SSD Global Solutions

Lean Six Sigma Yellow Belt

Training and Certification Study Guide

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Training and Certification Study Guie 2nd Edition

Accelerated Learning Systems

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The information contained in this document is of a general nature.

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About the Test

System Service and Delivery, Inc. aka SSD Global Solutions, Inc. (SSD) offers an on-line open-book exam for individuals interested in receiving Lean Six Sigma (LSS) Yellow Belt certification. Most exams related to quality topics, even advanced tests, are offered as open book exercises. However, questions, in accordance with industry standards, will only be successfully answered if a student has the knowledge base necessary. Therefore, notes, textbooks and additional study material should be considered reference items.

The SSD LSS Yellow Belt Certification Exam assumes the student has participated in an SSD course covering Yellow Belt topics for no less than 12 hours of classroom training accomplished via video, on-line live instruction or by an instructor-led class.

Students who have taken courses through other authorized service providers such as those related to accredited universities or ASQ are also candidates to sit for the exam. Students who have taken 16 hours of internal training through their company or have completed approximately 30 hours of independent study by also apply. Questions verifying these conditions are included on the exam. Answers to these questions may be subject to random audit.

The test works from a databank of 1,000 questions. 105 questions comprised of True/False, multiple choice, checked response where several choices may be made and short answer. The proper spelling of short answer questions is necessary.

The test is timed and times out after 2 hours. Most students finish in a much shorter time frame but extra time is provided for short breaks.

Students must have a 75% or higher score to receive a certificate. Student scoring less than 75% will be provided additional options at no extra charge. Certificates are mailed to students but can be sent electronically and include a graduation month/year along with a certification number.

Lean Six Sigma Yellow Belt
Basic Competency Model

SSD Global Solutions, Inc. (SSD) supports the concept that all process improvement programs are rooted in Total Quality Management (TQM) concepts and that process improvement begins with a firm understanding of Project Management basics. And, that if, basic project management is not in place; project management is the process improvement.

SSD Competency Performance Criteria for Yellow Belt Candidates

High-level understanding of the following:

- basic DMAIC (Define, Measure, Analyze, Improve, Control) Concept
- PDCA (Plan-Do-Check-Act) Model
- how Lean and Six Sigma work together

Ability To Explain the General Roles and Responsibilities of Lean Six Sigma Human Resources to Include:

- Master black belt
- Black belt
- Green belt
- Yellow belt
- White belt
- Champion
- Sponsor
- Process owner

Ability to Identify the 7 Tools Of Quality and Their Overall Purpose

- Fishbone
- Check sheet
- Flow Chart
- Histogram
- Pareto Chart
- Scatter Diagram
- Control Chart

Exposure/Understanding of Basic Project Management

- Project Charter
- Process Mapping
- Opening and Closing a project
- Basic project management tools

Understanding of the Importance of the Following as it Relates to Lean Six Sigma

- VOC, VOB, VOE and VOP (Voices of customer, business, employee and process)
- SIPOC model (Supply-Input-Process-Output-Customer)
- CTQ (Critical to Quality)
- Benchmarking

Ability to Explain why Lean Six Sigma is Important for Process Improvement and How it Relates to Other Process Improvement Programs

MODULE 1

Introduction to Lean Six Sigma for Yellow Belt Candidates

It is not necessary know everything about Lean Six Sigma (LSS) to use the methodology successfully. The purpose of this study guide is not only to provide the student with necessary information to pass the LSS Yellow Belt certification exam but also to offer an overview of this powerful critical thinking process.

All process improvement programs aim to take an existing process (activities that are already happening) and make that process better, faster or more cost-effective. LSS considers anything with a step-by-step approach a process.

LSS relies on a collaborative team effort to improve performance. The goal is to systematically reduce mistakes and waste. Mistakes in manufacturing are called defects. LSS combines two powerful process improvement programs, Lean Manufacturing, which morphed into Lean Thinking, along with Six Sigma. Although both methodologies started in manufacturing, by the early 1990s both programs – Lean and Six Sigma - were being applied to the service and IT sectors.

