Final Presentation

Northeastern University: College of Professional Studies

PJM6135: Project Quality Management

Instructor: Prof. Shahrooz

Team Introduction

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Background of the Simulation

Formula Based Calculations

Expense Management

Graphic Interpretation

Real Life Simulation

Key Concepts Covered

- Data Measurement from X-bar and R Control Limits Charts.
- Able to use the Control Limits and make the necessary modifications to measure and track expenses and errors.
- Control chart analysis and data-based operation competency evaluation.
- Analyze the alteration in Quality Cost by connecting it to changes made in a number of operational areas.

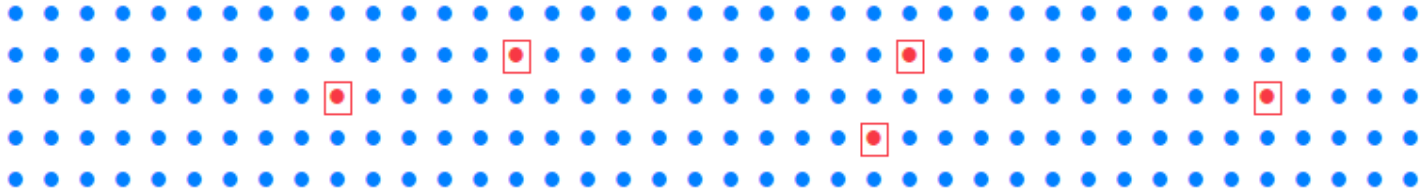
Purpose of Control Charts

1. Recognize the variances that are present in processes at all times.
2. Look for trends among the plotted points. The patterns point to potential causes, which can direct you toward potential remedies.
3. Future performance forecast.
4. Create fresh suggestions for enhancing quality in light of our investigation.

Challenge 1

Use the sample statistics to calculate the control limits for the X-bar & R Graphs

