Abstract. This study aims to do a prediction of demand goods at a factory for 1 day ahead using double moving average method and comparing the forecasting results. Data sources come from two different types of data which are complete data and clean data. Clean data was an optimal data that has been cleaned from outlier using boxplot method. The data source used in the calculation is simulation data for 945 days. Based on the test results, Shows the results of forecasting using complete data that is equal to 4692 with MAPE 6.88 while the results of forecasting use clean data that is equal to 4876 with MAPE 3.84. From these results, it can be concluded that forecasting using clean data is more accurate than forecasting using complete data because the smaller the error rate (MAPE) produced, the better the accuracy.

1. Introduction
This study aims to do a prediction of demand goods at a factory for 1 day ahead using double moving average method and comparing the forecasting results. Data sources come from two different types of data which are complete data and clean data. Clean data was an optimal data that has been cleaned from outlier using boxplot method. Boxplot (also known as a box-and-whisker diagram) is a box (square box), boxplot can be used to show the outlier value of an observation. Double Moving Average technique performs calculations in a way, the first calculation uses the Moving Average. After that, the results of the first calculation will be recalculated using the Moving Average.

2. Method and systems
2.1. Designed System
The application system designed is a system used to estimate the demand for goods with forecasting techniques using the Double Moving Average method. And compare forecasting with complete data and clean data that is clean from outliers. Clean data is data that was selected first using the Boxplot method so that optimal data is obtained when calculating the demand of the estimated good. System flowchart can be seen in Figure 1.
2.2. Method
2.2.1 Boxplot
Boxplot (also known as a box-and-whisker diagram) is a box (square box). Boxplot is one way in descriptive statistics to be viewed by graphs from numerical data through the following 5 sizes:

1. observation value
2. lowest quartile or first quartile (Q1), which deducts 25% of the lowest data
3. median (Q2) or middle value
4. highest quartile or third quartile (Q3), which deducts 25% of the highest data
5. greatest observation value

Values that are above or below the whisker are called outlier or extreme values.
Steps of the Boxplot Method
1. Prepare production data
2. Calculate the total amount of data
3. Sort all data from the smallest to the largest
4. Calculate the first quartile (Q1)
   \[ Q_1 = \frac{1(n+1)}{4} \]
5. Calculate the second quartile (Q2)
   \[ Q_2 = \frac{2(n+1)}{4} \]
6. Calculate the third quartile (Q3)
   \[ Q_3 = \frac{3(n+1)}{4} \]
7. Calculate Interquartile Range (IQR)
   \[ IQR = Q_3 - Q_1 \]
8. The last step is to enter all calculations into the equation as follows, then an outlier value will be obtained.
   \[ Q_3 + (1.5 \times IQR) < \text{outlier} \leq Q_3 + (3 \times IQR) \text{ Or } \]
   \[ Q_1 - (1.5 \times IQR) > \text{outlier} \geq Q_1 - (3 \times IQR) \text{ Or } \]
   \[ \text{outlier} > Q_3 + (3 \times IQR) \text{ or } \]
   \[ \text{outlier} < Q_1 - (3 \times IQR) \]

2.2.2 Double Moving Average
As the name implies the Double Moving Average technique performs calculations in a way, the first calculation uses the Moving Average. After that, the results of the first calculation will be recalculated using the Moving Average.
Steps of the Double Moving Average Method
1. Prepare production data
2. Specify length (n)
3. Calculate the first Moving Average (MA)
   \[ M_t = \frac{1}{n+1} \left( Y_t + Y_{t-1} + Y_{t-2} + \cdots + Y_{t-n+1} \right) \]
4. Calculate the second Moving Average (M’t)
   \[ M'_t = \frac{1}{n} \left( M_t + M_{t-1} + M_{t-2} + \cdots + M_{t-n+1} \right) \]
5. Calculate the difference value between the first Moving Average and the second Moving Average.
\[ a_t = 2M_t - M_t' \]

6. Calculates the scope value between the first Moving Average and the second Moving Average.
\[ b_t = \frac{n - 1}{n - 1} (M_t - M_t') \]

7. The final stage calculates the forecast value.
\[ \hat{Y}_{t+p} = a_t + b_t p \]

Followed by calculation of error evaluation, aims to determine the level of accuracy in forecasting:

1. Calculate the Error value
\[ Error = Y_t - M_t' \]

2. Calculate the Mean Absolute Deviation (MAD)
\[ MAD = \frac{1}{n} \sum_{i=1}^{n} |Y_i - \hat{Y}_i| \]

3. Calculate the Mean Squared Deviation (MSD)
\[ MSD = \frac{1}{n} \sum_{i=1}^{n} \left( \frac{Y_i - \hat{Y}_i}{Y_i} \right)^2 \]

4. Calculate the Mean Absolute Percentage Error (MAPE)
\[ MAPE = \frac{1}{n} \sum_{i=1}^{n} \left( \frac{|Y_i - \hat{Y}_i|}{Y_i} \right) \]

The smaller the error rate (MAPE) produced, the better the accuracy rate.

3. Results and discussion

3.1. Result test using complete data

Forecasting calculation results using complete data that is equal to 4692 with MAPE 6.88, can be seen in Figure 3.

| Type | Hari | Forecast | Mape |
|------|------|----------|------|
| Lengkap |   |          |      |
| Lengkap | 1 | 4692 | 6.88796 |

Figure 3. Result test using complete data

Historical data of forecasting using clean data can be seen in Figure 4. From the picture, it can be seen that there are still many outliers in the data, so the calculation of forecasting is not optimal.
3.2. Result test using clean data

Forecasting calculation results using clean data that is equal to 4876 with MAPE 3.84, can be seen in Figure 5.

| Type                | Hari | Forecast | Mape  |
|---------------------|------|----------|-------|
| Bersih dari Outlier | 476  | 4876     | 3.848 |

Figure 5. Result test using clean data

Historical data of forecasting using clean data can be seen in Figure 6. From the picture, it can be seen that the data is clean from the outlier so that the optimal forecasting calculation is obtained.
3.3. Comparison of forecasting results
From the calculation results can be seen differences in forecasting results using complete data and clean data can be seen in Table 1.

| Data          | Forecasting | MAPE |
|---------------|-------------|------|
| Complete Data | 4692        | 6.88 |
| Clean Data    | 4876        | 3.84 |

Table 1. Comparison of forecasting results

4. Conclusion
From the test results, it can be concluded that the results of forecasting using clean data types are more accurate than using complete data types because the error rate (MAPE) generated by using clean data types is smaller than that of complete data types. The smaller the error rate (MAPE) produced, the better the accuracy rate.

5. References
[1] DT Wiyanti, R Pulungan, 2012 Peramalan Deret Waktu Menggunakan Model Fungsi Basis Radial (Rbf) Dan Auto Regressive Integrated Moving Average (Arima).
[2] Evaristus Didik, 2018 Mengukur Error Dalam Forecasting.
[3] John E. Hanke, Arthur G. Reitsch, 1982 Business Forecasting 5th Edition
[4] Junaidi, 2014 Deskripsi Data Melalui Box-Plot
[5] M.A.Yulianto, 2012 Analisa Time Series
[6] Moh Yamin Darsyah, 2014 Pengunaan Stem and Leaf Dan Boxplot Untuk Analisis Data Vol 1
[7] Subagyo, 2008 Forecasting Konsep dan Aplikasi
[8] Statistikian, 2016 Pengertian Data Outlier Univariat dan Multivariat