



Setting the Standard for Automation™

ISA Certified Automation Professional® (CAP™)

Standards
Certification
Education & Training
Publishing
Conferences & Exhibits



Rev. 2/15/2006



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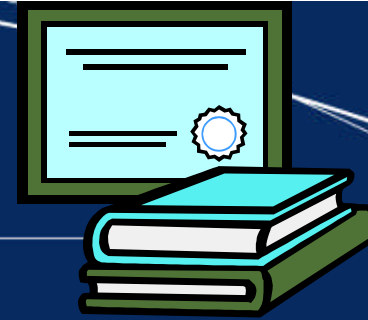
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CAP Overview and Discussion of Benefits

Major New Certification by ISA



- “High Stakes” certification used for hiring, advancement, and contracting decisions
- Setting the standard for automation knowledge
- Worldwide credibility
- Not just one more credential, THE credential for professional level automation knowledge



Like certifications in many other fields,

CAP adoption driven by:

- **Individual automation professionals**
who want to distinguish their automation knowledge
- **Companies with automation professional employees**
who want to advance the education of their employees
- **Users of automation services**
who want to improve the quality of services they purchase

...rather than by any legal requirement

Market Studies Show Strong Interest in Automation Certification



- 77% of the respondents believed certification would enhance recognition and respect for individuals working in this field
- 67% of the respondents reported that certification in this field would be valuable to their organization.
- 64% of the employer respondents agreed that salary/remuneration/benefits should increase for certified industrial automation professionals.
- 77% of respondents indicated that they would encourage eligible employees to seek certification in this field if it is offered by ISA.

Employer respondents cited the following benefits for CAP:

- *-Increased quality*
- *-Safety*
- *-Standardization*
- *-Professional recognition*
- *-Additional means of evaluating potential job candidates*
- *-Help to weed out amateurs posing as automation specialists*



Who Is ISA?

- A leading, global, nonprofit organization
- Setting the standard for automation
- 30,000 worldwide members

- Develops standards
- Certifies industry professionals
- Provides education and training
- Publishes books and technical articles
- Hosts a number of conferences including the largest conference and exhibition for automation professionals in the Western Hemisphere.



CAP Benefits Employers

- Develops a better trained workforce
 - Provides documented evidence that employees are qualified to do their job. Such documentation is a requirement of the ISO 9001 standard.
- Incentive for employees to remain current
- Promotes safe practices
- Qualification tool for hiring and advancement decisions
- Enhances company image with internal or external customers

Employers tend to be early adopters of a new certification... and many employers are encouraging their key employees to become certified



CAP Benefits Individuals

- Enhances professional credibility
 - Travel from job to job and provide immediate proof of ability.
 - Younger professionals increase their recognition and credibility
 - Mid-range professionals validate and document their range of knowledge
 - Those nearing retirement enhance their future marketability
- Enhances self image
- Improves career opportunities -
promotion, pay increases, job portability
- Encourages life long learning and professional development

Individuals also tend to be early adopters of a new certification... and many have achieved CAP status have done so to enhance their own credibility



CAP Benefits Companies Contracting for Automation Services

- Increases the knowledge level of people working on your projects
- Demonstrates competence of those designing your mission critical systems and safety critical systems
- Demonstrates that the provider company values the capability of its employees
- Useful as a tool to evaluate the lead personnel on a project team

*Users of services tend to be later at requiring their providers to be certified...
leaving an opportunity for an individual user to seize an advantage in the market*



Who are Automation Professionals?

- Automation Professionals are:
 - responsible for the direction, definition, design, development/ application, deployment, documentation, and support of systems, software, and equipment used in control systems, manufacturing information systems, systems integration, and operational consulting
- Work for
 - End-users
 - Engineering contractors
 - Specialty automation and manufacturing information providers including System Integrations and application services divisions of supplier companies
 - Hardware and Software product companies as application sales personnel and as product developers



Requirements for CAP

- **Education**
 - Four year technical degree (engineering, engineering technology, computer science, math, science, etc.)
 - Until the end of 2006, people without a four year degree can apply with 10 years of experience including two in responsible charge
- **Experience**
 - Five years working as an automation professional
- **Exam**
 - Pass a comprehensive exam
- **Continuing education**
 - 45 hours every three years (average of 15 hours per year)



CAP Exam

- Covers the Automation Body of Knowledge
- Difficult and comprehensive...
 - **but passable by many automation professionals,** particularly after studying less familiar topics
 - Experience helps
 - 76% pass rate to date
- Multiple choice questions
- Testing locations worldwide
- Testing available every business day and Saturdays at some locations



Who should become CAP certified?

