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CPE 695 HW 1

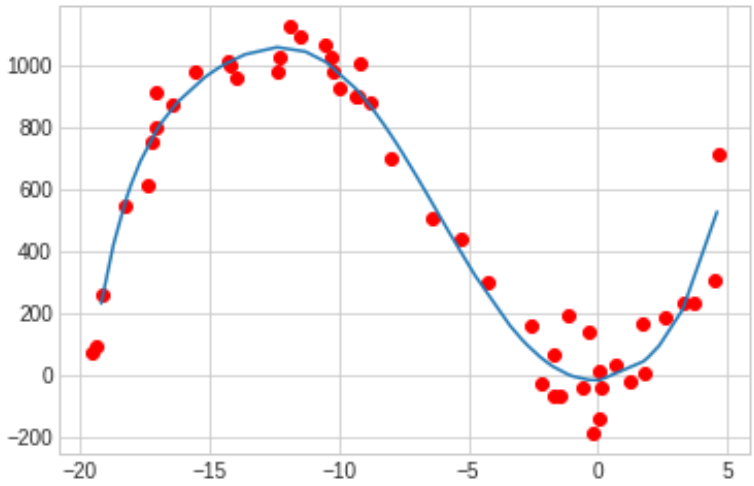
I pledge my honor that I have abided by the Stevens Honors System.

1) A supervised learning model uses a dataset with clear features and labels. It will use the given data to learn the mapping function from the features to the label. The model should then be able to predict an unknown label given a set of features. Classification and regression models are the most common uses of supervised learning.
2) An unsupervised learning model on the other hand only uses input data with no corresponding labels. The model is on its own to find patterns and structure in the input data. The common uses of unsupervised learning models are clustering, dimensionality reduction, and association rule learning.
3) An online learning model is trained with new data incrementally, so it continues to learn on the fly. This method allows the model to improve continuously when given new data, without having to retrain the model from scratch.
4) Batch learning uses static data to train the model, which will be fixed based on the original data used. This means that the model doesn't develop at all when given new input data. In order to improve, it needs to be retrained from scratch unlike online learning.
5) Most machine learning algorithms are model based. This uses historical data to train the model, which then has set parameters that aren't altered when given new data. This trained model can then predict unknown labels, when given new data.

6) In instanced based learning, you don't train the model with existing data. Each new input instance is stored and labelled. New instances that occur are then compared to the historical data and categorized based on the previous instances.

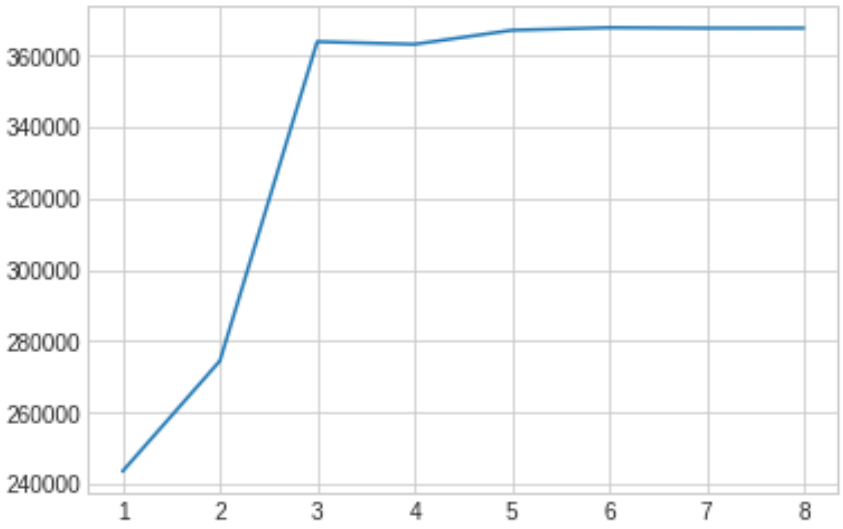
1.

Plot of 3rd degree polynomial as well as the noisy data



2.

