
**Software and systems engineering —
Certification of software and systems
engineering professionals —**

**Part 4:
Software engineering**

*Ingénierie du logiciel et des systèmes — Certification des
professionnels de l'ingénierie du logiciel et des systèmes —
Partie 4: Ingénierie du logiciel*

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Foreword

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This document was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information Technology*, Subcommittee SC 7, *Software and systems engineering*.

A list of all parts in the ISO/IEC 24773 series can be found on the ISO and IEC websites.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html and www.iec.ch/national-committees.

Introduction

The ISO/IEC 24773 series addresses the certification of professionals in software and systems engineering. ISO/IEC 24773-1 contains general requirements for such certification schemes. This document contains requirements specific to certification schemes for software engineering professionals.

The concepts, and requirements for certification schemes contained in ISO/IEC 24773-1 and ISO/IEC 17024 apply to this document.

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Software and systems engineering — Certification of software and systems engineering professionals —

Part 4: Software engineering

1 Scope

This document elaborates requirements and recommendations for certifications schemes based on ISO/IEC 24773-1, which are specific to the domain of software engineering.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC/IEEE 12207, *Systems and software engineering — Software life cycle processes*

ISO/IEC 17024, *Conformity assessment — General requirements for bodies operating certification of persons*

ISO/IEC TS 17027, *Conformity assessment — Vocabulary related to competence of persons used for certification of persons*

ISO/IEC/TR 19759, *Software Engineering — Guide to the software engineering body of knowledge (SWEBOK)*

ISO/IEC 24773-1:2019, *Software and systems engineering — Certification of software and systems engineering professionals — Part 1: General requirements*

Software Engineering Competency Model, version 1.0, IEEE Computer Society 2014

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO/IEC 17024, ISO/IEC TS 17027, ISO/IEC 24773-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

knowledge area

KA

identified group of knowledge

3.2 software engineering

systematic application of scientific and technological knowledge, methods, and experience to the design, implementation, testing, and documentation of software

[SOURCE: ISO/IEC/IEEE 24765:2017, 3.3810, definition 1, modified — The abbreviated terms "SE" and "SWE" have been removed.]

4 Conformity

This document contains requirements for conformity certification schemes which are specific to software engineering. General requirements for conformant schemes defined in ISO/IEC 24773-1 also apply.

A certification scheme (the Scheme) for professionals in software engineering may claim conformance to this document if it satisfies all the requirements contained in this document, ISO/IEC 24773-1 and ISO/IEC 17024.

5 Requirements for certification of software engineering professionals

5.1 General

This clause contains requirements and recommendations specific to the certification of software engineering professionals. The following requirements, recommendations and associated criteria may also be used to compare certification and qualification schemes of software engineering professionals.

5.2 Fundamental components of a conformant scheme

5.2.1 This clause contains additional requirements for fundamental components defined in ISO/IEC 24773-1:2019, 6.3.

5.2.2 The Scheme shall contain a description of software engineering professionals to be certified or targeted by that scheme.

5.2.3 A list of skills that the professional to be certified in software engineering is expected to exhibit shall be mapped by the Scheme to the knowledge areas of the reference body of knowledge (BOK), and to the defined competencies.

NOTE Examples of skills and competencies are shown in [Annex B](#) and [C](#) respectively. An exemplar mapping is shown in [Annex D](#).

5.2.4 Each task or activity associated with the Scheme shall be “mapped” to at least one of the following:

- KA of the Guide to the SWEBOK, ISO/IEC TR 19759;
- Process, activity or task of ISO/IEC/IEEE 12207;
- Technical skill area of IEEE Software Engineering Competency Model (SWECOM) V1.

The Scheme may define tasks at a different abstraction level of the tasks defined in ISO/IEC/IEEE 12207.

Tasks and their descriptions are associated with any certification scheme. ISO/IEC 17024 contains the requirements that the scheme declares a scope and describe the targeted individuals who would be certified. Part of the required scope and target description includes a list of tasks which represent the activities performed by certificants within the professional scope of that certification. These tasks are

high-level activity descriptions and not a comprehensive set of details of technical tasks which may be included within structure of the knowledge, skills or competencies of the scope.

5.2.5 The Scheme should require a minimum level of formal engineering education, where “formal engineering education” is defined as an engineering or computing degree from an accredited program, and where “computing degree” is one of the following: computer science (CS), computer engineering (CE), software engineering (SE), information systems (IS) and information technology (IT).

NOTE ISO/IEC 24773-1 contains a requirement that all conformant schemes define and document a minimum level of education, but this additional requirement is more specific regarding that minimum.

While minimum formal education requirements allow for various computing degrees, the requirements related to knowledge and coverage of KAs by the BOK (5.3.3) used by the Scheme still apply.

5.2.6 If formal engineering education is required as part of the certification scheme, the requirements shall be clearly stated.

The engineering degree does not have to be in software engineering, but shall be followed by software engineering work/experience.

