MEASI
Institute *of* Management

SIX SIGMA QUESTION BANK

UNIT 1: OVERVIEW & DEFINE PHASE

PART-A (Blooms Taxonomy K1/K2 - Remember/Understand)

1. Define Six Sigma and explain its statistical significance in process improvement.
2. List the five phases of the DMAIC methodology and state the primary objective of each phase.
3. What is a Project Charter in Six Sigma? Identify its key components.
4. Describe the concept of Voice of Customer (VOC) in Six Sigma projects.
5. What is a SIPOC diagram? Explain each component of the acronym.

PART-B (Blooms Taxonomy K3/K4 - Apply/Analyze)

1. Compare and contrast Six Sigma with Total Quality Management (TQM) and Lean Manufacturing. Analyze how these methodologies can complement each other in an organization.
2. Develop a Project Charter for a hospital seeking to reduce patient waiting time in the emergency department. Include business case, problem statement, goals, and team roles.
3. Analyze the relationship between variation and defects in a manufacturing process. How does reducing variation lead to improved process capability?
4. Apply the CTQ (Critical to Quality) tree methodology to translate customer requirements for a food delivery service into measurable specifications.
5. Examine the financial benefits of Six Sigma implementation. Calculate the potential cost savings if a process operating at 3 sigma level is improved to 4.5 sigma level (assume 1 million opportunities).

PART-C (Blooms Taxonomy K5/K6 - Evaluate/Create)

1. Evaluate the organizational readiness factors necessary for successful Six Sigma implementation. Design a comprehensive change management strategy for introducing Six Sigma in a traditional manufacturing company resistant to change.
2. Create a detailed stakeholder management plan for a Six Sigma project aimed at reducing defects in software development. Justify your approach for gaining executive support and managing resistance.
3. Synthesize the concepts of VOC, CTQ, and business objectives to design a Six Sigma project selection framework. Propose criteria and a scoring system for prioritizing multiple potential projects.
4. Critically evaluate the limitations of Six Sigma methodology. Under what circumstances would you recommend alternative quality improvement approaches, and why?
5. Design a comprehensive training and certification program for implementing Six Sigma across a multinational organization. Include curriculum structure, certification levels, and mechanisms for sustaining the culture.

UNIT 2: MEASURE PHASE

PART-A (Blooms Taxonomy K1/K2 - Remember/Understand)

1. Define Process Capability and explain the difference between Cp and Cpk indices.
2. What is Measurement System Analysis (MSA)? State its importance in the Measure phase.
3. Distinguish between continuous data and discrete data with suitable examples.
4. Explain the concept of Process Sigma Level and how it relates to defects per million opportunities (DPMO).
5. What are the key components of a Data Collection Plan in Six Sigma?

PART-B (Blooms Taxonomy K3/K4 - Apply/Analyze)

1. Conduct a Gage R&R study for a measurement system with the following components: repeatability variance = 0.04, reproducibility variance = 0.03, part-to-part variance = 0.25. Analyze whether the measurement system is acceptable.
2. A process produces parts with a specification of 50 ± 5 mm. Sample data shows a mean of 51 mm and standard deviation of 1.5 mm. Calculate Cp, Cpk, and the process sigma level. Interpret your results.
3. Develop a comprehensive Data Collection Plan for measuring customer service call resolution time. Include sampling strategy, operational definitions, and data collection forms.
4. Analyze the differences between common cause variation and special cause variation. Using a manufacturing example, demonstrate how to identify each type through statistical methods.
5. Apply process mapping techniques to document the as-is process for an online order fulfillment system. Identify measurement points and potential sources of variation.

