



Software Quality Engineer and Six Sigma Black Belt Certifications

Earning these certifications and focusing on quality to improve your organization's projects and products

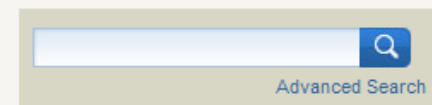
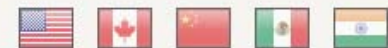


American Society for Quality Overview

- ASQ has nearly 80,000 members worldwide. For more on ASQ membership, you can visit their website.
- ASQ currently offers 17 certifications. Some are specific to software quality, others are specific to other industries, and some, such as the SSBB, are applicable to many industries.
- Over 11,000 people have passed the Six Sigma Black Belt certification exam.
- Over 5,000 have passed the Software Quality Engineer exam.



ASQ is a global community of people passionate about quality, who use the tools, their ideas and expertise to make our world work better. ASQ: The Global Voice of Quality.





CSQE Application Requirements

- 8 years work experience, including 3 in a decision making role
 - *Up to 5 years work experience can be waived for higher education (ex: 4 years for a bachelors degree)*
 - *“DECISION MAKING” is defined as having the authority to define, execute, or control projects/processes and being responsible for the outcome*
 - *Your work experience or resume must be provided with the application.*
- Exam Fee of \$259 for ASQ members or \$399 for non members



CSSBB Application Requirements

- 2 Signed Affidavits for SS projects, OR
- 1 Signed Affidavit and 3 years experience in one or more of the BOK areas.
- No consideration is given for education.
- Exam Fee of \$299 for ASQ members or \$449 for non members



CSQE Description, Per ASQ

- Understands software quality development and implementation including software inspection, testing, verification, and validation. Implements software development and maintenance processes and methods.

<http://asq.org/certification/right-for-you.html>



SSBB Description, Per ASQ

- Understands Six Sigma philosophies and principles, including the supporting systems and tools. Demonstrates team leadership and understands all aspects of the DMAIC model in accordance with Six Sigma principles.
- *Note that while ASQ does offer a green belt certification, you do NOT need to earn a green belt certification prior to earning the black belt certification.*

<http://asq.org/certification/right-for-you.html>



Recertification

- Recertification is required every 3 years. To recertify, you can either retest or earn RUs (recertification units).
- 18 RUs are required. RUs can be earned any of the following ways:
 - For full time work, 3.6 RUs can be earned per year.
 - For training or higher education, .1 RUs can be earned per hour of training.
 - For teaching, .15 RUs can be earned per hour.
 - By attending ASQ meetings, participating on ASQ committees, proctoring certification exams, and publishing professional material.
 - Ex: If you wish to recertify by working and training alone, you would need to complete 72 hours of training in a 3 year period.
- All earned RUs must fall within the applicable certification(s) body of knowledge OR be directly related to your job. **Hard copy documentation has to be submitted with all RUs.**



Exam Formats

- The CSQE exam is 160 questions; the SSBB is 150.
- A cut score process is used to determine the passing score. A panel of 12 – 15 SMEs evaluate the material every time the body of knowledge is updated. Different versions of the exam are given, and the raw score required to ‘pass’ each version of the exam may be modified with each exam.
- Exams are open book. You can take primers, articles, books, a calculator, scratch paper, and you must take pencils into the exam – it is not an electronic exam.



Exam Preparation

- The BOKs (outlines) are available at ASQ.ORG.
- ASQ's Learning Institute provides some study materials and offers training courses.
- Primers, practice exams, solution texts, and other study resources are offered by third party providers, including the Quality Council of Indiana – QCI:

<http://www.qualitycouncil.com/>



BOKs (Book of Knowledge)

- ASQ provides BOKs for each of their certifications. The BOKs are 11 to 12 pages long, and they are essentially outlines of the topic areas and subtopic areas covered by the exam.
- ASQ uses Bloom's Cognition level scale - remember, understand, apply, analyze, evaluate, or create.
- The BOK specifies how many questions will cover each section, and for each subtopic area, it specifies the cognition level required.



SSBB BOK Excerpt

- **Define [15 Questions]**

- **Voice of the customer**

- **Customer identification**

- Segment customers for each project and show how the project will impact both internal and external customers. (Apply)

- **Customer feedback**

- Identify and select the appropriate data collection method (surveys, focus groups, interviews, observation, etc.) to gather customer feedback to better understand customer needs, expectations and requirements. Ensure that the instruments used are reviewed for validity and reliability to avoid introducing bias or ambiguity in the responses. (Apply)

<http://asq.org/certification/six-sigma/bok.html>



BOK Cognition Level Comparisons

Cognition Levels	CSQE		CSSBB	
	Number of Subtopics Per Level	Percentage of Subtopics Per Level	Number of Subtopics Per Level	Percentage of Subtopics Per Level
Remember	0	0%	1	1%
Understand	26	32%	21	19%
Apply	30	37%	41	38%
Analyze	9	11%	13	12%
Evaluate	15	18%	30	28%
Create	2	2%	2	2%



Exam Preparation Highlights

Eliminate all of the unknowns by...

