Group Assignment 5 - Quality Analytics: Group Presentation

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GROUP MEMBERS

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BACKGROUND OF THE SIMULATION

- Interactive Quality Analytics Simulation
- Quality Management Team at Gainsborough Manufacturing.
- Newly established plant producing high-volume consumer goods.
- Develop efficient production systems to deliver high quality goods and minimize costs.

BACKGROUND OF THE SIMULATION

Market Context

- Operates in highly competitive market
- Customer satisfaction depends on product quality & reliability
- Faces tight profit margins and growing customer expectations

Key Objectives

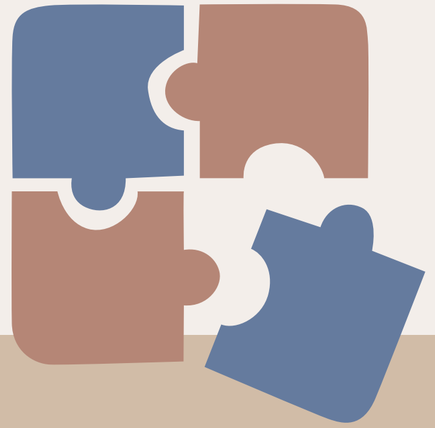
- Process stability using quality control methods
- Processes to meet customer specifications
- Minimize Total Cost of Quality through strategic investments

BACKGROUND OF THE SIMULATION

The simulation was structured around four key challenges:

Challenge 1: Establishing Process Control

- Calculate control limits using X-bar & R charts
- Set control baselines to prevent early-stage failures



Challenge 2: Real-time Monitoring & Control

- Monitor production using control charts.
- Maintain process stability to minimize defects.
- Manage process mean and variability
- Balance intervention costs

Challenge 3: Evaluating Process Capability

- Calculate Cpk for 4 scenarios: Hospital Laundry, Tea Shop, Filled Donuts, Tire Pressure
- Analyze control charts and defect frequencies
- Assess if processes met precision and quality standards

Challenge 4: Managing Cost of Quality

- Invest in prevention (training, equipment) and appraisal (inspection frequency)
- Minimize Total Cost of Quality

KEY CONCEPTS

Statistical Process Control (SPC):

- Used to monitor, control, and improve production processes using data.

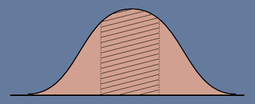
Control Charts:

- **X-bar Chart:** Tracks process mean; signals when corrective action is needed.
- **R Chart:** Tracks variation within samples; high variation indicates process instability.

KEY CONCEPTS

Process Capability Analysis:

- Cpk measures how well a process is performing relative to its specification limit and consistently meeting customer specifications.
- It checks if the process average is close to the target and how much variation there is.

Normal Distribution: 

- Cpk ≥ 1.33: Process is capable (good performance).
- Cpk < 1.33: Process may produce defects; improvement needed.

Non-Normal Distribution:

- Cpk ≥ 1.25: Process is considered capable.

Cpk Interpretation:

- **Highly** capable: 6 sigma, Cpk = 2.00
- **Good** performance: 4 sigma, Cpk = 1.33
- **Not** highly capable: 3 sigma, Cpk = 1.00

KEY CONCEPTS

Cost of Quality (COQ)

4 categories:

- **Prevention Costs:** Training, better equipment.
- **Appraisal Costs:** Inspections, audits.
- **Internal Failure Costs:** Rework, scrap.
- **External Failure Costs:** Warranty claims, product returns.

Control Limits vs. Specification Limits:

- **Control Limits:** Based on process data; used to monitor process behavior. (X-bar chart, R chart)
- **Specification Limits:** Set by customer requirements; define acceptable product performance (Cpk)

A process can be stable (within control limits) but fail to meet customer specifications.

KEY CONCEPTS

Quality Investment Decisions:

- Balance investments in prevention and appraisal to minimize failure costs.
- Focus on Return on Quality (ROQ) to ensure every dollar spent brings business value.

Continuous Improvement (PDCA Cycle):

- **Plan**: Identify issues and plan improvements.
- **Do**: Implement changes.
- **Check**: Analyze results.
- **Act**: Standardize successful changes or plan further improvements.