PART-C (Blooms Taxonomy K5/K6 - Evaluate/Create)

1. Evaluate the measurement system capability for a quality characteristic where the total variability is composed of 60% process variation and 40% measurement variation. Design an improvement strategy to enhance measurement system quality.
2. Create a comprehensive baseline performance dashboard for a hospital emergency department measuring patient flow. Synthesize multiple metrics including cycle time, wait time, and resource utilization using appropriate statistical displays.
3. Design a probability sampling strategy for a service organization with 50 locations nationwide. Justify your sample size calculation and stratification approach to ensure representative data collection.
4. Critically assess the limitations of using normal distribution assumptions in process capability analysis. Propose alternative approaches for non-

normal data and defend your recommendations with statistical reasoning.

5. Synthesize the concepts of process capability, measurement system capability, and statistical process control to develop a comprehensive quality assessment framework for a pharmaceutical manufacturing process.

UNIT 3: ANALYZE PHASE

PART-A (Blooms Taxonomy K1/K2 - Remember/Understand)

1. Define Root Cause Analysis and list three common tools used for identifying root causes in Six Sigma.
2. What is a Pareto Chart? Explain the 80-20 rule associated with it.
3. Describe the purpose of a Fishbone (Ishikawa) diagram in the Analyze phase.
4. What is Value-Added Analysis? Differentiate between value-added and non-value-added activities.
5. Explain the concept of data stratification and its importance in Six Sigma analysis.

PART-B (Blooms Taxonomy K3/K4 - Apply/Analyze)

1. Construct a Pareto chart from the following defect data: Scratches (45), Dents (30), Color mismatch (15), Dimension error (8), Cracks (2). Analyze which defects should be prioritized for improvement.
2. Develop a comprehensive Cause and Effect diagram for high employee turnover in a call center. Include at least four major categories with multiple sub-causes.
3. Apply hypothesis testing to determine if there is a significant difference in defect rates between two production shifts. Given: Shift A = 5.2% defects (n=500), Shift B = 3.8% defects (n=500), α=0.05.

4. Analyze process flow data using a detailed process map to identify bottlenecks and non-value-added steps in a loan approval process. Calculate cycle efficiency.

5. Use scatter diagram analysis to examine the relationship between temperature (X) and product yield (Y). Interpret correlation coefficient r = 0.82 and determine if the relationship is statistically significant.

PART-C (Blooms Taxonomy K5/K6 - Evaluate/Create)

1. Evaluate multiple root cause analysis techniques (5 Whys, Fishbone, Fault Tree Analysis) for investigating a critical safety incident in manufacturing. Design an integrated approach that leverages the strengths of each method.

2. Create a comprehensive Design of Experiments (DOE) plan to optimize three factors (temperature, pressure, time) in a chemical process. Justify your choice of design type, number of runs, and factor levels.

3. Synthesize qualitative and quantitative analysis techniques to investigate customer complaints about product reliability. Design a mixed-methods approach combining Affinity diagrams, FMEA, and statistical analysis.

4. Critically evaluate the validity of correlation versus causation in process analysis. Design a statistical framework to establish causal relationships between process inputs and outputs.

5. Develop a complete FMEA (Failure Modes and Effects Analysis) for a new product launch. Calculate Risk Priority Numbers (RPN) and propose a prioritization system for mitigation actions that considers both statistical and business factors.

UNIT 4: IMPROVE PHASE

PART-A (Blooms Taxonomy K1/K2 - Remember/Understand)

1. Define Quality Function Deployment (QFD) and explain the purpose of the House of Quality.

2. What is Poka-Yoke? Provide three examples of mistake-proofing devices.

3. List the key components of an Implementation Plan for a Six Sigma improvement solution.
4. Explain the concept of piloting in the Improve phase. Why is pilot testing important before full-scale implementation?
5. What is Design of Experiments (DOE)? State its main objectives in process improvement.

