TEAM #1

ISEN 614:700 SPRING 2020 SEMESTER PROJECT

Suyashkumar Chavan
Laurel Rawley
Daniel H. Salahuddin

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BACKGROUND

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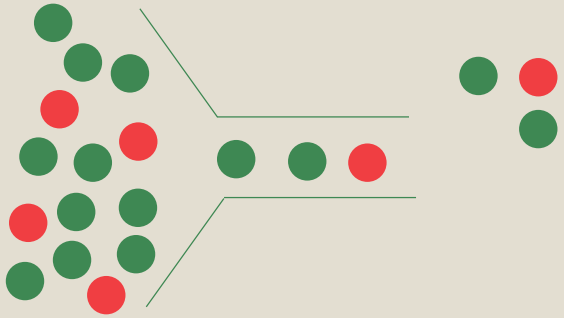
- Setting:
  - Manufacturing plant
    - 552 records
    - p 209
    - n= 1
    - Actual meaning of data points is omitted
- Audience
  - Manufacturing Manager
- Objective:
  - Classify data into two sets
    - In-control
    - Out-of-control
  - Determine in control population parameters

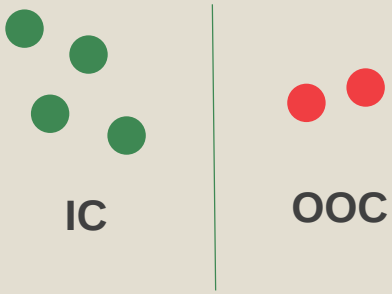
APPROACH

REFINE



- Refine the data to reduce the data set while retaining most of variation reflected in the original data set by using:
  - Principle component analysis

DISCOVER

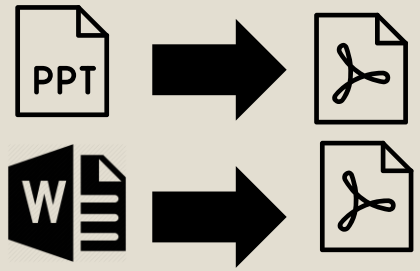


- Finding best method to determine the in-control and out-of-control subset by using and combining the following techniques:
  - Multivariate cumulative sum (m-CUSUM)
  - Multivariate exponentially weighted moving average (m-EWMA)
  - Hotelling T^2

DEFINE

- Determine the in-control dataset's parameters to describe the distribution by using:
  - Distribution tests