The Lean Six Sigma concept – combining both Lean and Six Sigma to make a hybrid process improvement effort – was first published in a book titled *Lean Six Sigma: Combining Six Sigma with Lean Speed* in 2002 by Michael George and Robert Lawrence. However by the late-1990s companies such as Allied Signal and Maytag had already discovered the benefits of combining Lean and Six Sigma.

The training for Lean Six Sigma is provided through a belt-based training system. This system recognizes each knowledge/experience level accomplished by a student in a fashion similar to Karate. The belts are designated as white belts, yellow belts, green belts, black belts and master black belts.

Students advance through the belt system based on their abilities, training and testing, However all students of Lean Six Sigma work from the same playbook or Body of Knowledge. In other words, the methodology and tools do not change.

All process improvement opportunities eventually become a project to complete. This is why basic project management is a key to being a good LSS practitioner. Process improvement starts with a problem statement. The statement may be a real problem or just a goal to make an existing process better, faster or more cost-effective.

If project manager already knows how to solve the problem or perform the activity successfully they may not need to apply LSS. LSS shines when there is a problem that needs to be solved or an activity that needs to be performed but the path is unclear. LSS enhances critical thinking skills so the manager can reason out the best possible solution.

What makes a good Lean Six Sigma project? It is very simple. Is there something you are already doing that you can make better, faster or more cost effective?

The process begins with a project charter. A project charter is simply a request to work on problem. Some companies have a formal form or template that they use when requesting permission to work on a project. Some companies are less formal but, at the very least, an email containing the following bullet points should be considered:

- Reasons for the undertaking
- Objectives and constraints of the project
- Directions concerning the solution
- Identities of the main stakeholders

After the charter has been accepted it is necessary to determine the methodology to be used. If the project manager knows the direction, then basic project management theory may be applied. This starts with creating a project plan (or to do list) with the major components that need to be completed. These tasks are then assigned a timeframe and cost. If the project manager is not working alone these task may also include a human resource.

If the project manager does not know how to solve the problem or satisfy the requirement an option is to adopt a LSS attitude. This begins with selecting a methodology to follow. LSS recognizes the Plan-Do-Check-Act model as a method. However, the flagship model is Define-Measure-Analyze-Improve-Control (DMAIC).

To function in an LSS environment, students need to understand the basics of the DMAIC model.

MODULE 2

The DMAIC Model Basics

Define ® Measure ® Analyze ® Improve ® Control

The DMAIC Model is composed of five phases: Define, Measure, Analyze, Improve and Control. DMAIC refers to a data-driven improvement cycle used for improving, optimizing and stabilizing business processes and designs. The **DMAIC** improvement cycle is the core tool used to drive Six Sigma projects

The DMAIC model is used to improve the effectiveness and efficiency of organizational processes. Collectively, the process becomes a powerful tool to lead an organization to stronger performance standards and can be skillfully used to streamline resources and clarify business goals. Whereas most advanced courses in LSS require the student complete a project using the DMAIC model, and we are no exception, SSD asserts that the DMAIC model can also be used in DMAIC thinking. In other words the steps can be scaled down to handle even simple problems.

After each phase of the model a toll gate review is performed.

A toll gate is a list of questions that need to be answered before moving to the next phase. Think of the toll gate as a checklist to ensure everything has been completed. In straight Six Sigma it is rare to start activities on a phase until the previous phase is complete. Lean Six Sigma is a little more flexible. In other words, if there is an opportunity in Define to satisfy some of the Measure requirements those are taken into consideration. Remember Lean Six Sigma is about speed and efficiency as well as getting good solid data.

DEFINE

In the Define portion of the DMAIC model, the goal should be that everyone understands the problem that is being tackled. This includes the project manager. Unlike other problem solving models, the DMAIC model, specifically in step one, DEFINE, wants to ensure that the problem selected maps to the business goals and that the project manager feels comfortable that they have selected the right problem.

