

A Brief History of Certification

Professional certification programs have become an essential method of competency testing and setting a standard for employee qualifications in many industries. Until ISA created the Certified Automation Professional™ (CAP™) program, however, there hasn't been a certification program to address the specific realities of industrial automation professionals.

Historical Overview

Certification programs in the US grew out of the standardization movement. According to the National Standards Policy Advisory Committee a standard is, "A prescribed set of rules, conditions, or requirements concerning definitions of terms; classification of components; specification of materials, performance, or operations; delineation of procedures; or measurement of quantity and quality in describing materials, products, systems, services, or practices."

As civic and economic problems uncovered the need for standardization in all facets of business and governance, independent organizations and governmental bodies developed more codes. Standardization proved so successful at eliminating production and operations problems at all levels that by the late 1980s there were approximately 30,000 standards developed by more than 400 organizations in the US alone.

With the development of each new standard, certification programs soon appeared as the best means of assuring that a product or service adhered to the standards' requirements. By one definition, certification programs, which are sometimes called schemes, are the "[procedures] by which written assurance is given that a product or service conforms to standard

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CAP™ Job Analysis

The ISA Certified Automation Professional™ (CAP™) exam is designed to assess competence in the automation professionals, and a passing score indicates that the CAP has achieved a level of ability consistent with requirements for competence on the job. The job analysis study is an integral part of ensuring that the aspects of industrial automation covered on the exam reflect the tasks performed in the range of practice settings throughout the United States and Canada.

The following is an excerpt from the job analysis study that details the specific tasks and knowledge included in **Domain 2: Definition**. In the next issue of *CAPacity*, we'll detail Domain 3.

Performance Domain II: Definition

Task	RATINGS				
	Importance	Criticality	Frequency	% of Items on Exam	# of Items on Exam
1	3.11	2.55	2.05	3.23%	5
2	2.60	2.18	1.89	2.79%	5
3	3.23	2.87	2.10	3.43%	6
4	2.69	2.23	1.89	2.85%	5
5	2.83	2.35	1.84	2.94%	5
TOTAL				15.23%	26

Task 1: Determine operational strategies through discussion with key stakeholders and using appropriate documentation in order to create and communicate design requirements.

Knowledge of:

1. Interviewing techniques
2. Different operating strategies
3. Team leadership and alignment

Skill in:

1. Leading a individual or group discussion
2. Communicating effectively
3. Writing in a technical and effective manner
4. Building consensus
5. Interpreting the data from interviews

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au·to·ma·tion (n) - The implementation of processes by automatic means. **2.** The theory, art, or technique of making a process more automatic. **3.** The investigation, design, development, and application for methods for rendering processes automatic, self-moving, or self-controlling. **4.** The conversion of a procedure, a process, or equipment to automatic operation.

Source: *The Automation, Systems, and Instrumentation Dictionary, 4th Edition* ISA - The Instrumentation, Systems, and Automation Society

or specification.”

There are numerous certification programs in the US administered by the government at all levels, trade associations, consumer groups, and independent testing facilities. A 1988 report by the National Institute of Standards and Technology (NIST) estimated that there were 110 private sector organizations throughout the country that certified different types of products.

Because the concerns and methods of standardization differ between certification administration groups, there is a considerable range of certification programs. However, these programs can be placed in one of three groups:

- product certification,
- service certification, and
- process certification programs.

Differences in Types of Professional Credentials

Product Certification Programs oversee the quality of manufactured products for consumer and business use. Organizations that administer these programs are monitoring the processes that develop the products to guarantee that those products adhere to a public standard of safety. Examples of product certifications are poultry and beef USDA certification and electrical equipment certification by the Underwriter’s Lab.

Service Certification Programs are concerned with testing working competency and knowledge against a base standard set by the members of a particular industry. Teacher certification at the State level and the CAP certification are examples of this type of program.

Process Certification Programs are designed to test an organization against a standard set of operational best practices that guarantee a general level of output quality and efficiency. The certification programs administered by the International Standards Organization (ISO) and the Lean Manufacturing Certification program administered by R. Michael Donovan and Co. are examples of process certification.

Developing a Certification Program

Certification programs all go through a similar creation process: Defining the job role description, the job task analysis, and ranking job objectives.