DESCRIBE

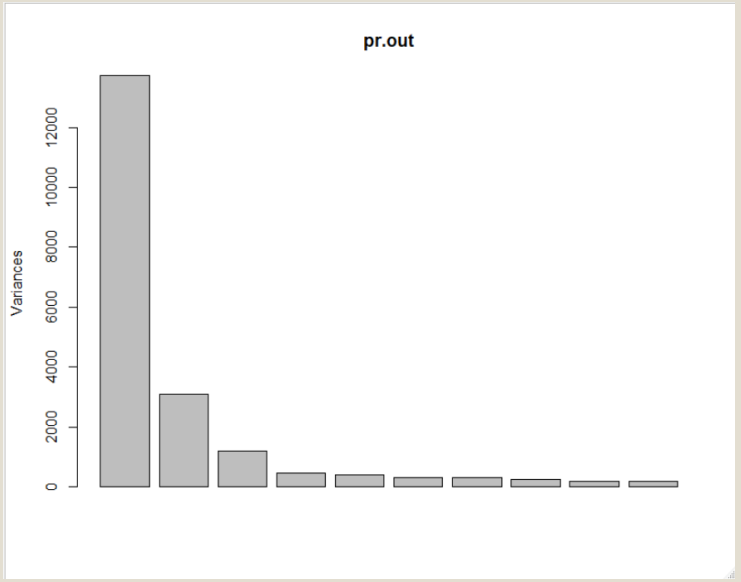


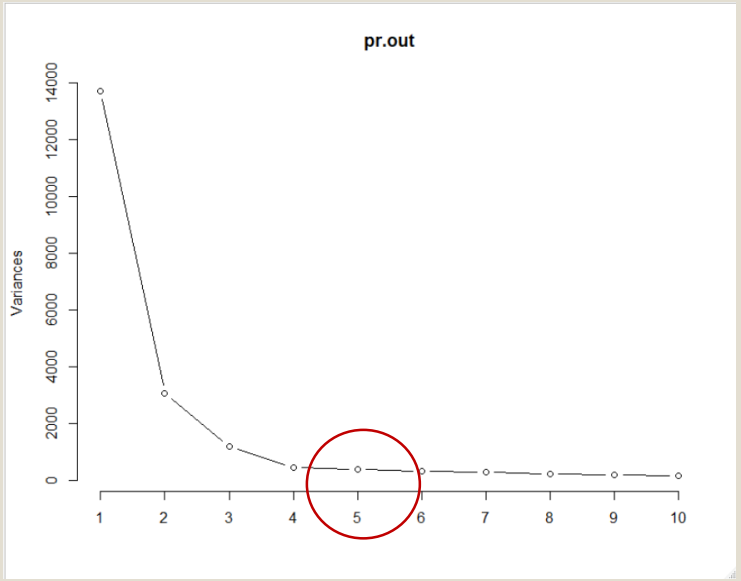
- Summarize approach and findings into deliverables
  - Microsoft Word report saved as a PDF
  - Microsoft PowerPoint presentation saved as a PDF

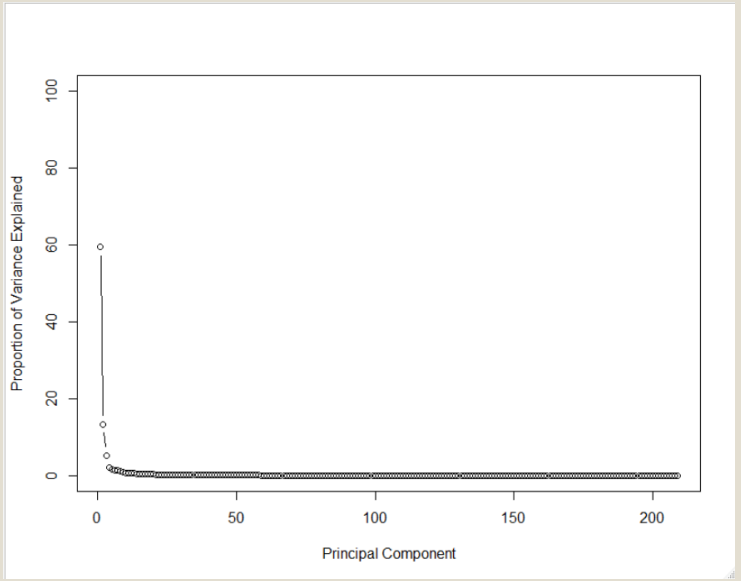
PRINCIPAL COMPONENT ANALYSIS (PCA) RESULTS

- Vital Few effects to be monitored
- Eigenvalues ordered from largest to smallest
  - PVE = Proportion of Variance Explained
  - CVE = Cumulative Variance Explained
- 5 Principal Components Selected because it explains 81.79% of the data's variance