The core “Define” activities should include:

- Project Name and Purpose
- Complete Project Charter (Required)
- Develop a High-Level Process Map (Required)
- Identify Process Owner, Champion, Team
- Define Customers and Requirements (CTQ)
- Align Goals with Business Initiatives
- Determine Projected ROI

Tools that will help in this phase include:

- Brainstorming
- Project Charter Template
- Graphing Software/House of Quality
- Stakeholder’s Analysis
- SIPOC Diagram/VOC Gathering
- Historical Data
- ROI Formulas and Cost/Benefit Analysis

MEASURE

In the MEASURE phase the goal is to get a clear snapshot of what is happening NOW! This view needs to not be bias as it forms the “before” picture.

The core “Measure” activities should include:

- Determining what should be measured
- How to Measure
- How to Explain through a Data Collection Plan the Purpose and End Result Anticipated
- There are a number of tools that can make this easier to included:

    - A More Detailed Process Map
    - Scorecards
    - ROI Formulas
    - Sigma Calculation
    - Benchmarking Studies
    - Industry metrics
    - Observation

At the end of Measure, you should have a clear picture of how things look today.

ANALYZE

In the Analyze phase Measure is examined. Why do things look the way they do? Variance for the purpose of reducing the variance is studied. Other items include:

- Defining performance objectives
- Identifying value added and non-value activities
- Determining root cause
- Checking for correlation

Tools that will help in this phase include:

- Voice of the Customer
- Voice of the Employee
- Voice of the Process
- Voice of the Business
- Historical Data
- Seven Quality Tools
- Fishbone
- Flowchart
- Check Sheets
- Pareto Chart
- Histogram
- Scatter Diagram
- Control Chart
- The 5 Whys

At the end of the Analyze phase you should have 3-5 Solutions to the Problem Statement

IMPROVE

The core “Improve” activities should include:

- Listing Potential Solutions
- Ranking Solutions
- Selecting Solution
- Piloting the idea
- Double Check Results
- Roll Out
- Evaluate and Correct

Tools that will help in this phase include:

- Brainstorming
- Decision Matrix
- SWOT analysis on solutions

- Capability Studies
- Pilot, Simulation, or Focus Group
- Failure Mode Effects Analysis (FMEA)
- Project Management Software
- Evaluation Plan or Template.

CONTROL:

In Control you verify the ROI, benefits, cost saving/ cost avoidance and make a plan for sustainability.

The core “Control” activities should include:

- Verify Benefit
- Document Procedures to Standardize
- Re-Write/Update Standard Operating Procedures or Policies
- Transition Plan

Tools that will help in this phase include:

- On-line Sigma Calculator
- Return on Investment or Cost-Saving formula
- Control Plan Template
- Transition Plan Template

Remember this is just a quick start. The more that is known about the Lean Six Sigma methodology and tools the higher the rate of success. But, learning can work in tandem with doing the first project.

MODULE 3

Lean Six Sigma Key Terms

Affinity Diagram - Organizes brainstorming ideas into categories or themes. Useful when there are large amounts of information collected during a brainstorming session. It is also called the KJ method, after Kawakita Jiro (a Japanese anthropologist) who first developed the idea.

ANOVA - Analysis of Variance – This is a statistical test done by comparing the variances around the means of the conditions being compared. In its simplest form ANOVA gives a statistical test of whether the means of several groups are all equal.

ANOVA Gauge R&R - measures the amount of variability induced in measurements by the measurement system itself, and compares it to the total variability observed to determine the viability of the measurement system

Attribute Data - Data which on one of a set of discrete values such as pass or fail, yes or no. It is purely binary in nature. Attributes data are qualitative data that can be counted for recording and analysis.

Average - Also called the mean, it is the arithmetic average of all of the sample values. It is calculated by adding all of the sample values together and dividing by the number of elements (n) in the sample.

Balanced Scorecard – is a performance management approach that focuses on customer perspective, internal-business processes, and learning and growth and financials. It was originated by Drs. Robert Kaplan (Harvard Business School) and David Norton as a performance measurement framework that added strategic non-financial performance measures to traditional financial metrics to give managers and executives a more 'balanced' view of organizational performance.

Benchmarking – a standard used to compare performance against best-in-class companies. It then uses the information gathered to improve its own performance. Subjects that can be benchmarked include strategies, products, programs, services, operations, processes, and procedures.

Breakthrough Improvement – a rate of improvement at or near 70% over baseline performance of the as-is process characteristic.