5.2.7 If on-the-job experience in software engineering is to be acceptable as part or total replacement for formal engineering education, the experience defined by the Scheme shall be objectively described and the verifiable criteria shall be made explicit. The verifiable on-the-job experience in software engineering should be at least as long in years as the formal engineering education, and twice as long (at least eight years) if no formal university engineering degree is required.

5.3 Knowledge

5.3.1 The reference body of knowledge is ISO/IEC 19759 (SWEBOK).

The reference body of knowledge defines the following knowledge areas:

- software requirements;
- software design;
- software construction;
- software testing;
- software maintenance;
- software configuration management;
- software engineering management;
- software engineering process;
- software engineering models and methods;
- software quality;
- software engineering professional practice;
- software engineering economics;
- computing foundations;
- mathematical foundations;
- engineering foundations.

NOTE An elaboration of software engineering knowledge areas is shown in [Annex A](#).

5.3.2 The Scheme shall include requirements for knowledge of ISO/IEC/IEEE 12207.

5.3.3 If the Scheme contains another BOK (i.e. “alternative BOK”) other than the reference BOK identified in [5.3.1](#), the knowledge areas of the “alternative BOK” identified in the Scheme shall be mapped to knowledge areas of the reference BOK. The Scheme shall demonstrate that the “alternative BOK” covers the scope of the reference BOK as defined by the knowledge areas in [5.3.1](#), with rationale supporting any reduction in depth of coverage.

5.4 Skill

5.4.1 The Scheme shall define software engineering related skills covered by the Scheme, where they are specifically assessed or evaluated.

Skills covered by the Scheme should be placed into groups or categories, where skills are related, and where there are a large number of skills in one group or category.

NOTE Examples of software engineering skills are shown in [Annex B](#).

5.4.2 The skills defined by the Scheme should be mapped to one or more competencies ([5.5](#)) defined and covered by the Scheme.

5.4.3 The Scheme should define performance levels for each skill so that various levels of ability are defined and can be measured objectively.

5.5 Competence

5.5.1 The Scheme shall identify software engineering specific competencies required for the software engineering professional to be certified. The competencies defined/required should be consistent with the activities of the professional defined as the target of the scheme (See ISO/IEC 24773-1:2019, 5.5, footnotes 1 and 2, and ISO/IEC 17024).

NOTE Examples of software engineering competencies are shown in [Annex C](#).

5.5.2 Each competency associated with the Scheme shall be defined in terms of outcomes, deliverables, results or activities associated with that competency.

Competencies may be grouped into competency areas or groups. The Scheme may define its own competency groups and competencies within them.

5.5.3 The reference life cycle process is ISO/IEC/IEEE 12207.

NOTE This is an elaboration of the recommendation defined in ISO/IEC 24773-1:2019, 6.5.2.

5.5.4 Proficiency levels should be defined at least for the levels required to accomplish the tasks or activities undertaken by the targeted professional.

Annex A (Informative)

Elaboration of software engineering knowledge areas

[Table A.1](#) lists and provides some elaboration regarding the knowledge areas contained in the reference body of knowledge as defined in [5.3](#).

The source document (ISO/IEC TR 19759) contains detailed information regarding sub-topics and supporting literature for each knowledge area.

Table A.1 — Elaboration of software engineering knowledge areas

Software engineering knowledge areas	Sub-areas and sub-topics
Software requirements	Software requirements fundamentals, requirements process, requirements elicitation, requirements analysis, requirements specification, requirements validation, requirements management, requirements tools.
Software design	General design concepts, software design process, software design principles, key issues in software design (concurrency, control and handling of events, data persistence, distribution of components, error and exception handling and fault tolerance, user interaction and presentation, security), software structure and architecture, user interface design, software design quality analysis and evaluation, quality attributes, software design description and notations, software design strategies and methods, software design tools.
Software construction	Construction principles and objectives, reuse, complexity, construction standards, managing construction (planning and measurement), Integration, construction technologies, software construction tools.
Software testing	Testing-related concepts and terminology, test techniques, test-related measures, test process, software testing tools.
Software maintenance	Software maintenance fundamentals definitions and terminology, software evolution, maintenance costs, maintenance process, techniques for maintenance, software maintenance tools.
Software configuration management (SCM)	Management of the SCM process, software configuration identification, software configuration control, software configuration status accounting, software configuration auditing, software release management and delivery, software building, software configuration management tools.
Software engineering management	Project initiation and scope definition, software project planning, risk management, software project enactment, software acquisition and supplier contract management, implementation of measurement process, project review and evaluation, project closure, software engineering measurement, software engineering management tools.
Software engineering process	Software lifecycles, software process definition, software process assessment and improvement, software process and product measurement, software process measurement techniques, software engineering process tools.
Software engineering methods	Models and modelling principles, analysis of models, software engineering methods, formal methods, agile methods.
Software quality	Software quality fundamentals, costs of quality, models and quality characteristics, software safety, software quality management processes, software quality assurance, verification & validation, reviews and audits, software quality requirements, defect characterization, software quality management techniques, software quality measurement, software quality tools.