- People working in automation at the professional level employed by:
 - End users
 - System integrators
 - Engineering contractors
 - Vendors
- Technical supervisors
- Technical sales personnel
- Automation educators
- ISA leaders in particular should become certified (CAP or CCST) if their work background is appropriate -- section officers, district officers, division officers, and society officers



What some current CAPs are saying:

- The CAP has given me a way to prove to my employer that I have knowledge of automation
- Since I don't have a degree, becoming a CAP is the only way I can show my next employer that I am competent in automation
- I'm nearing retirement and the CAP will help me be more attractive for part-time work
- In our company, people advance faster with the right credential. CAP is that credential in the automation area
- My company is using CAP to demonstrate to our customers that we have competent personnel



Comparison of CAP to Other Certifications

Hundreds of Certifications are in Use Today



- Many certifications have a legal requirement – particularly in the health field
- Hundreds of certifications are voluntary
- Professional Engineer Registration in the U.S.
 - Control System Engineering
- Certified Control System Technician



Examples of Voluntary Certifications

- **Project Management Professional (PMP)** – 185,000 awarded, 38% outside North America
- **Certified Safety Professional** – 20% salary differential vs. those not certified doing similar work - 18,000 awarded, 10% are also P.E.s
- **Certified Industrial Hygienist** – virtually all practitioners in this area are certified
- **Certified Manufacturing Engineer (CMfgE)** – 12,000 are certified by Society of Manufacturing Engineers
- **Certified Quality Engineer (CQE)**
- **Certified HR Professional**



Each of these certifications...

- Have been shown to increase job opportunities for those holding the certification
- Some are essentially required to work in the respective field in some industries or companies
- Enhances competitiveness of companies offering services



What about the United States Professional Engineer (P.E.) License?

- P.E. is legal license granted by states in the U.S.
- The P.E. exam can be taken in many technical areas – so does not certify competence in any specific area
- Most states require an approved engineering degree (generally engineering technology and computer science do not qualify)
- U. S. only
- 15% of ISA members report that they have a P.E.
- Very little automation work requires the P.E.

All eligible automation professionals should obtain a P.E. to be able to legally use the title "engineer" in the U.S., to advance in companies that value the P.E., and as a matter of pride.



CSE option in the P.E. is more specific to automation

- Control System Engineering (CSE) exam -- option in the P.E. exam program
 - demonstrates competence in the process control area of automation -- so has similarities with certifications
- CSE focuses only on process control area of automation
- CSE is not usually identified in the P.E. designation
- CSE will apparently never reach critical mass
 - 1,442 or about 1% of automation professionals have passed in 13 years
 - Less than 2% of the automation professionals in the U.S. have passed the exam
 - Less than 1% of ISA members report that they have a P.E. based on the CSE



In automation, P.E.s and CAPs do the same type of work, but...

- CAP demonstrates competence specifically in automation
- CAP covers the entire field of automation
- CAP includes the large number of automation professionals with degrees in areas other than engineering
- CAP is worldwide and has worldwide credibility
- The number of CAPs will reach critical mass in a few years
CAP will be the de facto standard for demonstrating automation competence
- CAP is not a legal “license” to practice automation



Comparison to the Certified Control System Technician (CCST)

- The job description of a CCST includes:
 - Calibration
 - Loop Checking
 - Troubleshooting
 - Start-Up
 - Maintenance/Repair
 - Project Organization
 - Administration
- These are significantly different tasks from the project and system design tasks in the CAP's job description
- CCST is focused on process automation which is where most control system technicians work



How to Become a CAP



Apply for CAP

Basic Information Section

A. APPLICANT INFORMATION *(Please print or type.)*

Prefix: Mr. Mrs. Ms. Miss Other _____

Last name _____ First name _____ Middle initial _____

Maiden/Former last name _____

ISA Member: Yes Member Number: _____ No

Job title _____

Company name _____

Preferred mailing address: Home Office *All ISA materials will be mailed to this address.*

Address _____

_____ Mail stop _____

City _____ State/Province _____

Postal code _____ Country _____

Telephone (_____) _____ Fax (_____) _____

E-mail address _____

Current supervisor's name _____ Title _____

Address _____

City _____ State/Province _____ Postal code _____

Telephone (_____) _____ Fax (_____) _____ E-mail _____



Employment Summary for past 5 Years

D. EMPLOYMENT SUMMARY

Starting with your most recent job and working back, complete the information below to document your professional work experience. Make copies of this page if needed. **You must include all information for each position listed or your application cannot be approved.** Military experience must be entered on this page and documented with a copy of your DD214 as well as a written description of your duties.