Capability - measurement index that expresses the capability of the process by suing a percentage.

Cause and Effect Diagram – also called a fishbone diagram. This is a graph that places the issue being discussed in the head of the fish. The bones of the fish are categories of problems that could be a problem. The smaller bones are the possible root causes.

Central Tendency – data clustered around the middle. Mean, mode and median are all examples of central tendency

Champion – a person who supports the successful completion of the project.

Characteristic - a process input or output which can be measured and monitored.

Common Causes of Variation - sources of variability in a process which are truly random. These are generally inherent in the process itself and can be managed. This type of variation is usual, historical, quantifiable variation in a system.

Complexity -The level of difficulty to build, solve or understand something based on the number of inputs, interactions and uncertainty involved.

Control Chart - The most powerful tool of statistical process control. It consists of a run chart, together with statistically determined upper and lower control limits and a centerline.

Control Limits - Upper and lower bounds in a control chart that are determined by the process itself. They can be used to detect special or common causes of variation.

Cost of Poor Quality (COPQ) - The costs associated with any activity that is not doing the right thing right the first time.

Critical to Quality (CTQ) – Any activity or thought related to the successful outcomes of the project.

Cell. A cell is a group of people, machines, materials, and methods arranged so that processing steps are located adjacent to each other and in sequential order. This allows parts to be processed one at a time or, in some cases, in a constant small batch that is maintained through the process sequence. The purpose of a cell is to achieve and maintain an efficient, continuous flow of work.

Continuous flow. Each process, whether in an office or plant setting, makes or completes only the one piece that the next process needs; the batch size is one. Single-piece flow, or one-piece flow, is the opposite of a batch-and-queue process.

Cycle time. This is the time a person needs to complete an assigned task or activity before starting again.

Defect - An output of a process that does not meet a defined specification, requirement or desire such as time, length, color, finish, quantity, temperature etc.

Defective - A unit of product or service that contains at least one defect.

Design of Experiments (DOE) - an efficient, structured, and proven approach to interrogating a process or system for the purpose of maximizing the gain in process or system knowledge.

Design for Six Sigma (DFSS) - The use of six sigma thinking, tools and methods applied to the design of products. Any Six Sigma model for managing a project, that is not DMAIC, is generally considered a DFSS.

DMAIC - This acronym stands for "define, measure, analyze, improve, and control. It is the heart of the Six Sigma process and refers to a data-driven quality strategy for improving processes. It is an integral part of any company's Six Sigma quality initiatives.

DPMO - Defects per million opportunities - The total number of defects observed divided by the total number of opportunities, expressed in parts per million.

DPU - Defects per unit - The total number of defects detected in some number of units divided by the total number of those units.

Failure Mode and Effects Analysis (FMEA) - A procedure used to identify, assess, and mitigate risks associated with potential product, system, or process failure modes

Fishbone Diagram - See cause and effect diagram.

Flowchart - A graphic model of the flow of activities, material, and/or information that occurs during a process.

Gage R&R – is used in Measurement Systems Analysis (MSA) Quantitative assessment of how much variation (repeatability and reproducibility) is in a measurement system compared to the total variation of the process or system.

Histogram - A bar chart that depicts the frequencies (by the height of the plotted bars) of numerical or measurement categories.

Input - A resource consumed, utilized, or added to a process or system. Synonymous with X, characteristic, and input variable.

JIT- stands for "just in time." This means producing or conveying only the items that are needed by the next process when they are needed and in the quantity needed. This process can even be used between facilities or companies.

Kaizen Event – a rapid improvement event**.**

Lean – a thought process that identifies waste from the customer's perspective and then determines how to reduce or eliminate.

Linear regression - analyzes the relationship between two variables, X and Y.

Long-term Variation - The observed variation of an input or output characteristic which has had the opportunity to be observed over time.

Lower Control Limit (LCL) - used in control charts to show the lower limit. Typically, three standard deviations below the central tendency.

Measurement Accuracy - For a repeated measurement, it is a comparison of the average of the measurements compare to some known standard.

Measurement Precision - For a repeated measurement, it is the amount of variation that exists in the measured values.

Median - The middle value of a data set when the values are arranged in either ascending or descending order.

