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## ASQ's 2002 CSQE Body of Knowledge

Quality Week 2002

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### *“The Certified Software Quality Engineer ...*

*... is a professional who has comprehensive understanding of software quality development and implementation; has a thorough understanding of software inspection, testing, verification, and validation; and can implement software development and maintenance processes and methods.”*

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## ASQ

- The American Society for Quality
- Not-for-profit professional society
- Leading quality improvement organization in US for more than 50 years
- More than 117,000 individual and
- 1,100 corporate sustaining members
- 247 local Sections
- 22 industry and topic-specific Divisions.

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## CSQE

- Certification Requirements
- The Subject Areas of the CSQE 2002 BOK
- Bloom's Levels Of Cognition
- Example of Performance Skill Levels
- Example of Mapping of Performance Levels To Job Requirements
- Describing Individual Performance Levels

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## Certification Requirements

- Education and/or Experience
  - 8 years in quality field
  - up to 5 years credit for degrees
- Proof of Professionalism
- Examination
  - proctored, open book exam
  - 160 questions

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## Recertification Requirements

- Recertify every 3 years
- 18 points needed
  - Professional Development
  - Employment
  - Instructor/Student
  - Meetings
  - Committees
  - Certifications
  - Proctoring
  - Publishing

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## CSQE BOK Subject Areas

- General Knowledge, Conduct, and Ethics
- Software Quality Management
- Software Engineering Processes
- Program and Project Management
- Software Metrics, Measurement, and Analytical Methods
- Software Verification and Validation (V&V)
- Software Configuration Management

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## General Knowledge, Conduct, and Ethics

- Quality philosophy and principles
- Standards, specifications, and models
- Leadership tools and skills
- Ethical conduct and professional development

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## General Knowledge, Conduct, and Ethics

- Quality philosophy and principles
  - Benefits of software quality (C)
  - Prevention vs. detection (C)
  - Organizational and process benchmarking (A)
- Standards, specifications, and models (Ap)

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## General Knowledge, Conduct, and Ethics

- Leadership tools and skills
  - Organizational leadership (Ap)
  - Team management (Ap)
  - Team tools (Ap)
  - Facilitation skills (Ap)
  - Communication skills (Ap)

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## General Knowledge, Conduct, and Ethics

- Ethical conduct and professional development
  - ASQ Code of Ethics (P)
  - Software liability and safety issues (Ap)
  - Professional training and development (Ap)

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## Software Quality Management

- Goals and objectives
- Methodologies
- Audits

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## Software Quality Management

- Goals and objectives
  - Quality goals and objectives <sup>(B)</sup>
  - Outsourced services <sup>(B)</sup>
  - Planning <sup>(B)</sup>
  - Software quality management systems documentation <sup>(C)</sup>
  - Customer requirements <sup>(B)</sup>

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## Software Quality Management

- Methodologies
  - Reviews, inspections, and testing <sup>(B)</sup>
  - Change management methods <sup>(B)</sup>
  - Cost of quality (COQ) <sup>(An)</sup>
  - Quality data tracking <sup>(B)</sup>
  - Problem reporting and corrective actions <sup>(B)</sup>
  - Quality improvement process <sup>(B)</sup>

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## Software Quality Management

- Audits
  - Program development and administration <sup>(C)</sup>
  - Audit preparation and execution <sup>(C)</sup>
  - Audit reporting and follow up <sup>(Ap)</sup>

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## Software Engineering Processes

- Environmental conditions
- Requirements management
- Requirements engineering
- Analysis, design, and development methods and tools
- Maintenance management

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## Software Engineering Processes

- Environmental conditions
  - Life cycles <sup>(B)</sup>
  - Systems architecture <sup>(An)</sup>
- Requirements management
  - Requirements prioritization and evaluation <sup>(B)</sup>
  - Requirements change management <sup>(B)</sup>
  - Bi-directional requirements traceability <sup>(B)</sup>

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## Software Engineering Processes

- Requirements engineering
  - Requirements types <sup>(An)</sup>
  - Requirements elicitation <sup>(C)</sup>
  - Requirements analysis and modeling <sup>(An)</sup>
  - System and software requirements specifications <sup>(An)</sup>

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## Software Engineering Processes

- Analysis, design, and development methods and tools
  - Software design methods (Ap)
  - Types of software reuse (Ap)
  - Clean room and other formal methods (C)
  - Software development tools (Ap)

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## Software Engineering Processes

- Maintenance management
  - Maintenance types (C)
  - Operational maintenance (C)

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## Program and Project Management

- Planning
  - Project planning elements (Ap)
  - Goal-setting and deployment (Ap)
  - Project planning tools (Au)
  - Cost and value data (Ap)

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## Program and Project Management

- Tracking and controlling
  - Phase transition control techniques (Au)
  - Interpreting and reporting COQ data (B)
  - Tracking elements and methods (B)
  - Project reviews (Au)

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## Program and Project Management

- Risk management
  - Risk management planning methods (S)
  - Risk probability (B)
  - Product release decisions (B)
  - Software security, safety, and hazard analysis issues (Au)

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## Software Metrics, Measurement, and Analytical Methods

- Metrics and measurement theory
- Process and product measurement
- Analytical techniques

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### Software Metrics, Measurement, and Analytical Methods