1. Understanding the format of the exam – how is it administered, what types of questions are asked, what type of analysis are you expected to complete, how is it scored, etc.
2. Learn the material – via study guides, classes, study groups – whatever works for you.
3. **PRACTICE!!** Take practice exams that mimic the format and duration of the exam you are preparing for.



Certified Software Quality Engineer (CSQE) BOK Outline

- **I General Knowledge (16 questions)**
Quality principles, ethics and legal compliance, standards/models (ISO 9000 standards), leadership, organization, team, communication.
- **II Software Quality Management (26 Questions)**
Quality goals, customers/stakeholders, planning, outsourcing, methodologies such as cost of quality, process improvement models, corrective action procedures and defect prevention, audits.
- **III Systems and Software Engineering Processes (27 questions)**
Lifecycles (iterative, waterfall), process models (including feature driven or test driven development) and benefits of each, systems architecture, requirements gathering, requirements management, software analysis, design, development, maintenance management.



Certified Software Quality Engineer (CSQE) BOK Outline - Continued

- **IV Project Management (24 Questions)**
Planning, scheduling, tracking/controlling, risk management
- **V Software Metrics and Analysis (24 questions)**
Metrics and measurement theory, process and product measurement, analytical techniques
- **VI Software Verification and Validation (27 questions)**
Theory, test planning and design, reviews/inspections, test execution documentation, customer deliverables



Certified Software Quality Engineer (CSQE) BOK Outline - Continued

- **VII Software Configuration Management (16 questions)**
Configuration infrastructure, including roles/responsibilities of a configuration management team, configuration identification (including naming conventions, versioning), builds configuration control, config audits, product release/distribution

<http://asq.org/certification/six-sigma/bok.html>



Quality Definitions

BOK area I, General Knowledge

- Quality is conformance to requirements.

PB Crosby, 1979, Quality is Free

- Remember that in software development, requirements include all of the following:
 - The user's requirements
 - Performance requirements
 - Development standards
 - Maintainability
 - Architecture requirements



Software Verification & Validation

BOK area VI

- Software Verification and Validation (V & V) is a disciplined approach to evaluating and assessing the software product during each phase of the software life cycle *(QCI CSQE Primer 2002, VIII – 2)*
- There are 2 main objectives to V & V:
 1. Finding the defects as early as possible, and
 2. Ensuring that the requirements are built into the product.



Software Verification & Validation

(continued)

BOK area VI

- Testing, inspection along the way helps ensure that the user's requirements, performance requirements, development standards and maintainability are all being addressed throughout the project. That requires a variety of tools.
- Tools referenced include various review and inspection types – tools we commonly use include user testing, quality assurance testing, and developer testing/code reviews/inspections.
- The BOK covers tools and techniques such as structured analysis, dynamic tests, mathematical proof, simulation, prototyping, and testing.



Software Verification & Validation (continued) BOK area VI

- Identify the V & V Scope and Objectives
 - What are we measuring?
 - What are the requirements that we want to meet?
 - How are we going to measure them?
 - What tools are we going to use?
 - Does everyone agree? This includes all project participants, including users and developers.
 - How are we going to determine if something passes or fails? If we can't objectively measure an objective, we need to consider removing it.



Software Verification & Validation

(continued)

BOK area VI

- Analyze the Project Inputs
 - What inputs, including information, software deliverables, documentation, is going to be available throughout the project? This helps determine what resources will be required for performing all the V & V tasks.
- Select Techniques and Tools
 - The CSQE Primer lists around 8 tools and techniques that can be used for V & V – only 1 is traditional testing. Another is static testing, which includes code walkthroughs/inspections/code reviews – a good tool to ensure adherence to development standards and maintainability. 6 others include static analysis, structural analysis, dynamic tests, mathematical proof, simulation, prototyping and simulation tools.



Software Metrics and Analysis

BOK area V

- Psychology of Metrics:

“Any measurement program must have clearly stated objectives and these should be agreed to by all concerned. The most common cause of complaint, is where measures are gathered for one specific agreed objective, and are used for a different non-agreed objective (2002 CSQE Primer VII – 15).
- Measurable items include
 - Defect rate (number of defects per hour)
 - Defect Density (number of defects per 100 lines of code)
 - Phase Containment Effectiveness Measure or Defect Removal Effectiveness
 - Index of variation, which is used to measure reliability
 - Central limit theorem, measures of central tendency, mean, mode and median



Certified Six Sigma Black Belt (SSBB) BOK Outline

- **I Enterprise-wide Deployment – 9 Questions**

Basic values and foundations of six sigma, leadership, organizational roadblocks, change management, six sigma projects.