Work Experience 1

Employer _____

Your position title _____

Employer

Address _____

City _____ State/Province _____ Postal code _____ Country _____

Supervisor's name and title _____ Email _____

Supervisor's Telephone (_____) _____ Date started _____ Date ended _____

Description of job duties and responsibilities



Education/Training (plus transcript)

E. EDUCATION/TRAINING

An official transcript of the academic work must be submitted with your application. Copies are not acceptable. Certificates do not serve as verification of a degree. You must include all information for each degree listed.

College (Associate)

Degree Earned/Major _____
College _____
Address _____ Telephone _____
City _____ State/Prov. _____ Postal code _____ Country _____
Date awarded _____ Beginning Date _____ Ending Date _____

College (Bachelor's)

Degree Earned/Major _____
College _____
Address _____ Telephone _____
City _____ State/Prov. _____ Postal code _____ Country _____
Date awarded _____ Beginning Date _____ Ending Date _____

College (Master's)

Degree Earned/Major _____
College _____
Address _____ Telephone _____
City _____ State/Prov. _____ Postal code _____ Country _____
Date awarded _____ Beginning Date _____ Ending Date _____



Verification of Employment

F. VERIFICATION OF EMPLOYMENT

A Verification of Employment Form should be completed by your current and former supervisors for each period of employment that you submit. **This must include the job activities the candidate was involved in or the application cannot be approved. Provide original, signed forms as faxed, photocopied, or electronic signatures do not qualify.** Duplicate this form as necessary to document your work experience.

If you are self-employed, complete the Verification of Employment Form to document the professional work experience required for testing. A notarized letter from at least three of your customers, including full contact information, must be provided as part of the verification of employment for self-employed applicants.

_____ was employed as a(n)

name of candidate

_____ *title of candidate while employed*

in _____ at _____

name of company/organization

location

from _____ to _____.

month

year

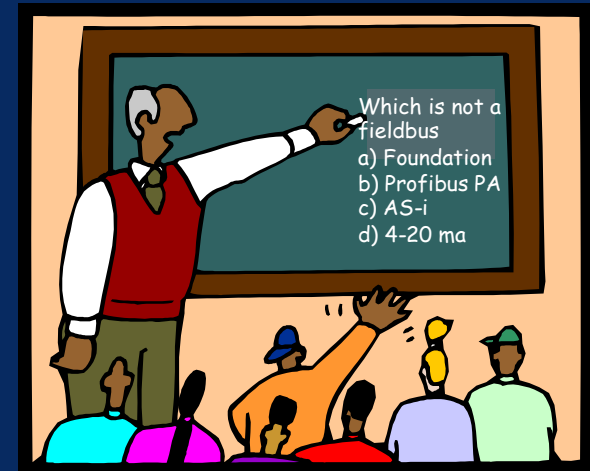
month

year

The candidate was directly involved in the following activities during the above period of employment:

First, Become Familiar with the Exam

- Half-Day CAP Introduction Course being given by local ISA Sections
- CAP Study Guide - 50 sample questions available at www.isa.org/cap



Second, Do General Study in All Topics

with one of the following approaches:

- A Guide to the Automation Book of Knowledge
 - 450 page, readable book
 - comprehensive overview of all 35 topics in the scope of the exam
 - available at www.isa.org
- CAP Three-Day Review Course
 - thorough basic preparation for the exam
 - For dates and locations of classes see www.isa.org/cap
 - Additional classes can be scheduled for companies or co-sponsored with ISA Sections.
- CAP Learning System
 - self-study modules and sample questions





Third, Further Study Weaker Areas:

- **Books** - For a list of recommended books see www.isa.org/cap
- **Web seminars** – ISA offers 40 archived web seminars free to members
- **Short Courses** – ISA offers over 60 courses of 1-3 day duration in the scope of CAP

Schedule the exam



- ISA will:
 - notify you when they approve your application
 - assign an eligibility ID number
 - send that to you and to the Thompson Prometric testing service
- Then go to www.prometric.com
 - enter your eligibility ID number
 - select the location you prefer - for a list of locations see www.prometric.com and select ISA as the testing program
 - Select a time that fits your schedule – anytime there is a space available at the testing center
- Take the exam within 6 months of application approval

Take the exam



- Multiple choice questions with four possible answers
- 175 questions, four hours
- Computerized exam
 - Allows marking questions for easy review later
 - Easy return to questions skipped
 - Pop-up calculator on computer
 - Instantaneous reporting of result when finished
- Nothing in, nothing out but scratch paper supplied
- Make sure you answer all questions --
but time is usually ample

If you Passed, Great!