- Metrics and measurement theory
  - Metrics and measurement theory (C)
  - Basic measurement theory and techniques (Ap)
  - Psychology of metrics (C)

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### Software Metrics, Measurement, and Analytical Methods

- Process and product measurement
  - Process, product, and resource metrics (Ap)
  - Commonly used metrics (Ap)
  - Software quality attributes (C)
  - Defect detection effectiveness measures (Ap)
  - Program performance and process effectiveness (An)

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### Software Metrics, Measurement, and Analytical Methods

- Analytical techniques
  - Data integrity (S)
  - Quality tools (An)
  - Sampling theory and techniques (An)

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### Software Verification and Validation (V&V)

- Theory
- Reviews and inspections
- Test planning and design
- Test execution and evaluation

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### Software Verification and Validation (V&V)

- Theory
  - V&V planning procedures and tasks (S)
  - V&V program (An)
  - Evaluating software products and processes (S)
  - Interfaces (C)

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### Software Verification and Validation (V&V)

- Reviews and inspections
  - Types (Ap)
  - Items (Ap)
  - Processes (Ap)
  - Data collection, reports, and summaries (Ap)

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**Software Verification and Validation (V&V)**

- Test planning and design
  - Types of tests (S)
  - Test tools (C)
  - Test strategies (S)
  - Test design (Ap)
  - Test coverage of specifications (S)
  - Test environments (S)
  - Supplier components and products (Ap)
  - Test plans (Ap)

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**Software Verification and Validation (V&V)**

- Test execution and evaluation
  - Test implementation (Ap)
  - Test documentation (Ap)
  - Test reviews (S)
  - Code coverage metrics (Ap)
  - Customer deliverables (S)
  - Severity of anomalies (S)

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**Software Configuration Management**

- Configuration infrastructure
- Configuration identification
- Configuration control
- Configuration status accounting
- Configuration audits
- Release and distribution issues

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**Software Configuration Management**

- Configuration infrastructure
  - Configuration management (C)
  - Library/repository processes (C)
  - Defect tracking and library tools (C)
- Configuration identification
  - Configuration items (Ap)
  - Baselines (C)
  - Configuration identification methods (C)
  - Software builds (S)

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**Software Configuration Management**

- Configuration control
  - Item and baseline control (Ap)
  - Proposed modifications (C)
  - Review and configuration control boards (CCBs) (Ap)
  - Concurrent development (Ap)
  - Traceability (Ap)
  - Version control (Ap)
  - Configuration item interfaces (Ap)

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**Software Configuration Management**

- Configuration status accounting
  - Status reporting (C)
  - Changes to configuration items and baselines (C)
  - Documentation control (C)

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## Software Configuration Management

- Configuration audits
  - Functional configuration audit ☉
  - Physical configuration audit ☉
- Release and distribution issues
  - Product release process issues ☉
  - Packaging, production, and distribution ☉

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## Levels of Cognition<sup>1</sup>

- Knowledge
- Comprehension
- Application
- Analysis
- Synthesis
- Evaluation

<sup>1</sup>Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). Taxonomy of educational objectives handbook 1: Cognitive domain. New York: McKay.

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## Levels of Cognition

<u>Level</u>	<u>Verbs</u>
Knowledge	- write, list, name, define, label, state
Comprehension	- explain, describe, summarize, illustrate, paraphrase
Application	- use, solve, apply, construct, demonstrate, compute
Analysis	- analyze, compare, contrast, separate
Synthesis	- create, design, invent, develop
Evaluation	- judge, recommend, critique, justify

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## Example of Performance Skill Levels

Area	Knowledge	Comprehension	Application	Analysis	Evaluation	Synthesis
Audits	Asks questions during audits	Understands purpose and methodology of audits	Able to participate as an auditor within an audit team	Participates as Lead Auditor gives the audit plan	Creates the audit plan and is Lead Auditor	Trains Lead Auditor and participates in audit
Leadership	Able to participate in projects	Has responsibility in projects	Leads routine projects	Plans and leads routine projects	Plans and leads a large or cross-organizational project	Plans and manages changes in organizational plans

- Row for each Skill Area
- Column for each Level of Performance
- Cell describes behavior that demonstrates mastery
- Color code by columns

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## Example Mapping Of Performance Levels To Job Requirements

Area	Level	Associate QE	Quality Engineer	Senior QE	Fellow
General Knowledge, Conduct and Ethics					
Quality philosophy and concepts	Assigned work area				
Standards, specifications, and models	NA	Assigned work area			
Leadership tools and skills	NA				
Ethical conduct and professional development					

- Column for each job title and grade
- Color indicates Performance Skill Level expected
- Text amplifies or explains

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## Example Describing Individual Performance Levels

Area	Quality Engineer	Remarks
General Knowledge, Conduct, and Ethics	<name>	
Quality philosophy and concepts	Knows quality principles in assigned work area	
Standards, specifications, and models	Does not use available standards. In assigned work area.	Send to ISO 9000
Leadership tools and skills	Excellent leadership skills	Performance Review
Ethical conduct and professional development	High ethics. Took leadership class.	

- Individual performance shown in second column
- Job Requirements column included for reference
- Remarks possibly color coded for strengths and weaknesses

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## Summary

- CSQE covers a wide field
- CSQE includes level of cognition
- You can
  - decide what applies to you
  - define Performance Skill Levels
  - define Job Requirements
  - describe Individual Performance



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