Job Role Description: The steps to develop a certification program begin with identifying a need within a given industry that can be resolved through certification. As there are different types of certification programs, this initial step in developing a certification helps determine whether the future program’s emphasis will be on product, service, or process certification.

In the case of a service certification, where the program would test the knowledge set and performance competency of workers performing a specific job role, it is necessary first to define that job role so as to demonstrate the certification’s scope.

Job Task Analysis: When the specific job role, in the case of a service certification, has been defined the next step in the certification development process is to determine and then delineate the knowledge domains that comprise the job role of interest. The knowledge domains are then further distilled into the specific job tasks that are subsets of the larger domain.

Job Objectives Ranking: The final step in developing a certification program is creating the exam that will test the exam taker’s competency and knowledge of the specific tasks under each knowledge domain. The most successful certification programs are those with exams that accurately reflect the competencies that professionals must apply in the real world.

To guarantee that the questions on the final exam will be content-valid, i.e. reflective of what a professional in the current field would need to know, a survey is often developed and presented to a representative sample of professionals in the job of interest. These survey respondents are asked to rank each of the knowledge domains, and subsequent job tasks, in order of importance.

For example, in the CAP job analysis survey respondents were asked to rank the knowledge domains on three separate scales: importance, criticality, and frequency. An analysis of the responses yielded a basic framework by which Subject Matter Experts could accurately write questions and weight the proportion of questions testing specific knowledge domains on the exam.

Types of Certification Testing

Pass/Fail: When the certification program meets the requirements of one set of stan-

dards. In this case the product or exam taker, when tested, either meets those requirements, or does not. The end result is either certification or failure to be certified.

Type-testing/Initial Inspection: Products from a pre-production run are inspected to see if the manufacturing process can ensure that the product conforms to a particular standard.

Surveillance of the Manufacturing Process: A measure of quality control that assesses a manufacturer’s materials, production, and control processes.

Audit Testing: Testing of randomly selected samples for adherence to a set of standards.

Field Investigations: Investigation of reported failures of a product or service used in the field.

Batch-testing: A statistical method of testing where a sample of products, of an adequate size to the entire population, are tested to ensure compliance of the entire population to a set of standards.

100 Percent Testing: The most expensive form of testing where every product in a production run is tested for adherence to a set of standards. By definition, service certifications require 100 percent testing.

Implications of the CAP Program

The CAP program represents the first certification for the automation field. Since ISA is broaching new territory, an examination of the implications must start with the impact of certification on other, comparable, industries.

The IT industry has, in recent years, publicized its efforts to develop and sustain certification programs with noted intensity. During the height of the technology boom certification was shown to positively correlate with increased job salaries and job portability. Self-differentiation in the job market was often the cited reason that a professional chose to attain a certification.

The CAP feasibility study supports the idea of worker differentiation through certification in the automation field. According to the employers surveyed, 77% believed certification would enhance recognition and respect for individuals working in the field. 64% of the employer respondents agreed that salary, remuneration, and benefits should increase for certified automation professionals.

It's easy to see why an individual would seek certification. But why would an employer want to subsidize the fees associated with certifying their employees?

Although the government mandates some types of certification and licensure, e.g. teacher, lawyer, and physician certification through state boards, there hasn't been a historical government mandate for certification of automation professionals.

The closest governmental mandate that impacts the industrial automation field comes from the regulations imposed by the Occupational Safety and Health Administration (OSHA). OSHA was established to develop and oversee workplace safety regulations. Under the law establishing those regulations, anyone involved with mechanical systems—owners, engineers, installers, and operators—directly or indirectly share liability for the protection of workers. OSHA defines a “system” as a combination of two or more components that operate together.

OSHA doesn't develop its own standards and certification schema through which to police its regulations; rather it uses accredited third-party certification programs as guidelines for compliance. Since automation professionals fall under the umbrella of responsibility as defined by OSHA, the need for third-party certifications for the field couldn't be more pressing.

The future impact of the CAP program is inextricably tied to the futures of all certification and professional credential programs: market penetration and changes in testing standards.