- Let your management know you are a CAP
- Discuss the value of CAP with your supervisor
- Suggest your company build CAP into its strategic plan for employee development
- Let your internal and/or external customers know you are a CAP and help them understand what it means
- Add CAP to your business card, your signature, and wherever you use your name professionally

If You Didn't Pass This Time...

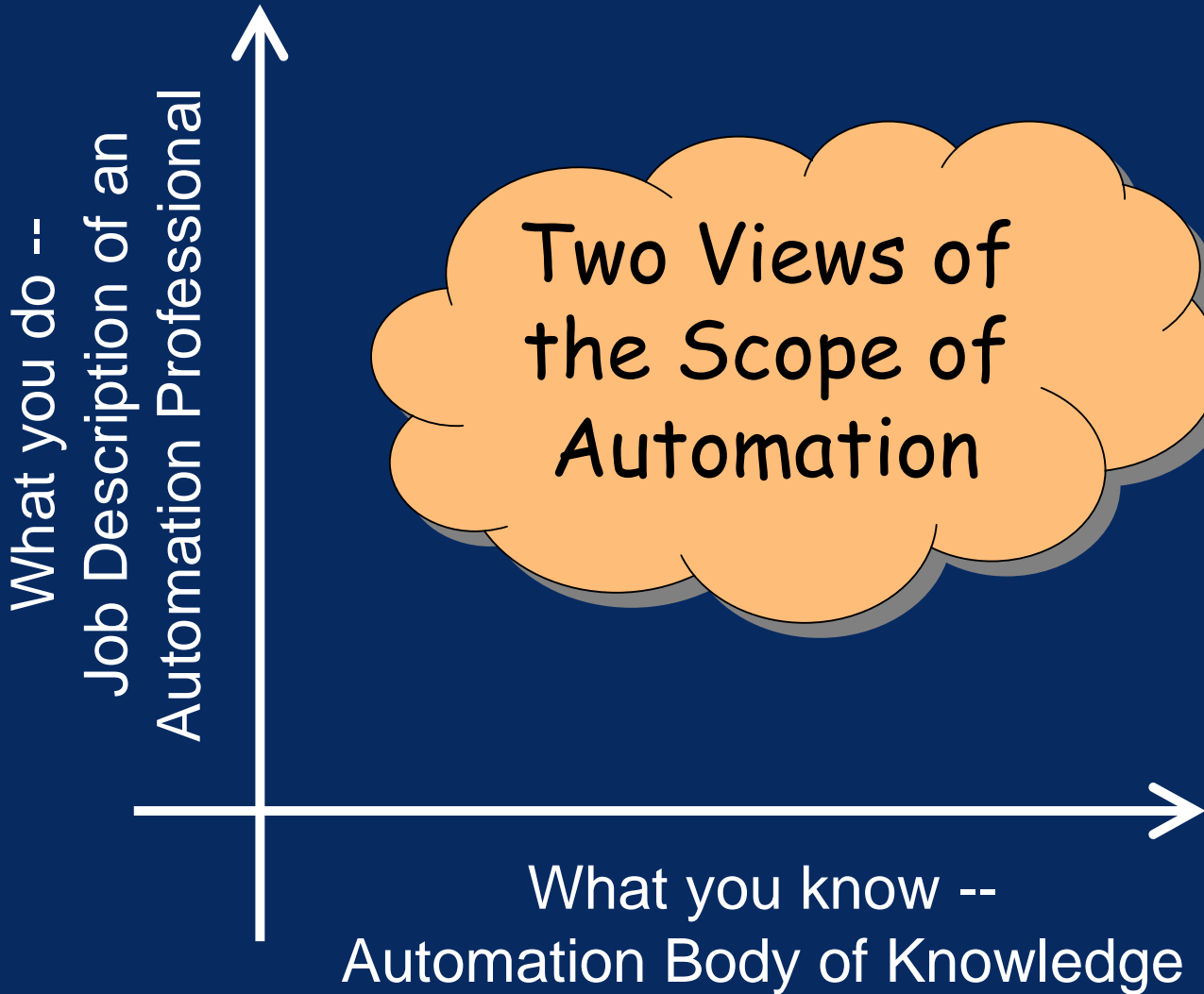
- Analyze your results
- Study areas where you could improve
- Take the exam again