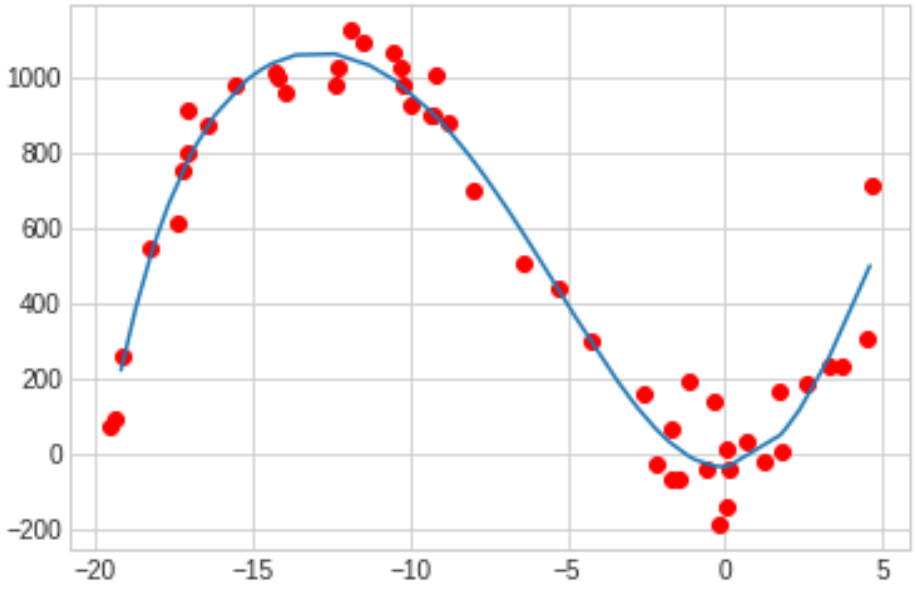
MSE versus order m, for m = 1, 2, 3, 4, 5, 6, 7, 8 respectively.



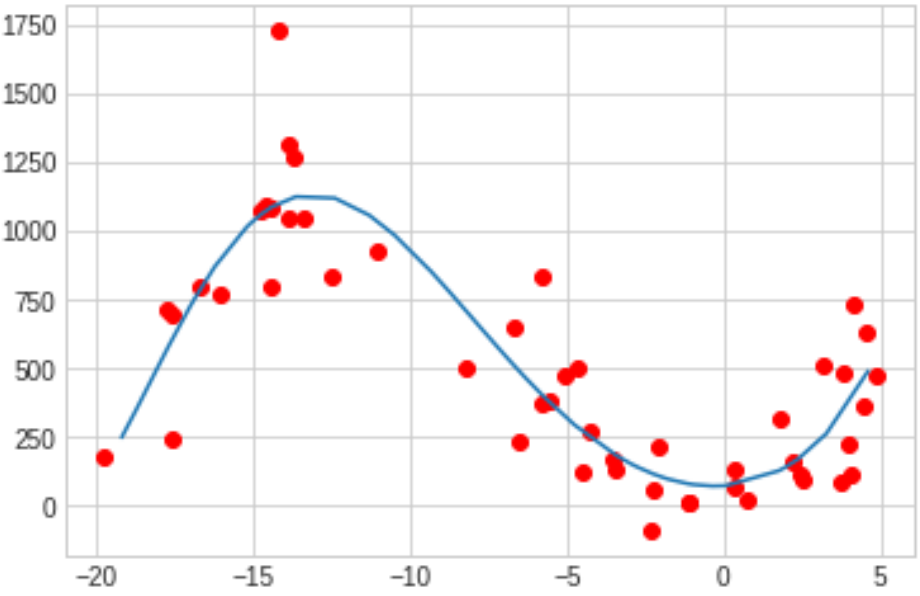
I found that M=6 is the best fit.