All units from the current batch



X_1	28.89	X_2	28.52	X_3	28.42	X_4	34.33	X_5	33.39

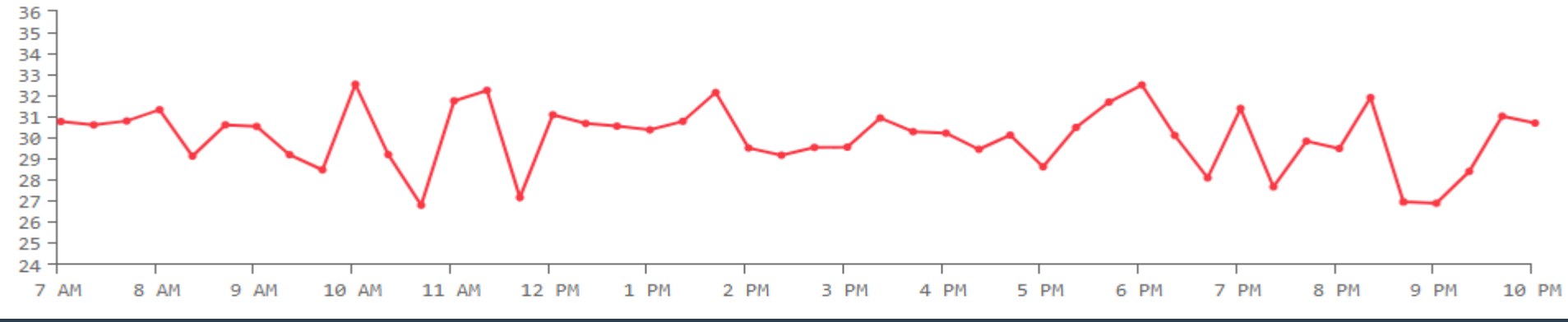
X-bar 30.71 **R** 5.91

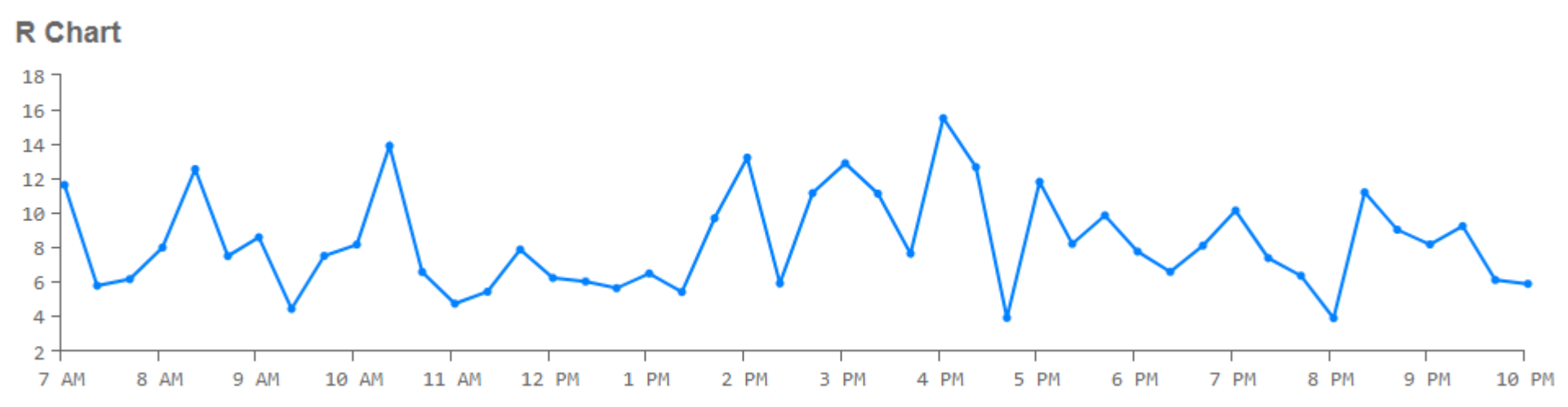
This production shift has ended. Click reset below to start a new run.