E.V.	PVE	CVE
1	59.52	59.52
2	13.35	72.87
3	5.23	78.1
4	2.00	80.1
5	1.69	81.79







MULTIVARIATE CUMULATIVE SUM (M-CUSUM) RESULTS

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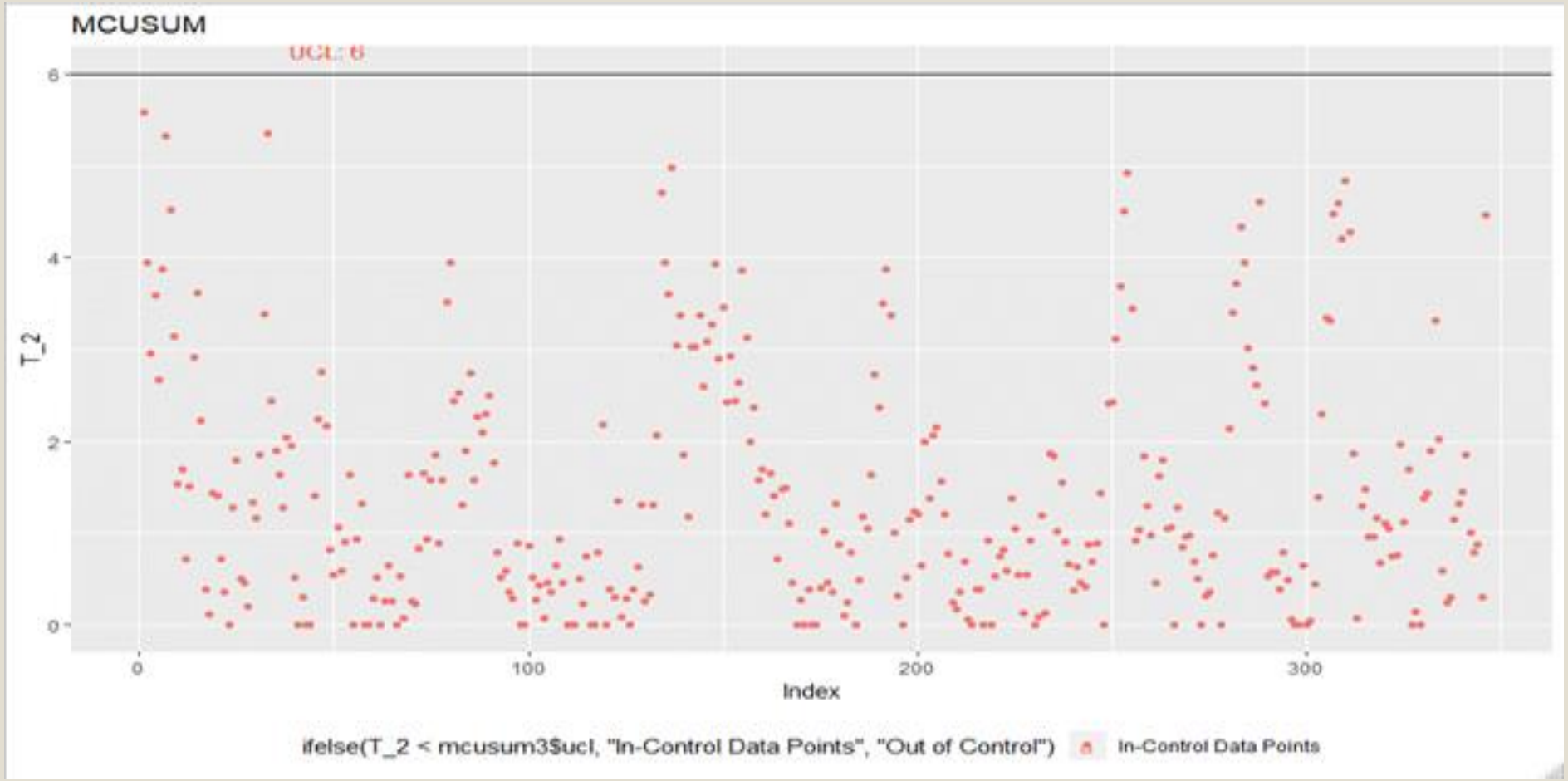
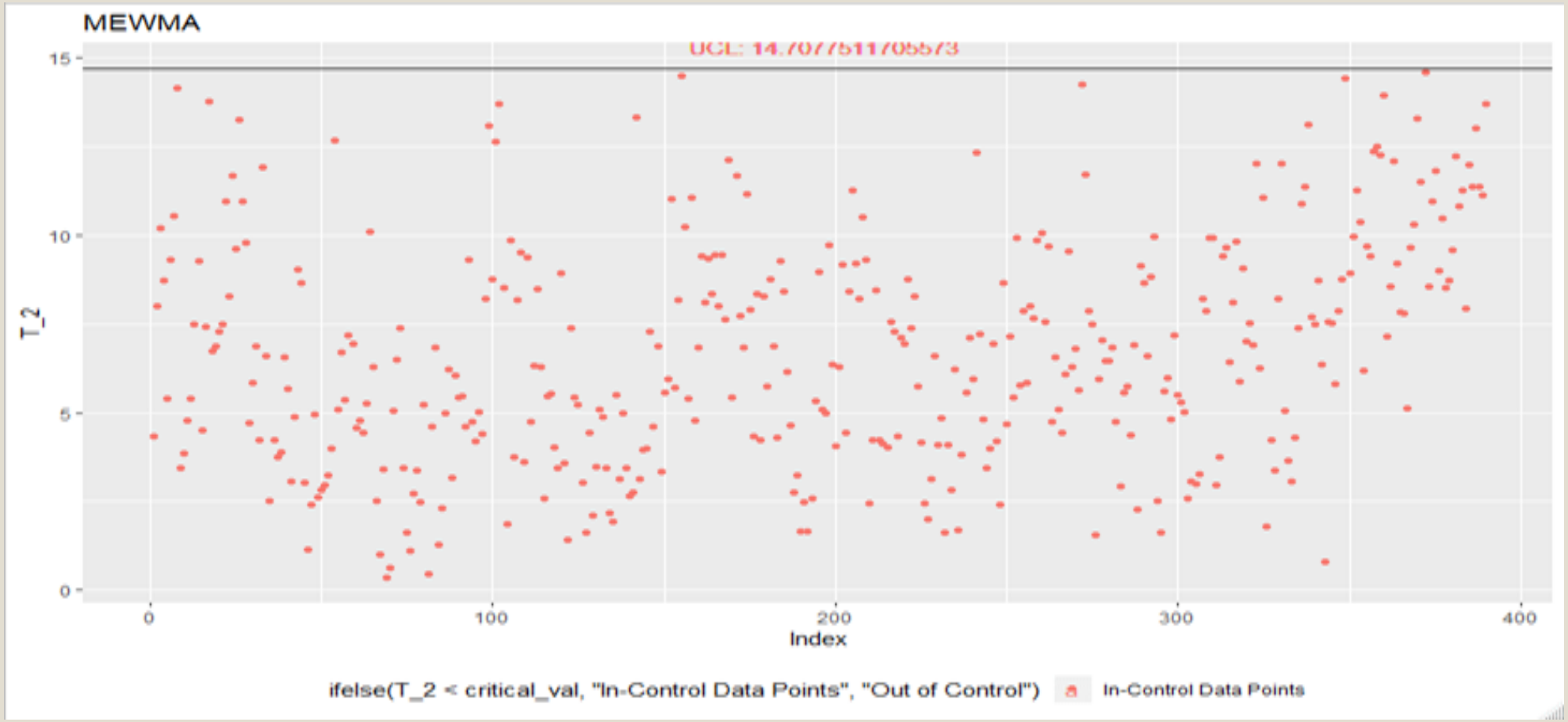
- Iterations: 6
- In-Control Points: 346