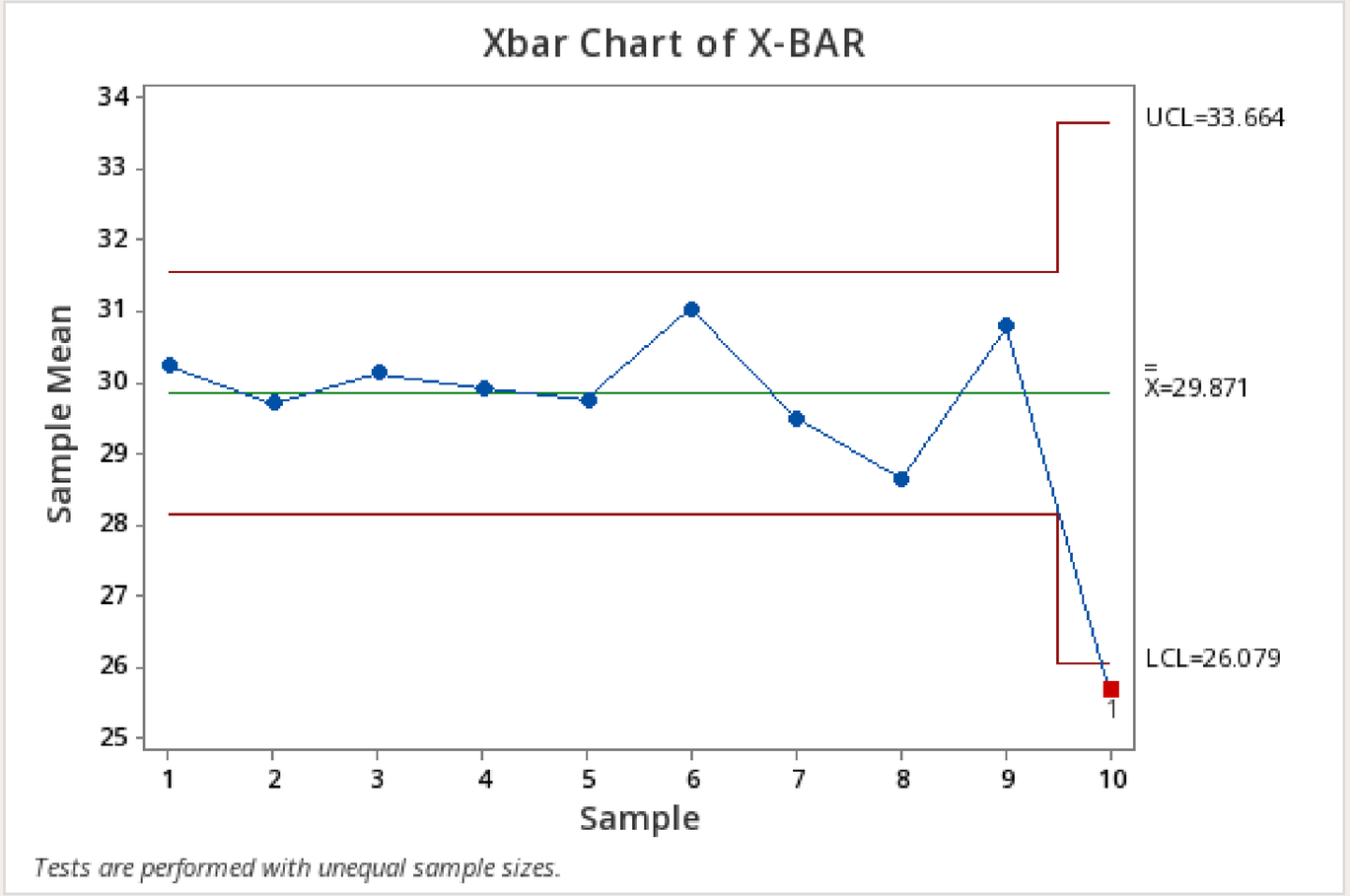
Purpose of Control Charts

Control charts help differentiate between common-cause and special-cause variation, ensuring that process adjustments are only made when necessary.

They provide real-time feedback, enabling timely interventions to maintain process stability and prevent defects.