RESET

COPY DATA

X-bar Chart

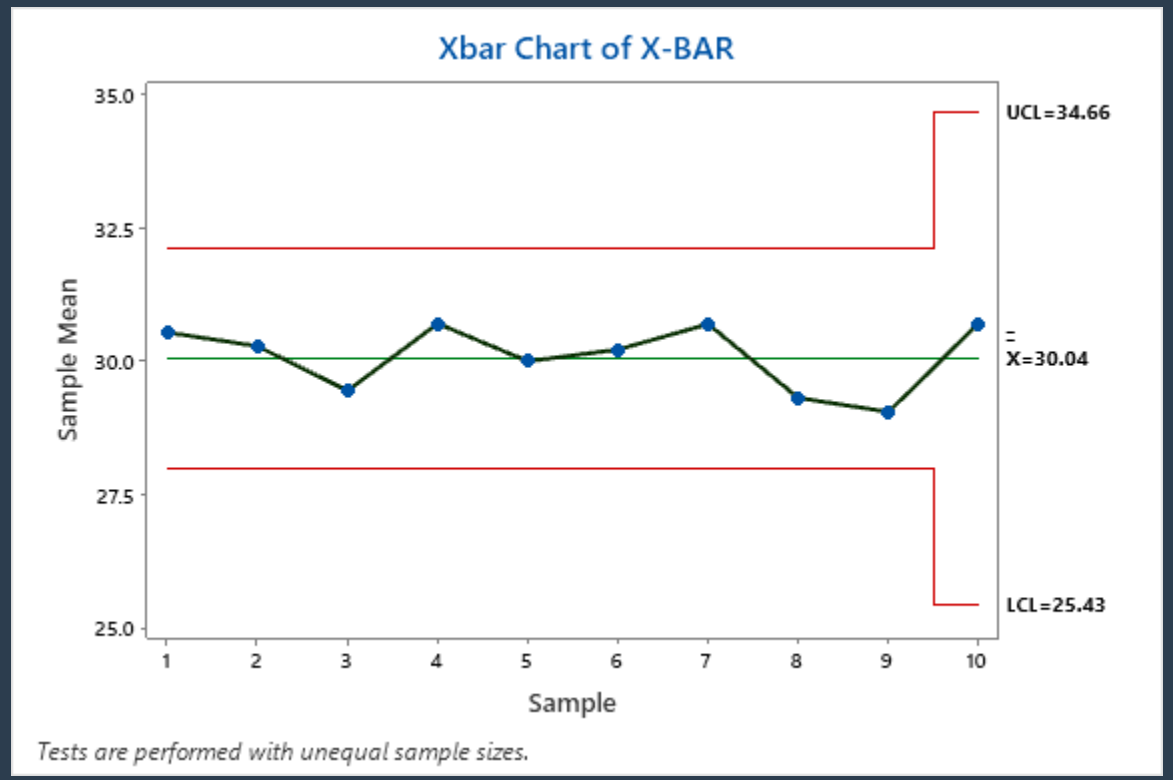


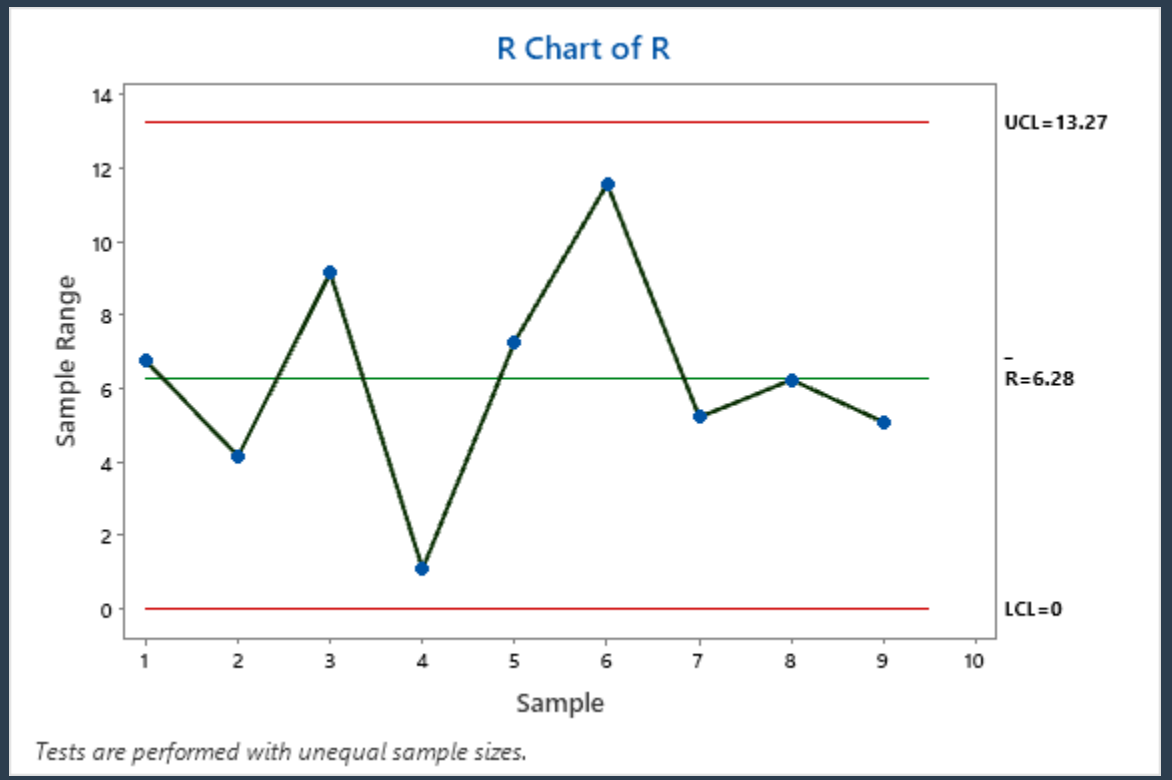


1. The simulation was run from 7 a.m to 10 p.m
2. The data was copied into Minitab, and X-bar and R limits were calculated.
3. X-bar: Stats -> Variable Control charts -> X bar -> feed in Sample size = 5 -> 'OK'
4. R - Chart: Stats -> Variable Control charts -> R Chart -> feed in Sample size = 5 -> 'OK'

Results:

Control Limits	X - Bar	R Chart
UCL	34.66	13.27
LCL	25.43	0


Xbar Chart of X-BAR
35.0
32.5
30.0
27.5
25.0
Sample Mean
UCL=34.66
X=30.04
LCL=25.43
1
2
3
4
5
6
7
8
9
10
Sample
Tests are performed with unequal sample sizes.


R Chart of R
14
12
10
8
6
4
2
0
Sample Range
UCL=13.27
R=6.28
LCL=0
1
2
3
4
5
6
7
8
9
10
Sample
Tests are performed with unequal sample sizes.