MULTIVARIATE EXPONENTIALLY WEIGHTED MOVING AVERAGE (M-EWMA) RESULTS

- Iterations: 11
- In-Control Points: 395



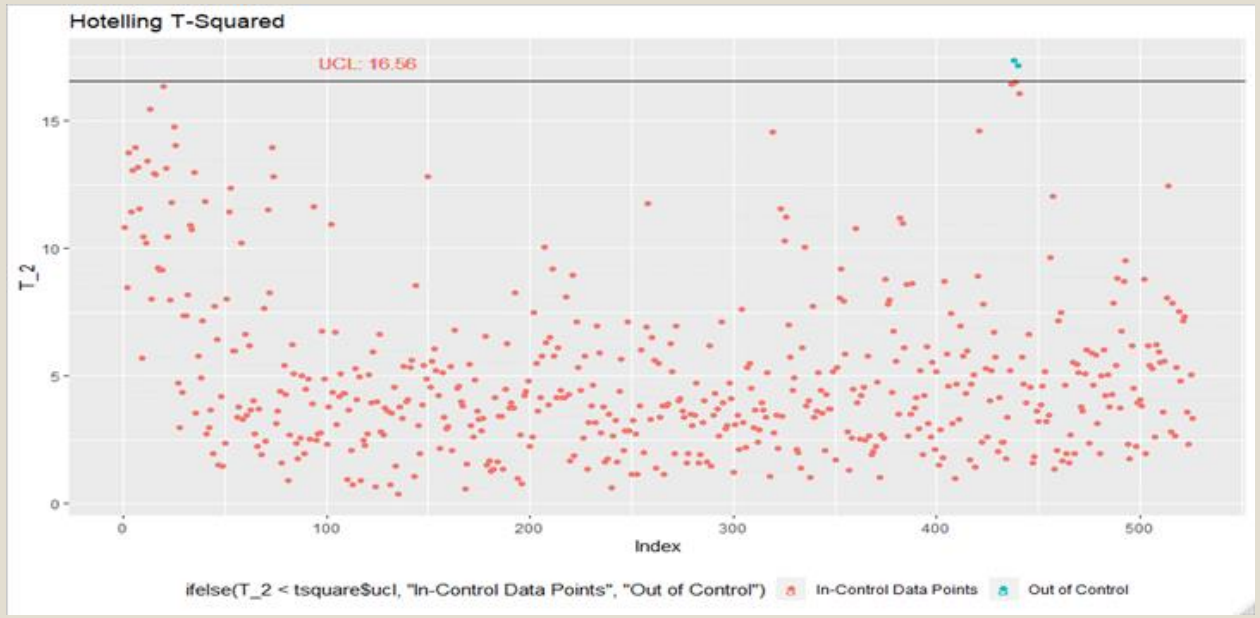
HOTELLING T^2 RESULTS (PART 1)