Overview of the CAP Exam

The CAP Exam Scope

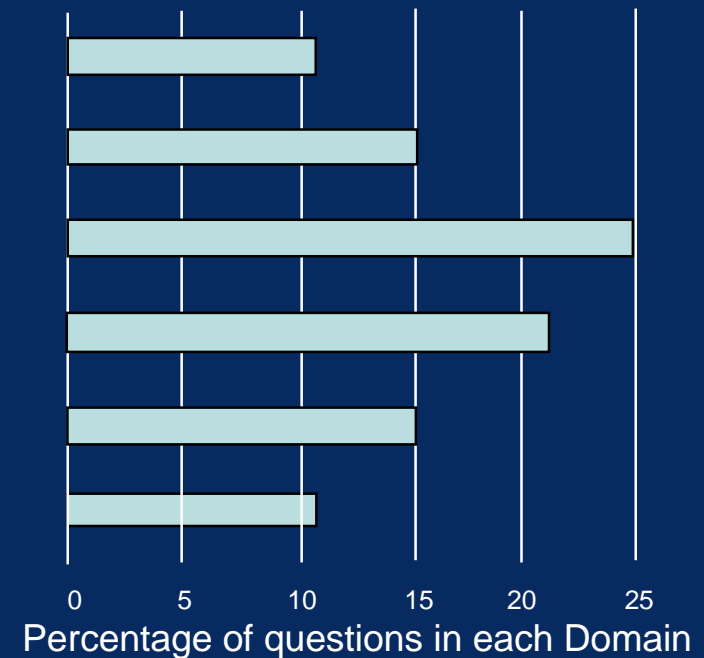




What you do -- Job Description of an Automation Professional

Job Description of an automation professional defined by these six “**Domains**” (subdivided into 52 “**Tasks**”)

- I. Feasibility Study
- II. Definition
- III. System Design
- IV. Development
- V. Deployment
- VI. Operation and Maintenance

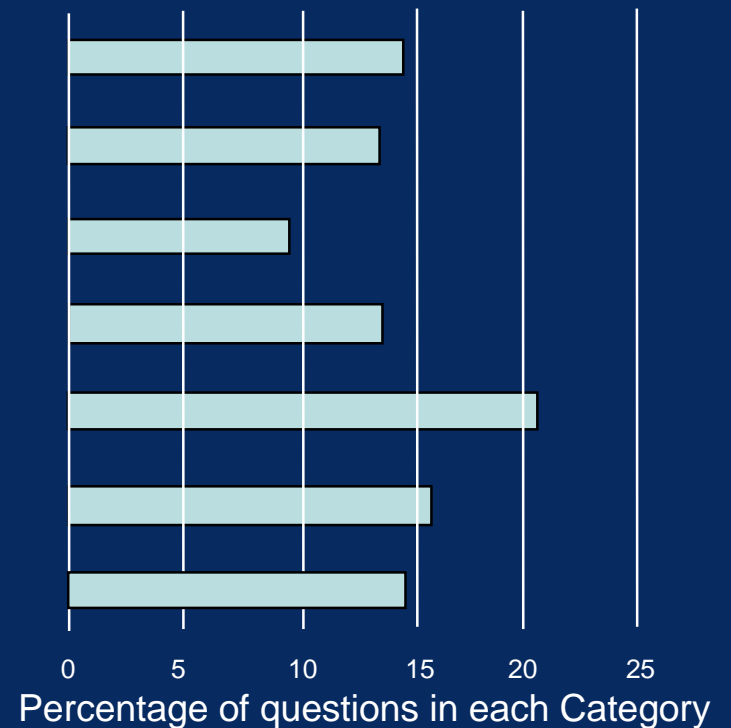


*A full listing of this job description is available at:
www.isa.org/cap under Knowledge and Skills*

What you know - Automation Body of Knowledge

The technical scope of professional work is defined in these seven “**Categories**” (subdivided into 35 “**Topics**”).

