.6501919384566286,0.6207349517238079,0.3728669257529393,0.14222839841242402,-0.06916187638286442,0.096
86762087079344,0.6361244299844399,0.18265389580234537,0.5798889021545268,0.08160423184365968,1.0605336543681 99,-0.829875952920411
6,0.19544367032011556,0.5372732260746145,1.2834716627185958,0.6501919384566286,0.6207349517238079,-1.3601168337263851,-1.07310679
69399621,-1.3225653430585955,-0.7014154175477697,0.00965704843447924,1.21913012714847,-0.7299011537826191,-0.5802664237520788,-0.
73641618345840 91,-0.08091386387221056,-0.4874729674082834,0.6501919384566286,0.6207349517238079,1.6657879080574738,1.52298144628
77878,0.6757653436975803,1.8442171926968618,1.1854671538696266,0.4926229101421955,
-0.23267771325085002,-0.7372607273839611,-1.164737266633127,-1.0422935958055124,-0.4871682741149402,1.4492103542214352,0.59450750
13520867,1.2536585355025704,0.40541082187483474,-0.41892577278793675,1.2020473624996675,-0.20451179675152464,-0.1827159524153413,
0.5343340457212438,-0.23267771325085002,0.5992954875900293,0.45290504334930287,0.4855708940915141 6,-0.6084364488085501,-1.1601319
218760213,-1.7151342549298105,-1.516501088186195,-1.2058567162278668,-0.45543580365583314,0.38280683413100364,0.1767547768593044,
-0.21948915823426868,-0.23267771325085002,-1.2701727567539278,-1.1633696642299485,-0.7251440230142179,1.5944874304339933,0.031609
504800574735,0.3297134193322418,0.5149198076074474,0.48116460757471335,0.7517277333000136,1.0249519015142463,0.9197058029635962,1
.1325882449785565,-0.4945333564538229,-0.7576315689762569,-0.16723738469804 63,0.8485698793812717,0.8431873244702331,0.55923779520
91033,0.13389814714527135,0.16801999069969756,-0.5347798594660816,0.5149198076074474,0.48116460757471335,0.43138088561873594,0.13
94976281031762,0.7226303348204112,0.3595061895678384,0.3990292413126787,0.01739524251298571,-0.33112588927699294,1.08258661147775
94,0.41066902098598185,0.8517467968846573,-0.15616795085328483,0.5149198076074474,0.48116460757471335,0.38648494710155795,1.22640
53122879068,1.8037194196160484,1.4558392693210263,1.2336983052530734,0.3297134193322418,
-0.5079281008482913,-0.6942725097004884,-0.8658340531128947,-0.5685558234813307,-0.5829485784464908,-1.790608697361653,-1.6175259
464313543,-1.2174627234117963,0.40541082187483474,0.6151169060495043,0.04669760446732137,-0.2769206099322542,0.7219508363728114,-
1.8181360352623381,-0.5079281008482913,-1.3101050085596389,-0.31555020261633165,-2.024054928663795,-1.41395418126624,-1.651895158
7351605,-0.3716699747092788,0.09089438698907822,1.9172254265205657,-1.9417852343948707,0.7494284862013617,0.012012460563253552,-1

.7601929987645133,-0.5079281008482913,-0.5263711537010604,0.5036947132753951,1.4069274651675931,0.10570837669014578,1.232933203956601,1.3124255090568004,0.6051012281735677,0.5649068140641701,0.7716677758340701,0.18199071837196557,-0.06916187638286442,0.12276063647348 75,0.37520340234484073,0.905950407170501,-0.049270076247639655,0.33725944768953037,0.7345141595212502,-0.141155691242753,0.3800802398446482,0.41418881428297555,1.8182515221846773,0.6051012281735677,0.5649068140641701,0.47075446186807923,0.5598671621181308,0.12515744015912958,0.041391187129825036,-0.379715144443719 07,-0.7473451386186845,0.7322748160713435,0.2511600938628403,0.34694206518351567,-0.9203084585533916,0.0925165585623728,0.6051012281735677,0.5649068140641701,0.2701846779237474,0.2581714630530012,0.22458371333019278,-0.29186138587023336,-0.2614673876337741,1.3124255090568004,

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Cluster 9:

Center:

-0.24773046882258506,-0.15584508321499307,-0.12205382399792689,-0.07113116254093756,0.051595937750032274,-0.5250543803370092,-0.3989325202863695,-0.3828536315529732,0.06736267801710458,-0.02146561810979536,0.18459418849053694,0.38380981034190303,0.43339332615590054,-0.3184363586353046,-0.24773046882258506,0.6725327668944001,0.7487603130460723,0.22088379559778976,0.34736787773338895,-0.20938966394835495,-0.41136323753397697,0.25609892193764794,-0.1440087876933998,0.4374998770836038,0.9174634100669425,1.055243178 5079956,0.13230488535347046,-0.24773046882258506,-1.0689087935749169,-0.7069739451624246,-0.020375947754119102,-0.3940960199238602 3,-0.64413507597469,1.0086781358692094,1.409406772847656,1.3963971393324004,0.6839315888162213,1.3281793535257103,1.231199121957 7316,1.330669814339166,0.673088242233383,-0.576807441134218,1.0355376310442217,1.3407061698845726,1.0768346291105462,1.0661475810 286343,0.23698689846313536,0.4555588526907209,0.3181940163823186,1.409406772847656,1.3963971393324004,1.1661902523721055,0.857763 6492037284,1.0564108653956092,1.4025439202773502,1.1583050174251652,0.6701557821218056,1.5165328362657415,-0.46594527758002735,1.389674379501368,-0.7640877978766162,1.2696232364631523,1.409406772847656,1.3963971393324004,-0.20470808788564562,-0.0973564466022 4829,0.07230991308119993,0.45576611662824995,0.1340280537104888,1.0086781358692094,