Challenge 2

Keeping the Process in Control While Minimizing Costs

4 internal defects × $3.20	$12.80	Number of Recalibrations	3	Number of Labor Changes	3
502 external defects × $4.50	$2,259.00	Cost per Recalibration	$75	Cost per Labor Change	$100
Total Defect Costs	**$2,271.80**	**Total Recalibration Costs**	**$225**	**Total Labor Change Costs**	**$300**

Shift Over

This process produced 506 total defects and was out of control 7 times

Defects discovered

4

Defects shipped

502

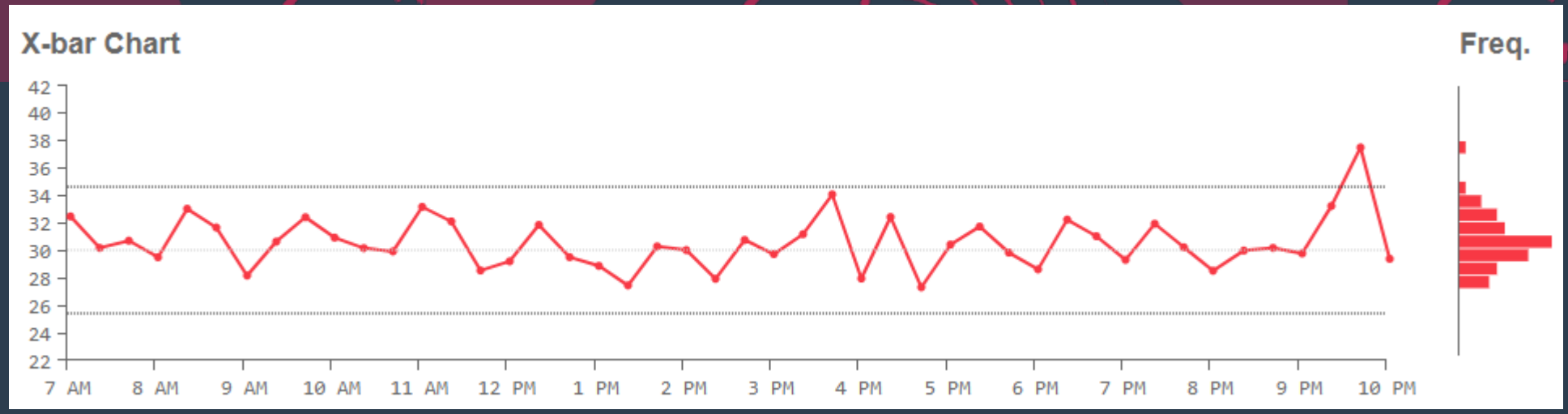
Effective Yield

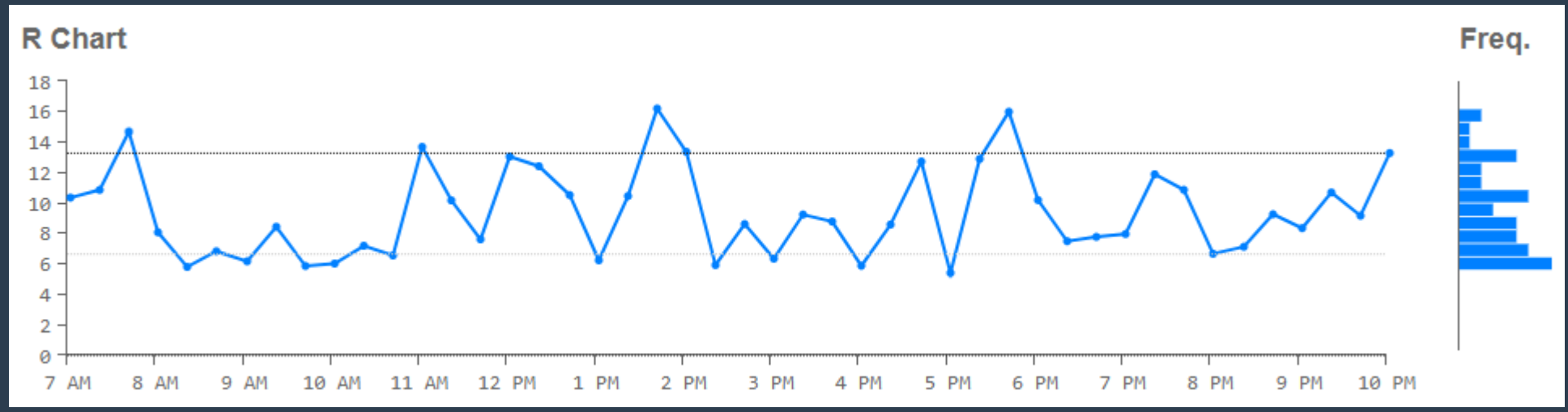
98%

Total Cost

$2,879.30

1. Used the UCL and LCL from challenge 1, and tried to keep the process within control limits while minimizing the cost by either of the following:
    - Recalibrating the equipment
    - Labour changes
    - Both