PART-B (Blooms Taxonomy K3/K4 - Apply/Analyze)

1. Conduct a brainstorming session followed by multi-voting to select improvement solutions for reducing order processing errors. Given 8 potential solutions, demonstrate the multi-voting process to narrow down to the top 3.
2. Develop a House of Quality (QFD matrix) for a smartphone product, relating customer requirements (battery life, screen quality, speed, camera) to technical specifications. Include competitive assessment.
3. Design a 2^3 factorial experiment to optimize yield in a chemical process with factors: Temperature (Low/High), Catalyst amount (Low/High), and Mixing time (Low/High). Create the design matrix and explain the analysis approach.
4. Apply FMEA to evaluate proposed improvement solutions for a service process. Calculate RPN values before and after improvements for at least three failure modes.
5. Analyze a pilot test result where the new process showed 2.5% defect rate (n=400) compared to the baseline of 4.5%. Determine if the improvement is statistically significant and recommend next steps.

PART-C (Blooms Taxonomy K5/K6 - Evaluate/Create)

1. Evaluate different solution selection criteria (cost, feasibility, impact, time) for a Six Sigma project. Create a weighted decision matrix that balances short-term results with long-term sustainability.
2. Design a comprehensive pilot implementation plan for a new patient admission process in a hospital. Include success metrics, risk mitigation strategies, rollback plans, and stakeholder communication protocols.

3. Synthesize DOE methodology, FMEA, and cost-benefit analysis to optimize a manufacturing process with multiple conflicting objectives (quality, cost, speed). Propose a multi-objective optimization framework.

4. Create an innovative mistake-proofing system for preventing medication errors in hospital pharmacies. Integrate technology solutions with human factors engineering principles.

5. Critically assess the change management challenges associated with implementing Six Sigma improvements. Design a comprehensive change management strategy that addresses resistance, training needs, and cultural transformation.

UNIT 5: CONTROL PHASE & ADVANCED TOPICS

PART-A (Blooms Taxonomy K1/K2 - Remember/Understand)

1. Define Statistical Process Control (SPC) and explain its role in the Control phase.

2. What is a Control Plan? List the essential elements that should be included.

3. Distinguish between X-bar and R charts. When is each type of control chart used?

4. Explain the concept of Design for Six Sigma (DFSS) and how it differs from traditional DMAIC.

5. What is an Operating Characteristic (OC) curve? Describe its significance in acceptance sampling.

PART-B (Blooms Taxonomy K3/K4 - Apply/Analyze)

1. Construct an X-bar and R chart for a process with the following sample data (5 samples of size n=4). Analyze the process for statistical control and identify any out-of-control conditions.

2. Develop a comprehensive Process Control Plan for a critical manufacturing process. Include process parameters, specifications, measurement methods, sampling frequency, and response plans.

3. Apply the DMADV (Define-Measure-Analyze-Design-Verify) methodology to develop a new customer service process from scratch. Compare this approach with DMAIC.

4. Analyze an attribute control chart (p-chart) with 20 subgroups showing an average proportion defective of 0.04 and sample size n=100. Calculate control limits and interpret process stability.

5. Use acceptance sampling to design a sampling plan with AQL=1.5%, LTPD=6%, α=0.05, and β=0.10. Determine sample size and acceptance number using OC curve principles.

PART-C (Blooms Taxonomy K5/K6 - Evaluate/Create)

1. Evaluate the effectiveness of different control chart types (variables vs. attributes, traditional vs. advanced) for monitoring a high-speed automated production line. Design a multi-layered SPC system.

2. Create a comprehensive Six Sigma project closure and knowledge transfer plan. Include documentation requirements, lessons learned capture, process standardization, and mechanisms for sustaining improvements.

3. Synthesize DFSS principles with traditional product development processes to design a new product development framework. Integrate DFX concepts (Design for Manufacturing, Assembly, Reliability, etc.).

4. Critically evaluate the challenges of sustaining Six Sigma improvements over time. Design a governance structure and monitoring system that prevents process degradation and ensures continuous improvement culture.

5. Develop an integrated quality management system that combines Six Sigma methodologies with ISO 9001 requirements. Create an implementation roadmap that demonstrates compliance while driving operational excellence.

MEASI
Institute *of* Management