- **II Organizational Process Management and Measures – 9 questions**

Stakeholders, requirements, benchmarking, measures for business performance and financial methods.

- **III Team Formation - 16 questions**

Team types, members, roles, team dynamics, time management, team and management tools, team performance and evaluation.



Certified Six Sigma Black Belt (SSBB) BOK Outline (Continued)

- **Note:** *The next 5 sections of the BOK represent the Six Sigma Process*

- **IV Define (15 questions)**

Customer identification, feedback, requirements gathering tools including CTQ (critical to quality) flow-down, quality function deployment, and the Kano Model, project charter, project tracking.

Note: Remember that defining your requirements IS defining quality

Note: Problem statement and project tracking are the only 2 topics on the exam that require you to meet the create cognitive level

- **V Measure (26 questions)**

This section includes process characteristics (such as input and output variables, data collection, measurement systems, basic statistics, probability and process capability.

Note: Many questions in this section are on the evaluate cognitive level, which is the most difficult level tested on the cognitive scale.

- **VI Analyze (24 Questions)**

This section includes measuring and modeling relationships between variables, hypothesis testing, and additional analysis methods.



Certified Six Sigma Black Belt (SSBB) BOK Outline (Continued)

- **VII Improve (23 Questions)**
Design of experiments, waste elimination, cycle-time reduction, and other topics.
- **VIII Control (21 Questions)**
This section includes statistical process control, other control tools, maintain control, and sustain improvements.
- **IX Design for Six Sigma - Frameworks and Methodologies (7 questions)**
Methodologies including DMADV (design and validate), DMADOV (design, optimize, and validate), Design for X (X being various constraints such as cost or maintainability), and special design tools.

<http://asq.org/certification/six-sigma/bok.html>



Six Sigma Definitions

BOK I, Enterprise-Wide Deployment

- Principle of Six Sigma: Deliver near perfect products and services by improving the process and eliminating defects.

(QCI Primer CSSBB 20007, II – 3)

- A business improvement approach that seeks to find and eliminate causes of mistakes or defects in business processes by focusing on outputs that are of critical importance to customers.”

RD SNEE, “Why Should Statisticians Pay Attention to Six Sigma?” Quality Progress, 1999–“



Six Sigma Definitions (Continued)

BOK I, Enterprise-Wide Deployment

- Sigma refers to the standard deviation of a process about its mean. Note that mean here means expected value. At a 6 sigma level, you only have 3.4 ppm (parts per million) of non-conformances.
- 3.4 PPM (or defects per million) means that 99.99966% of the products created are statistically expected to be free of defects.
- This 3.4 ppm figure takes into consideration Motorola's assertion that many operations tend to sift 1.5 sigma over time... if you take this consideration out, you would come up with 2 PPM...



Six Sigma Benefits to Business

BOK I, Enterprise-Wide Deployment

- Benefits to business that should result from a Six Sigma Initiative: (Primer II – 4)
 - Cost Reductions
 - Market-Share Growth
 - Defect Reductions
 - Culture Changes
 - Productivity Improvements
 - Customer Relations Improvements
 - Product and Service Improvements
 - Cycle-time Reductions



Lean and Six Sigma

BOK I, Enterprise-Wide Deployment

Some experts point out the differences in lean and six sigma theory, some point out similarities.

Topic	Six Sigma	Lean
Improvement	Reduce Variation	Reduce waste
Justification	Six sigma (3.4 ppm)	Speed (velocity)
Main Savings	Cost of poor quality	Operating costs
Learning Curve	Long	Short
Project Selection	Various approaches	Value stream mapping
Project Length	2 – 6 months	1 week – 3 months
Driver	Data	Demand
Complexity	High	Moderate



Classic Problem Solving Methodology

BOK Section III, Team Management

Classic Team Problem Solving

- Identify business or customer problems; select one to work on.
- Define the problem; if it is too large, break it down to smaller ones and solve these.
- Investigate the problem. Collect data and facts.
- Analyze the problem. Find all possible causes; decide which are MAJOR causes.
- Solve the problem. Choose from available solutions. Implement the solution.
- Confirm the results. Was the problem fixed? Make sure it stays fixed.



DMAIC Process

BOK Section III, Team Management

DMAIC Process

- **Define** the customer, their critical to quality (CTQ) issues, and the core business problem involved.
- **Measure** the performance of the core business process involved.
- **Analyze** the data collected and process map to determine root causes of defects and opportunities for improvement.
- **Improve** the target process by designing creative solutions to fix and prevent problems.
- **Control** the improvements to keep the process on the new course.