X-bar Chart
Freq.
42
40
38
36
34
32
30
28
26
24
22
7 AM
8 AM
9 AM
10 AM
11 AM
12 PM
1 PM
2 PM
3 PM
4 PM
5 PM
6 PM
7 PM
8 PM
9 PM
10 PM


R Chart
Freq.
18
16
14
12
10
8
6
4
2
0
7 AM
8 AM
9 AM
10 AM
11 AM
12 PM
1 PM
2 PM
3 PM
4 PM
5 PM
6 PM
7 PM
8 PM
9 PM
10 PM

Challenge 3

Determine whether each process is capable of producing to specifications

Hospital Laundry

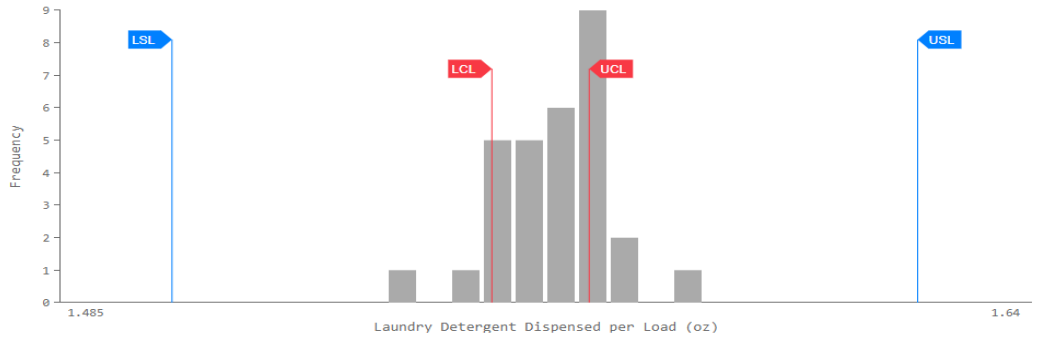
The laundry department of a large hospital contains energy efficient industrial washing machines for laundering sheets and towels. High energy (HE) laundry detergent is automatically dispensed at the start of each load. If an insufficient amount of detergent is dispensed, the laundry will not be completely cleaned, while too much is unnecessarily costly and can damage the machine's bearings.

Spec Limits

Lower	Upper
1.5	1.62

Control Limits

Lower	Upper
1.5535	1.5691



Determine whether each process is capable of producing to specifications

Tea Shop

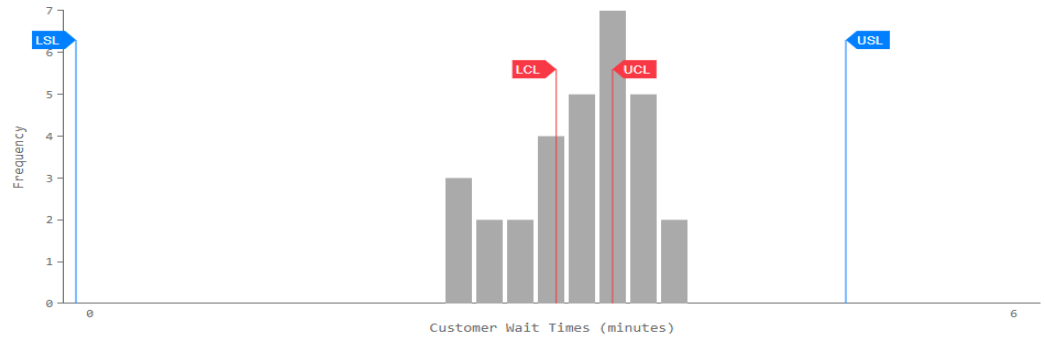
Herb's Tea Garden is a small tea shop specializing in blended loose leaf hot tea. Customers select from a variety of fine loose tea leaves, dried flowers and dried fruits to create their own unique tea blend. Because of the popularity of the tea shop, combined with the custom blending process, waiting times can sometimes be excessive; most customers would prefer to wait less than five minutes.