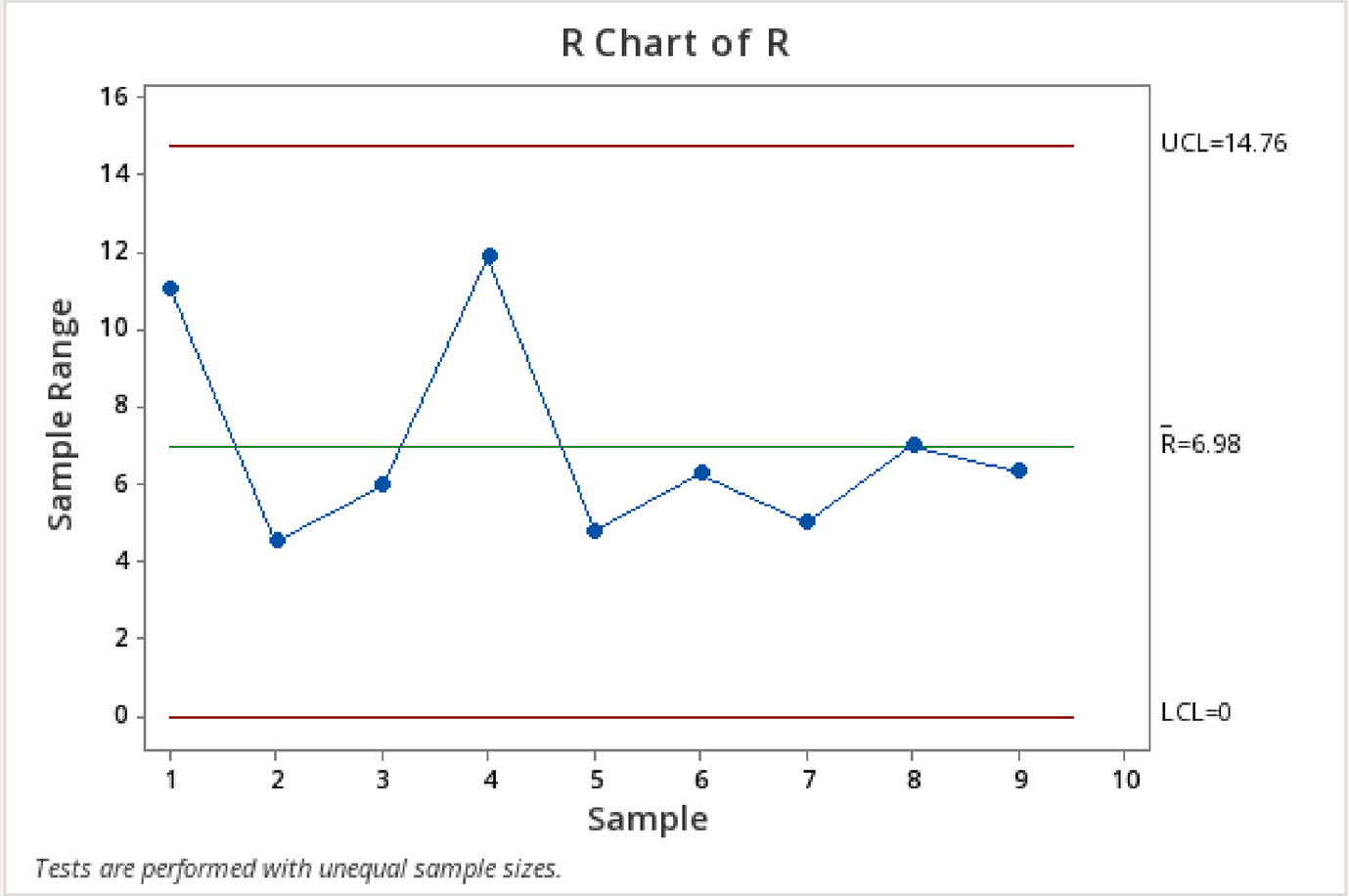
Visualization: X Bar Chart

- Sample 10 falls below LCL (out of control).
- Indicates an issue with consistency in process mean.



Visualization: R Chart

- All points within control limits.
- No patterns indicating instability.
- Process variation is stable.



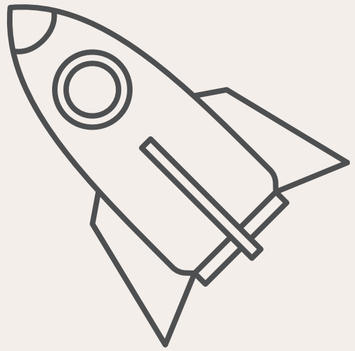
Process Adjusments

Action Taken:

- Limited recalibrations and labor changes to control costs.
- Focused on process stability before making changes.

Decision Criteria:

- Used X-bar and R charts to monitor real-time process variation.
- Adjustments triggered when points fell outside control limits (e.g., Sample 10 below LCL).



Outcome:

- Maintained a high yield (98%) while minimizing unnecessary interventions.

Insight:

- Early detection via SPC allowed for proactive, rather than reactive, adjustments.

Controlling total cost of quality: Strategies to Minimize Total Cost of Quality (TCQ)

Managerial Actions:

- Invest in prevention (e.g., labor training, equipment upgrades).
- Optimize appraisal through strategic sampling.
- Minimize internal/external failure costs through early detection.

Simulation Result:

- Final investments: $1,250 (Training), $4,000 (Equipment), $400 (QA).
- External failure cost remained high ($2,500); total COQ = $8,100.

Lesson:

- Small investment in suppliers or increased sampling could reduce external failures further.

Lessons Learned: Insights from the Simulation

- **Real-time Monitoring:** Control charts caught early signs of deviation.
- **Strategic Decision-Making:** Not all investments yield the same return—balance is key.
- **Capability Analysis:** Cp and Cpk values helped assess long-term performance.
- **Continuous Improvement:** Quality success relies on ongoing monitoring, adjustment, and investment.
- **Big Picture:** Quality tools are powerful when used proactively and strategically.

Serious Games & Simulations

How can serious games and simulations help improve the learner experience?

Immersive Experience	Personalized Pace
Increased Engagement	Real-World Application
Safe Practice	Teamwork Development
Simplifies Complexity	Data-Driven Feedback

Thank You