Another trend in certification that might influence the course that CAP takes is the rise of performance-based tests (PBTs). In the IT sector, whose business cycles tend to mature at a faster rate than manufacturing's, the continued relevance of certification has come under attack. There have been concerns that multiple-choice exams don't accurately test job task performance. This criticism has given rise to the performance-based test, which uses scenarios rather than multiple-choice questions to, “measure ability by requiring completion of a task.” During such tests, “a candidate is required to analyze a problem or situation, determine the course of action, select the appropriate tool (or tools) and perform the steps to solve the problem . . .”

A 2002 article in *Certification Magazine* asserts that multiple-choice tests aren't going away. Rather, it states, they can be stepping-stones to a performance-based certification. What the PBT debate will mean for the CAP program, as well as certification as a whole, has yet to be determined.

Job Analysis, continued from page 1

Task 2: Analyze alternative technical solutions by conducting detailed studies in order to define the final automation strategy.

Knowledge of:

1. Automation techniques
2. Control theories
3. Modeling and simulation techniques
4. Basic control elements (e.g., sensors, instruments, actuators, control systems, drive systems, HMI, batch control, machine control)
5. Marketplace products available
6. Process and/or equipment operations

Skill in:

1. Applying and evaluating automation solutions
2. Making intelligent decisions
3. Using the different modeling tools
4. Determining when modeling is needed

Task 3: Establish detailed requirements and data including network architecture, communication concepts, safety concepts, standards, vendor preferences, instrument and equipment data sheets, reporting and information needs, and security architecture through established practices in order to form the basis of the design.

Knowledge of:

1. Network architecture
2. Communication protocols, including field level
3. Safety concepts
4. Industry standards and codes
5. Security requirements
6. Safety standards (e.g., ISAM, ANSI, NFPA)
7. Control systems security practices

Skill in:

1. Conducting safety analyses
2. Determining which data is important to capture
3. Selecting applicable standards and codes
4. Identifying new guidelines that need to be developed
5. Defining information needed for reports
6. Completing instrument and equipment data sheets

Task 4: Generate a project cost estimate by gathering cost information in order to determine continued project viability.

Knowledge of:

1. Control system costs
2. Estimating techniques
3. Available templates and tools

Skill in:

1. Creating cost estimate
2. Evaluating project viability

Task 5: Summarize project requirements by creating a basis-of-design document and a user requirements document in order to launch the design phase.

Knowledge of:

1. Basis of design outlines
2. User-requirements document outlines

Skill in:

1. Writing in a technical and effective manner
2. Compiling and summarizing information
3. Making effective presentations

ISA Members can download the complete job analysis for free at www.isa.org/CAP

Dated Material—Open Immediately!

Please share this publication with others in your company:

- Automation Engineer
- Plant Manager
- Control Systems Engineer
- Systems Integrator

CAP Review Course and Exam Locations and Dates

The ISA Training Institute has scheduled several offerings of its CAP Review Course across the US. To make it even more convenient, we have scheduled the CAP exam on the day after the course at each location.

You still need to submit your application and payment, 6 weeks in advance of the exam date, even though you can register for the course at a later time.

2005 Review Course Dates	Exam Date	Locations:
28-30 June	1 July	Crosspoint Engineering, Westwood, MA
19-21 July	22 July	County College of Morris at Headquarters Plaza, Morristown, NJ
23-25 August	26 August	San Jacinto College Central, Pasadena, TX
27-29 September	30 September	ISA Training Institute Headquarters, Research Triangle Park, NC
24-26 October	27 October	ISA EXPO 2005, McCormick Place, Chicago, IL

Frequently Asked Questions about the CAP Program

Each issue we'll provide answers to some of the most commonly asked questions about an aspect of the CAP program. This month focuses on what happens after you submit your application.

What will I receive after I submit my CAP application?

If you meet the exam qualifications, you'll receive a confirmation letter with the date, time, and site address of your exam. A map to the test site will be enclosed with an information sheet regarding testing procedures.

If you do not meet the qualifications, or if you did not supply all the necessary documentation, you'll receive a letter stating such. A checklist is also provided to indicate what documentation, if any, is still needed to meet the requirement.

When do I need to arrive at the test site?

If the examination is on the Public Exam Schedule, the examination is a four hour period from 9:00 a.m. to 1:00 p.m. You must arrive at the exam site by 8:30 a.m. on the day of the exam. Private test offerings may select a different starting time; however, all examinations are given in a four hour period.