Spec Limits

Lower	Upper
0	5

Control Limits

Lower	Upper
2.8665	3.3051



Determine whether each process is capable of producing to specifications

Filled Donuts

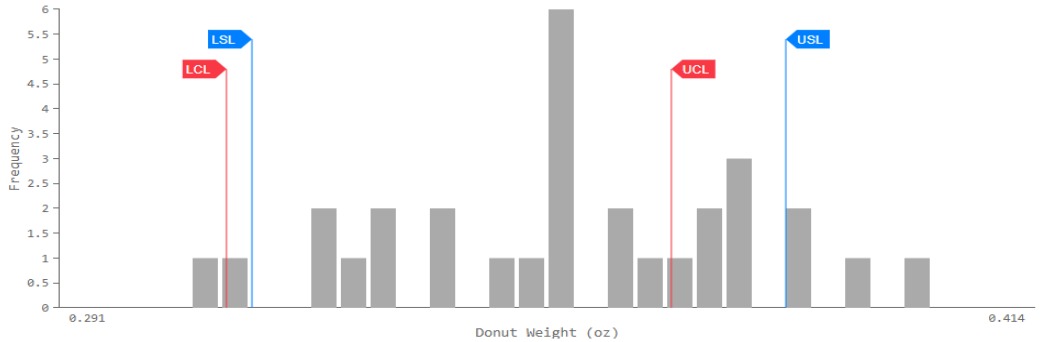
Bob's Bakery carries a wide variety of pastries, including his famous filled donuts. Each donut is injected with a flavored jelly or cream. The customers complain if they feel that there isn't a sufficient amount of filling in their donuts. Overfilled donuts are messy and waste costly filling.

Spec Limits

Lower	Upper
0.32	0.38

Control Limits

Lower	Upper
0.315	0.365



Determine whether each process is capable of producing to specifications

Tire Pressure

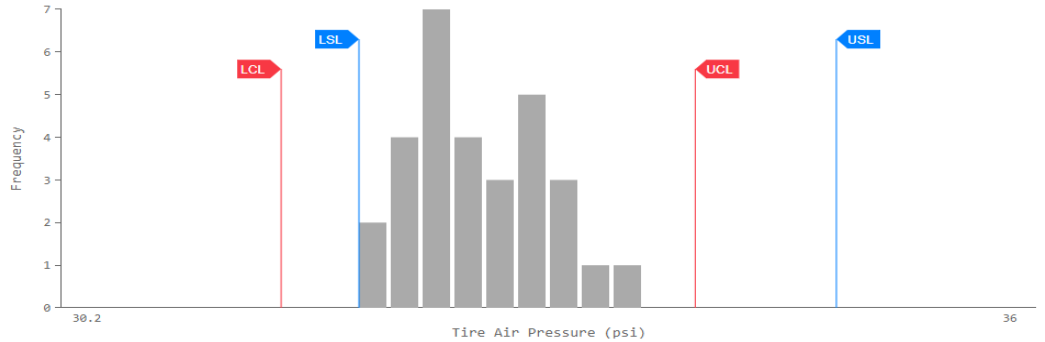
One of the tasks on the turnaround list for a rental car agency is to check and adjust tire pressure. When a tire is over-inflated, it can cause a bouncy ride and poor handling. If it is under-inflated, it can cause premature wear due to increased friction.

