Southwest Center for Microsystems Education (SCME)
University of New Mexico

Statistical Process Control (SPC) Learning Module

This learning module contains:
Knowledge Probe (Pre-test)
Introduction to Statistical Process Control (Primary Knowledge)
Control Chart Basics (Primary Knowledge)
Activity – Apply SPC to Resistance Measurements
A MEMS Process Activity*
Final Assessment (2 – multiple choice and short answer)

**A MEMS Process activity can be found in the SCME Systematic Approach to Problem-Solving Learning Module. SPC is used to solve a real process problem.*

Statistical Process Control or SPC is a set of tools used for continuous improvement and the assurance of quality in an active manufacturing process. This learning module introduces some of the SPC tools used by technicians and engineers, including one of the most common tools - control charts. Activities provide the opportunity to demonstrate an understanding of control charts using select sets of data.

Target audiences: High School, Community College, University, Industry Technicians

Made possible through grants from the National Science Foundation Department of Undergraduate Education #0830384, 0902411, and 1205138.

Any opinions, findings and conclusions or recommendations expressed in this material are those of the authors and creators, and do not necessarily reflect the views of the National Science Foundation.

SPC Knowledge Probe (KP) Pre-test
Participant Guide

Knowledge Probe

Statistical Process Control or SPC is a set of tools used for continuous improvement and the assurance of quality in an active manufacturing process. This learning module introduces some of the SPC tools used by technicians and engineers, including one of the most common tools - control charts. Activities provide the opportunity to demonstrate an understanding of control charts using select sets of data.

This knowledge probe determines your current knowledge of Statistical Process Control and how it relates to MEMS fabrication. There are 15 assessment questions below. Answer each of these questions to the best of your knowledge.

1. Which of the following is NOT subject to variation?
    a. Size of an egg
    b. Measurement of flour for a cake
    c. The answer to 2 + 2
    d. Amount of cereal in a box

2. Which of the following BEST describes variation in a manufacturing environment?
    a. Common cause variation is naturally occurring; special cause variation is background noise.
    b. Common cause variation is predictable, special cause variation is not predictable.
    c. Natural variation is background noise that is expected, special cause variation is inherent to the process.
    d. Any variation in a process is undesirable and one should strive to reduce or eliminate it if possible.

3. What specific method in manufacturing is used to monitor variation?
    a. Design of Experiments (DOE)
    b. Statistical Process Control (SPC)
    c. Continuous Quality Control
    d. Lean Manufacturing

4. Which of the following BEST describes the goal of Statistical Process Control (SPC)? The goal of SPC is to…
    a. provide statistical information about a process and how specific process parameters are varying over time.
    b. eliminate or reduce any and all variation from each step in a manufacturing process.
    c. improve a process through daily observations, adjustments, and data gathering.
    d. provide process technicians with data that allow them to make adjustments to a process before it goes out of control.

5. Which of the following statistical calculations is NOT commonly used in Statistical Process Control?
    a. Mean
    b. Standard deviation
    c. Range
    d. Mode

6. Most of the data used in Statistical Process Control is assumed to have what type of distribution?
    a. Even
    b. Normal
    c. Poisson
    d. Logarithmic

7. What is the tool most commonly used to monitor daily variation in a manufacturing process?
    a. Histograms
    b. Pareto Charts
    c. Control Charts
    d. Process Flowcharts

8. Which of the following BEST describes a control chart?
    a. Identifies common and special variation that can exists in a process
    b. Shows the variation of a process over time using actual process data
    c. Uses process data to determine how a process is meeting process specifications
    d. Identifies parameters that can be adjusted to reduce process variation

9. What type of data is plotted on an xbar-R Control Chart?
    a. Variable
    b. Normal
    c. Attribute
    d. Logarithmic

10. What are the main calculated components of a Control Chart?
    a. Target (centerline), Upper Tolerance Limit, Lower Tolerance Limit
    b. Target (centerline), Upper Specification Limit, Lower Specification Limit
    c. Target (centerline), Upper Control Limit, Lower Control Limit
    d. Target (centerline), +One Standard Deviation, -One Standard Deviation

11. Which of the following can NOT be identified with Control Charts?
    a. A process that is shifting high or low
    b. The natural variation of a process
    c. A special cause present in the process
    d. The cause of process variation

12. Control Limits are determined by _____. Specification limits are determined by _____.
    a. The management, the customer
    b. the customer, the process
    c. the process, the customer
    d. the process, management

13. An X-bar chart uses the following statistical calculation as its target.
    a. Mean
    b. Mode
    c. Range
    d. Standard deviation

14. The term "six sigma" refers to which of the following?
    a. The sum of the first six data points on a control chart
    b. The sum of the last six data points on a control chart
    c. The mean plus and minus three times the standard deviation
    d. The mean plus and minus the standard deviation

15. When a control chart shows that a process is out of control (OOC),…
    a. the control chart will tell you how to fix the problem by studying the historical data.
    b. you refer to company OOC procedures to know how to proceed.
    c. you call the process engineer to help you troubleshoot the problem.
    d. you can assume that the data in your control chart is incorrect and needs to be rechecked.

Support for this work was provided by the National Science Foundation's Advanced Technological Education (ATE) Program through Grants. For more learning modules related to microtechnology, visit the SCME website (http://scme-nm.org).