3. Plots of a sixth degree polynomial, given noise scale = 150, 200, 400, 600, 1000 respectively

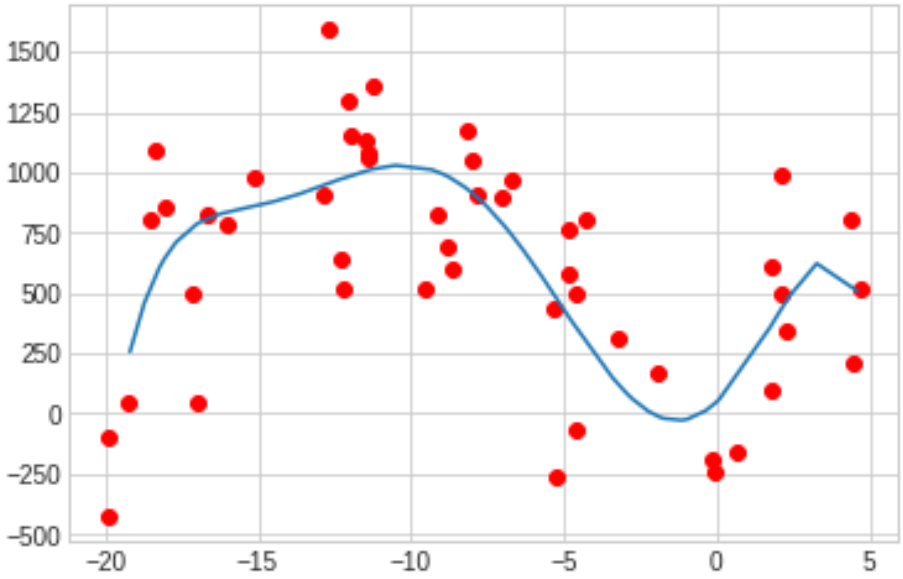
noise_scale = 150



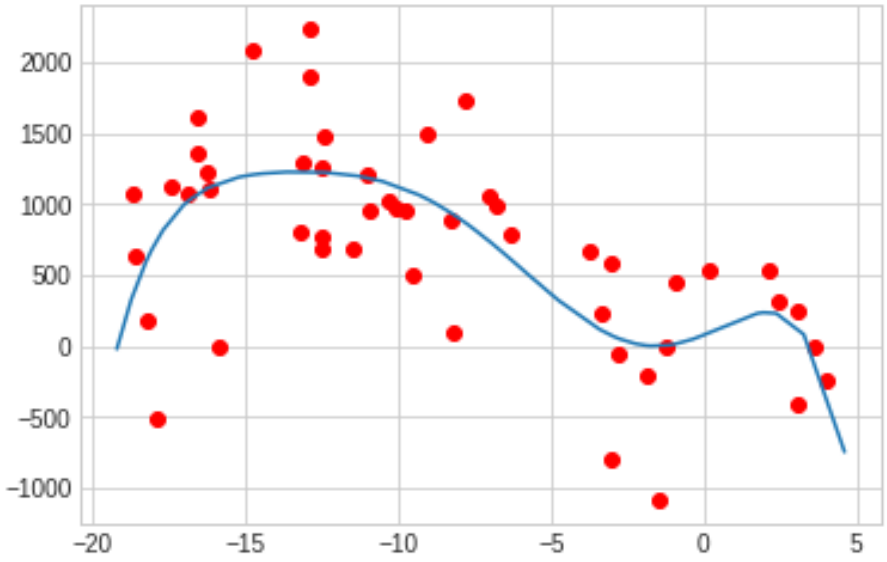
noise_scale =200



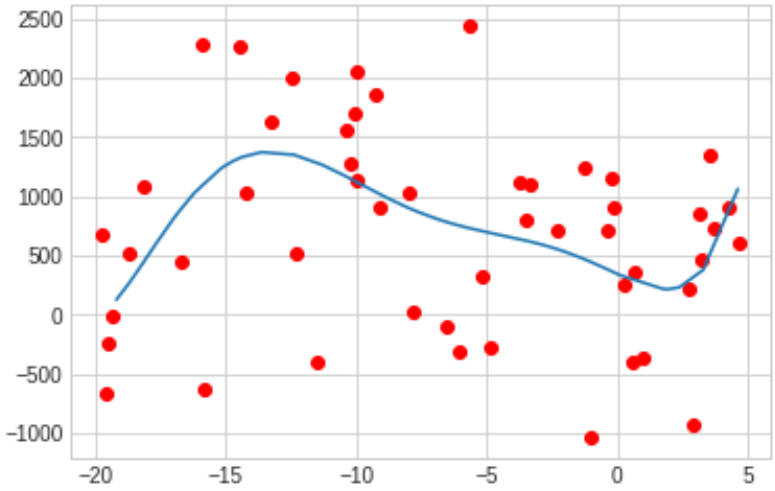
noise_scale = 400



noise_scale = 600



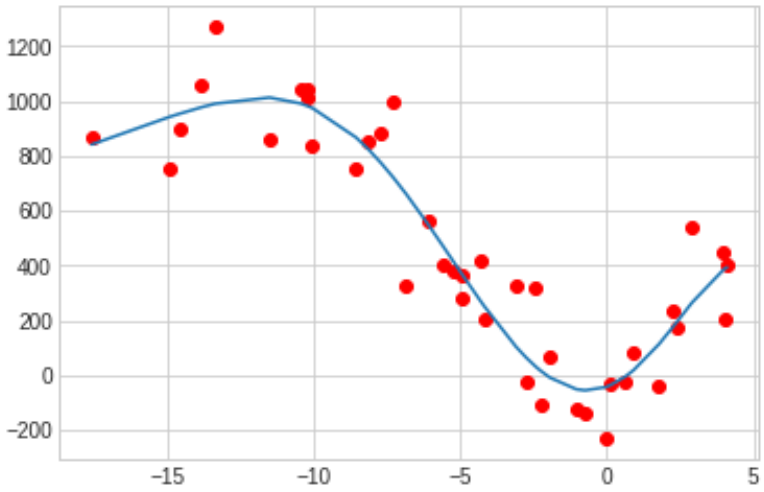
noise_scale = 1000



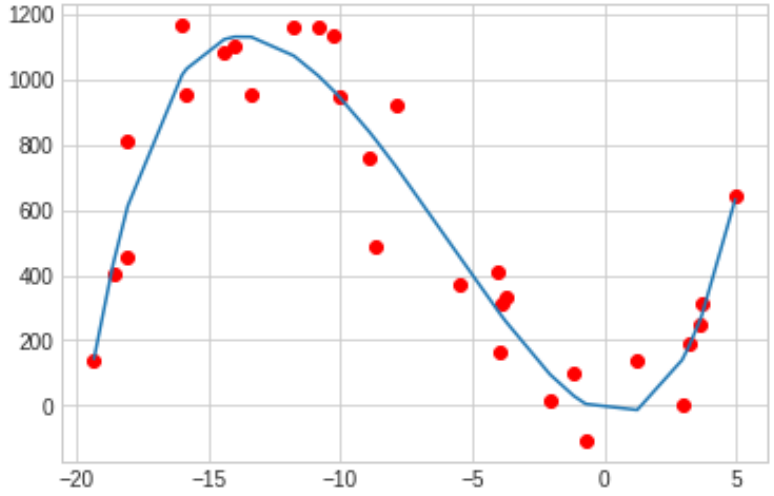
With an increase in noise, the models became less and less accurate. As I incrementally increased the noise, the mean squared error in the polynomial that I determined increases substantially. Even in the plots it is obvious how inaccurate the polynomial becomes as the noise scale is increased up to 1000.