Spec Limits

Lower	Upper
32	35

Control Limits

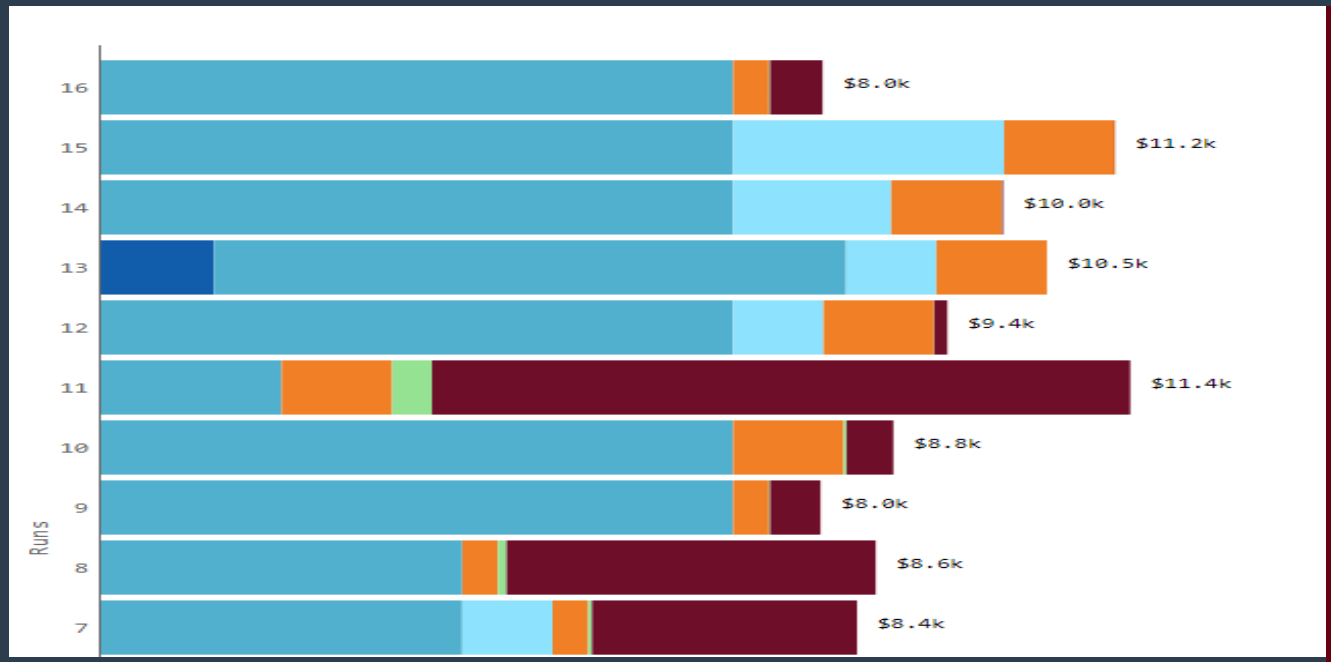
Lower	Upper
31.2763	33.8737



Challenge 3 Results

Challenge	LSL	USL	LCL	UCL	Process Mean	Process Standard Error	Sample Size	Standard Deviation	Process Centered (M) M= (USL+ LSL)/ 2	Centered / Not Centered	Cp / Cpk	Capability Index For two sided: For Cp>1.33 = Yes For Cpk> 1.33 = Yes For one sided: For Cp>1.25 = Yes For Cpk>1.25 = Yes
A	1.5	1.62	1.5535	1.5691	1.56	0.0026	30	0.014	1.56	Centered	1.40	Yes
B	0	5	2.8665	3.3051	3.08	0.0731	30	0.400	2.50	Not Centered	1.59	Yes
C	0.32	0.38	0.315	0.365	0.34	0.0083	30	0.046	0.35	Centered	0.22	No
D	32	35	31.276	33.874	32.57	0.4329	30	2.371	33.50	Not Centered	0.45	No

Challenge 4



Labor Training Investment

$0.00

Equipment Investment

$7,000.00

Supplier

$0.00

Sample Size

5 - $5.50

Sample Frequency

high

RUN TO END

RESET

COPY DATA

The total cost in investments in prevention and appraisal to improve the quality of processes was $8k with $7k in equipment investment, high sample frequency and sample size of 5 - $5.

Process Adjustments

Process Control

Need for Process Control

Process is beyond the control limits

Cost Control

Variability Reduction

Improve Consistency and Quality of the Process

Process Adjustments

Keeping the Process in Control While Minimizing Costs

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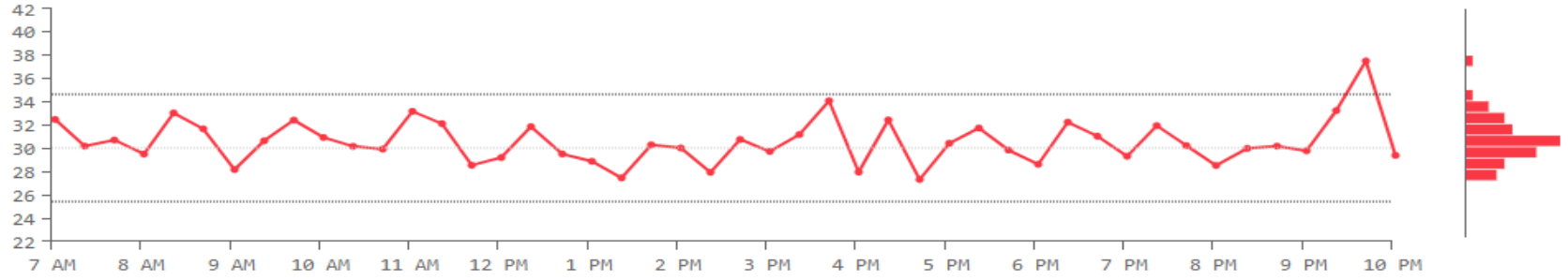