Metric - A measure that is considered to be a key indicator of performance. It should be linked to goals or objectives and carefully monitored.

Non-Value Added (NVA) - Any activity performed in producing a product or delivering a service that does not add value.

Normal Distribution - The distribution characterized by the smooth, bell- shaped curve.

Overproduction – the process of producing more, sooner, or faster than is required by the next process or customer.

Poka Yoke - mistake-proof device or procedure designed to prevent a defect from occurring throughout the system or process. Error-proofing is a manufacturing technique of preventing errors by

designing the manufacturing process, equipment, and tools so that an operation literally cannot be performed incorrectly. Poka Yoke is the Japanese phrase for do it right the first time.

Process Owner - have responsibility for process performance and resources. They provide support, resources and functional expertise to six sigma projects. They are accountable for implementing developed six sigma solutions into their process.

Quality Function Deployment (QFD) - A systematic process used to integrate customer requirements into every aspect of the design and delivery of products and services. Output graphic is often the House of Quality.

Regression Analysis - includes any techniques for modeling and analyzing several variables. Linear regression was the first type of **regression analysis** to be studied rigorously, and to be used extensively in practical applications.

Repeatability (of a Measurement) - the extent to which repeated measurements of a particular object with a particular instrument produce the same value.

Reproducibility (of a Measurement) - The extent to which repeated measurements of a particular object with a particular individual produce the same value.

Rework - Activity required to correct defects produced by a process.

Short Term Variation - The amount of variation observed in a characteristic which has not had the opportunity to experience all the sources of variation from the inputs acting on it.

Special Cause Variation - non-random causes of variation. Sometimes outside the project manager's control.

Specification Limits – the boundaries of acceptable performance

Standard Deviation - One of the most common measures of variability in a data set or in a population. It is the square root of the variance.

Statistical Process Control (SPC) - use of basic graphical and statistical methods for measuring, analyzing, and controlling the variation of a process for the purpose of continuously improving the process.

Supplier – vendor on entity responsible for providing an input to a process in the form of resources or information.

Takt time – rate of demand from a customer. It is the available operating time for the requirement.

Theory of constraints - theory describes the methods used to maximize operating income when an organization is faced with bottleneck operations. This theory also deals with how to handle the unknown.

Trend - A gradual, systematic change over time or some other variable.

Value. This term refers to a product or service capability that is provided to a customer at the right time and at an appropriate price.

Value stream - all activities, both value added and non-value added, that are required to bring a product, group, or service from the point of order to the hands of a customer and a design from concept to launch to production to delivery.

VOB - The voice of the business is derived from financial information and data.Voice of the business - Represents the needs of the business and the key stakeholders of the business. It is usually items such as profitability, revenue, growth, market share, etc.

VOC - Voice of the customer - Represents the expressed and non-expressed needs, wants and desires of the recipient of a process output, a product or a service. It is usually expressed as specifications, requirements or expectations.

VOE – Voice of the employee. Represents the expressed and non-expressed needs, wants and desires of what the employee needs to be successful.

VOP - Voice of the process - represents the performance and capability of a process to achieve both business and customer needs.

X – Input

Y – Output

Waste (Muda) - includes anything that does not add value to a final product or service.

WIP (Work in process). These are items--material or information--that are between machines, processes, or activities waiting to be processed.

MODULE 5

Testing Information and Tips

The test is multiple choice, true/false and short answer.

The test is timed and usually takes a little over an hour. You will have two hours to complete so that you don't feel rushed. Review this guide and the study notes you have from your on-line course or self-study specifically relating to the DMAIC model.

If you pass with 75% or more you will be contacted by an SSD Global Solutions representative who will record your certificate number in our database and mail you a hard copy.

If you need to have an employer verify this they may call Margi, leave a message in our general mailbox or email our company at SixSigma@SSDGlobal.net. All of our contact information is located on our website on the Contact Us Site.

When you are ready to take this test, simply click the link below.

Lean Six Sigma Yellow Belt Exam

Use your own email when signing into the test. Your password is 80433.

If you Need additional study tools, just contact Alex.Ramsey@SSDGlobal.net.