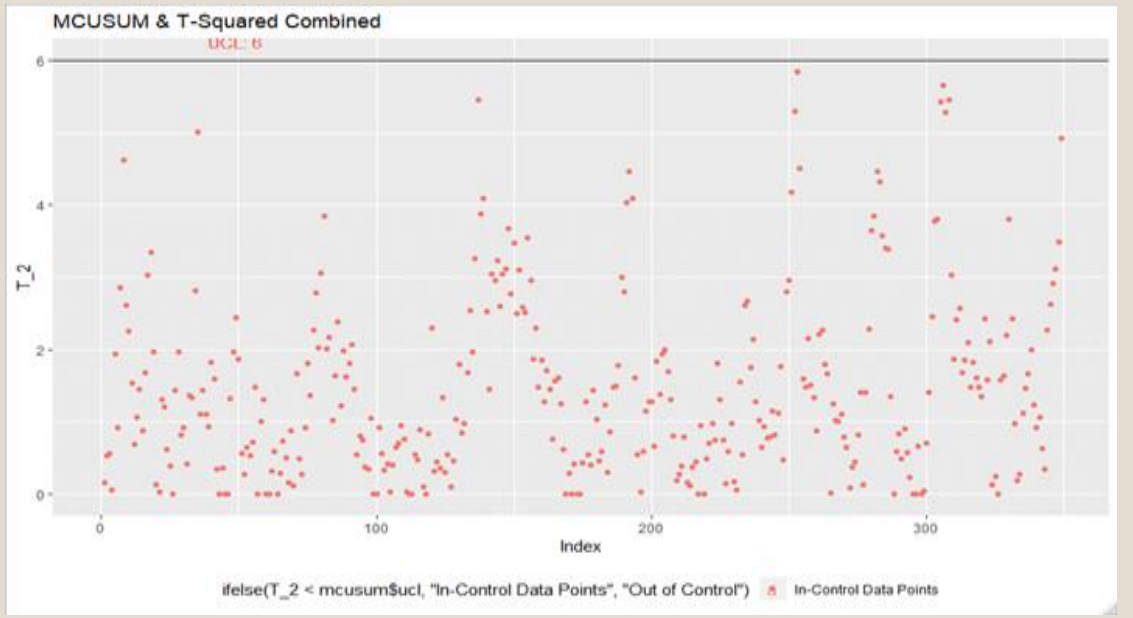
HOTELLING T^2 ONLY

- Iterations: 15
- In-Control Points: 482
- Out-of-Control Points: 2

HOTELLING T^2 + m-CUSUM

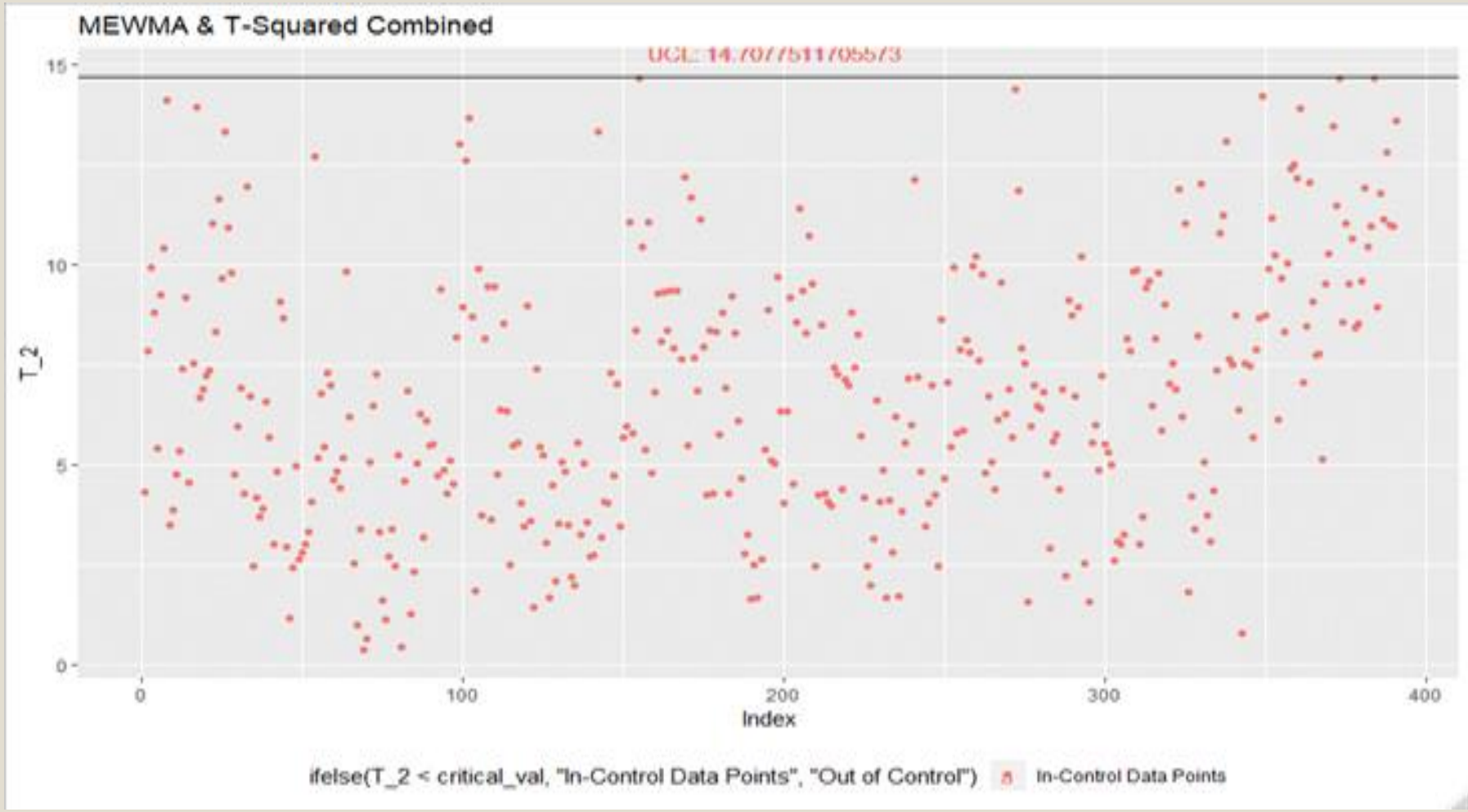
- Iterations: 5
- In-Control Points: 349





HOTELLING T^2 + m-EWMA RESULTS

- Iterations: 9
- In-Control Points: 491
- UCL = 14.71



DISTRIBUTION TESTS RESULTS

- Minitab Individual Distribution Identification indicated that a Johnson Transformation best fit the data
- Transformation
  - $x_{Transformed} = 1.11147 + 1.24842 * \ln(\frac{x+0.156411}{19.5056-x})$
- Estimated Population Parameters on the Transformed Data ~N($\hat{\mu}$,$\hat{\sigma}$)
  - $\hat{\mu} = -0.0058$
  - $\hat{\sigma} = 0.9975$
- Probability plot to the right confirms that a normal distribution on the transformed data fits the data with only a few outlying points