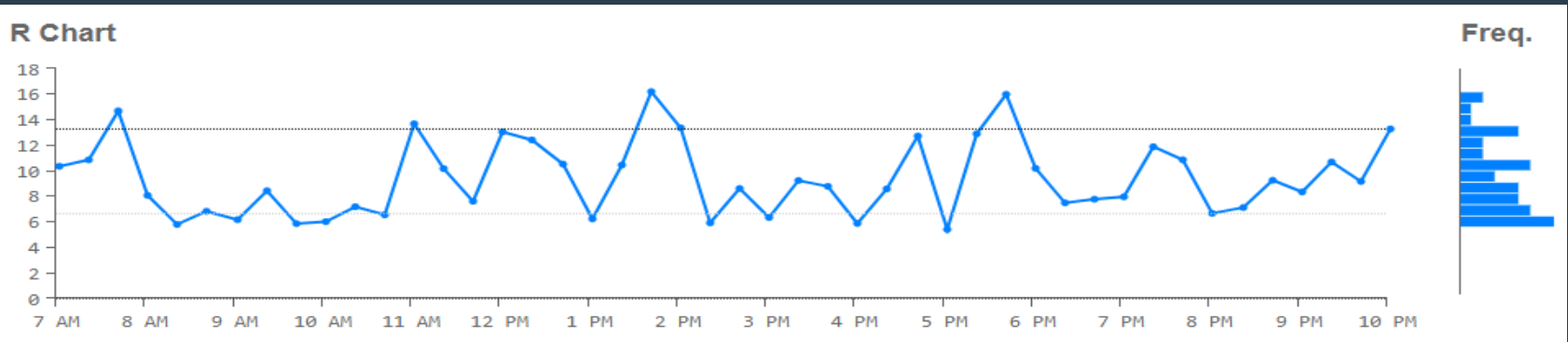

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Cost of Quality

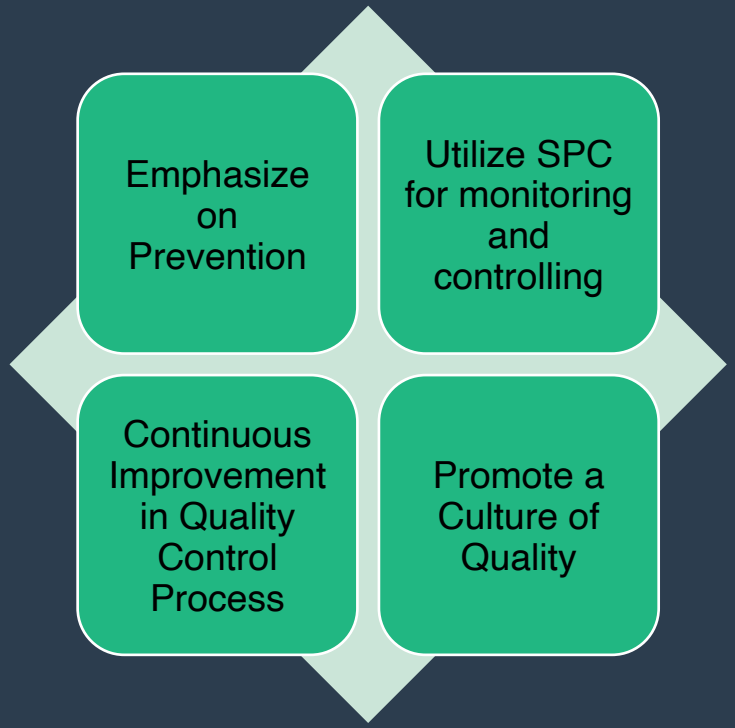
A tool used to evaluate the effectiveness of quality management and identification of improvement areas in the process

Cost of quality is the sum of good quality and bad quality cost

Four Categories

Prevention Cost	Appraisal Cost	Internal Failure Cost	External Failure Cost

Managing Cost of Quality



Lessons Learned - Takeaways

- Quality Assurance
- Quality Control
- Statistical Process Control
- Cost of Quality
- Capable v/s Non Capable Process

Learnings from Serious Games & Simulations

- Real world Connection
- Train Oneself to Spot Problems
- Learn to Identify Wrong Inputs
- Learn from Mistakes
- Assess Process Reliability

Thank You.