Max Dist. to Center: 9.317178093132988

Min Dist. to Center: 4.389678785708287

Avg Dist. to Center: 6.226288649968521

SSE: 1609.601821688544

40 Points:

-0.9208036822444533,-0.479331421283125,-0.877113419660828,-0.8054247096434215,0.15136708809539753,-0.7781652437419381,-1.301521168176577,-0.1514888470173642,0.8663855634990122,0.8736275757588645,0.46908353751140486,0.08512345597139356,-0.5102677207696724,-1.2834837441297058,-0.9208036822444533,0.2331090910681751,0.5407285000310897,-0.27254523986581836,-0.17345687328139744,-0.668368685 0168835,-0.6159362074766496,-0.44490410473601283,1.2926089979708792,0.13009579027166648,0.7494284862013617,0.34149709315535526,-0.9384842838150494,-0.9208036822444533,-1.1607901680696826,-1.2812759856252183,-0.9620408550344194,0.10570837669014578,-0.18681298 595506637,0.9866065274368931,1.326552592702533,1.2906726036394611,0.9910082433786921,1.2587543428763508,0.9197058029635962,1.3656 25385402803,0.8100717817441726,-0.7576315689762569,1.2876927528569653,0.8485698793812717,1.0605336543681 99,0.3374465244993349,1.67 25362265163768,1.6518709550766786,1.2834716627185958,1.326552592702533,1.2906726036394611,1.5929013849743638,1.1904214631405627,1.3430829561994364,1.410739014883304,0.788401434190877,0.01739524251298571,0.3334995515657173,-0.9959796825595384,1.27098292431927 5,-0.08091386387221056,1.0043597597531175,1.326552592702533,1.2906726036394611,-0.44700031533941753,-0.2390297027703287,0.2245837 1333019278,1.4558392693210263,0.6549244886517 13,0.9866065274368931,
0.3866356588433 93,-1.1241546865352152,0.1793872469955904,0.8526574934912202,-0.1998273611202882,-1.3856313159137672,-1.2225199736128827,-0.9509692543131878,0.09809432745871641,-0.8066917773519772,1.1772011311441337,0.7368027745979595,0.6985542814903591,1.496708169759982,0.3866356588433393,-0.6038883866960 63,-0.6009764368321389,-0.2986871755195199,0.14184578199489833,0.8069210255605298,1.2160605382786216,1.6982898621643514,-1.4140621924110959,-0.23023134445294868,0.38280683413100364,0.6545074941178519,1.321214682 2959758,0.3866356588433393,-0.6138772246484565,0.11067364195782879,0.9331338011271901,-0.3196570672366678,-0.4052354767107075,0.65 55324009521492,0.9658269104380504,0.9277897088518157,0.6719675633137874,1.4496134786821502,1.3152528747021808,1.0549091981704741,1.3319138370233707,-0.3959833132921792,1.6415946782081838,0.33725944768953037,0.19114833477633575,0.454178772241325,0.87244442524 34019,0.6671956607435667,-1.4973836065050286,0.9658269104380504,0.9277897088518157,0.8841770124861841,0.8508922241284841,0.515812 7943607367,1.368754293749353,1.0479828961096762,1.0006328 75396563,1.6627504332511378,0.8747299820740295,1.3347098801217412,-2.132 76731753732,0.7556752503374599,0.9658269104380504,0.9277897088518157,0.07635089596072986,0.18548123413146175,0.22458371333019278,-0.8744282709339867,-0.06854278209998732,0.6555324009521492,
-0.5595375485228116,-0.24289622402402528,-0.9842674018661943,-1.0422935958055124,-0.29560766545183886,0.234278209877777,0.2785027230973094,0.11500462208124423,-0.8238551557896385,-0.8066917773519772,-0.5123426010322011,-1.2182351812817382,-0.5258654240246406,-0.5349705365440208,-0.5595375485228116,0.12848440634764532,0.7822430059060034,-0.7431000816324399,-0.44272994384582526,-1.1601319218760213,-0.86020244024401 83,-0.8021030992194068,0.8761980456044215,0.40034114131512 79,1.1160501382717198,1.2970025276724502,-1.1439114625524154,-0.5595375485228116,-1.2264197212802297,-1.0847654499664352,-0.4882471909940165,-0.3196570672366678,-0.7328692128441692,1.6434996355415443,1.3941886581271228,1.3604577757140084,-0.8833557520026227,0.6448241227010292,1.3152528747021808,0.2263326988842638,0.11428237470524166,-0.9746205223867037,0.6388725563797308,0.33725944768953037,0.6258409945722673,-0.0244234435007 76958,0.13389814714527135,-0.2559374276937256,0.5347798594660816,1.3941886581271228,1.3604577757140084,0.09670548749931772,-0.2323677289100529,0.6307114279494466,0.8132641372078474,1.4373550889878746,1.4376273789003753,1.6627504332511378,0.8747299820740295,0.9842116232081772,-1.1068405907047651,1.0043597597531175,1.3941886581271228,1.3604577757140084,-0.3500834243579088,-0.28555144928011394,-0.001007101853500006,0.0965165375056021,-0.7920100528516877,1.6434996355415443,

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