4. All of the plots shown use noise_scale = 150

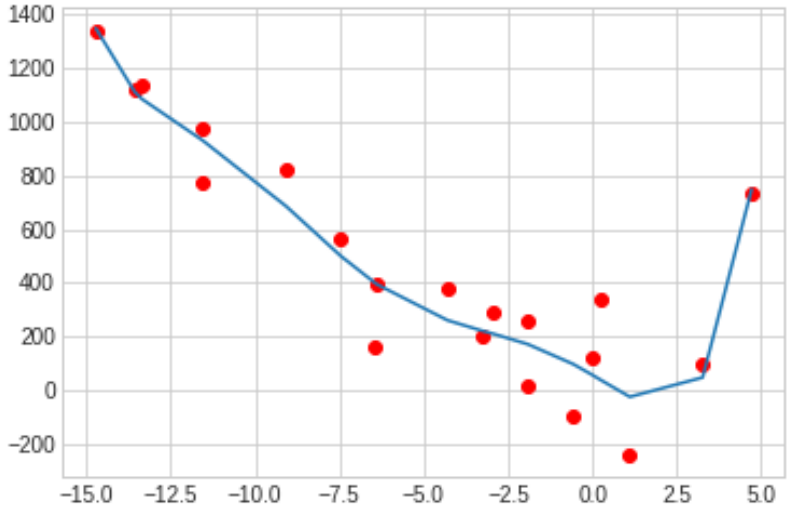
number_of_samples = 40



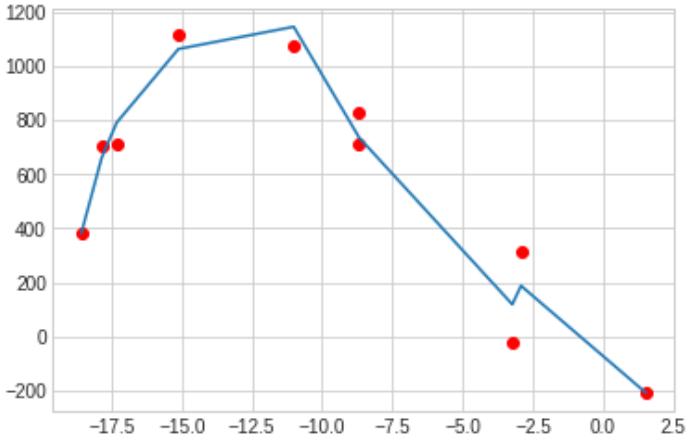
number_of_samples = 30



number_of_samples = 20



number_of_samples = 10



The amount of data given to a model is an extremely important factor. The returned parameters may not be very accurate with low sample sizes. This is especially true when the noise is greater for the data. The greater the sample size, the more accurately parameters should be able to be estimated.