- I. Basic Continuous Control
- II. Discrete and Manufacturing Control
- III. Advanced Control
- IV. Reliability, Safety, and Electrical
- V. Integration and Software
- VI. Deployment & Maintenance
- VII. Work Structure (projects, teams)



*A full description is in the book,
[A Guide to the Automation Body of Knowledge](#)
 and the table of contents can be viewed on the [ISA website](#).*



Category I – BASIC CONTINUOUS CONTROL

1. Process Instrumentation
2. Analytical Instrumentation
3. Continuous Control
4. Control Valves
5. Analog Communication
6. Control System Documentation
7. DCS Control Equipment

Category I - sample question

When tuning a three mode controller by trial-and-error, which mode is usually adjusted first

- a) integral
- b) gain
- c) derivative
- d) offset



Category II – BASIC DISCRETE AND MANUFACTURING CONTROL

8. Discrete Sensors and General Manufacturing Measurements
9. Discrete Control Concepts and PLC Equipment
10. Motor and Drive Control
11. Motion Control

Category II – sample question

IEC 1131 graphical programming languages for PLCs include:

- a) Structured text
- b) The ADA programming language
- c) Function Block Diagrams
- d) Fuzzy Logic

Category III – ADVANCED CONTROL



12. Process Modeling

13. Advanced Process Control

14. Batch Control

15. Building Automation

Category III – sample question

What is the best type of control to use if the process changes from time to time and if there are a number of variables to be controlled?

- a) Fuzzy Logic
- b) Model Predictive Control
- c) Model Reference Control
- d) Advanced Regulatory Control

Category III – sample question

What is the relationship between a control recipe and a master recipe and a batch?

- a) Control recipes are a copy of the master recipe and describe the formulation for a series of batches in a run
- b) A control recipe is derived from the master recipe and is unique to a batch
- c) The control recipe is a more general version of the master recipe and covers an entire plant
- d) The control recipe is used by the research department as a control over a series of batches.



Category IV – RELIABILITY, SAFETY & ELECTRICAL

- 17. Alarm Management
- 18. Reliability
- 19. Process Safety
- 20. Electrical Installations
- 21. Electrical Safety



Category IV – sample question

Which of the following logic systems is the safest and the one most likely to respond to a true demand?

- a) 1 out of 1
- b) 1 out of 2
- c) 2 out of 2
- d) 2 out of 3



Category V – INTEGRATION AND SOFTWARE

22. Digital Communications

23. Industrial Networks

24. Manufacturing Execution Systems and Business
Integration

25. Systems and Network Security

26. Operator Interface

27. Data Management

28. Software

Category V – sample question

A network device that provides isolation from different networks, without changing any of the data is called:

- a) Hub
- b) Router
- c) Switch
- d) Gateway



Category V – sample question

Which of these types of communication methods usually results in less field wiring when connecting process transmitters to a control room

- a) AS-i bus
- b) Profibus PA
- c) HART
- d) 4-20 ma

Category VI – DEPLOYMENT & OPERATION



29. Operator Training

30. Checkout, System Testing, and Startup

31. Troubleshooting

32. Maintenance, Long Term Support and System Management

Category VI – Sample question

When training operators on a new control system, which training method would be best:

- a) Self-study of printed material
- b) Lecture by the supervisor
- c) Demonstration by the system design professional
- d) Practice using the controller on a simulated system



Category VII – WORK STRUCTURE

- 33. Automation Benefits and Project Justification
- 34. Project Management
- 35. Interpersonal Skills



Category VII – Sample question

A project has completed 40% of the work but has spent 60% of the budgeted funds. What is the cost performance index?

- a) 0.50
- b) 0.67
- c) 0.60
- d) 0.20



What Can You Do About CAP?



As an Individual what can you do about CAP?

- Become certified yourself
- Encourage others to become certified
- Talk with your management about CAP
 - Encourage your company to select a representative to become certified
 - Suggest your company build CAP into its strategic plan for employee development



As a Company Employing Automation Professionals what can you do about CAP?

- Identify an initial person in your organization to apply
 - Also possibly take the three day review course
- Build CAP into your strategic training plans
- Encourage professionals in your organization to become certified
 - Develop a policy of payment/part payment for application and/or preparatory training for CAP
 - Consider a one time bonus for becoming a CAP
 - Give preference in salary and advance to those who have taken the initiative to become CAPs



As a Company Using Outside Automation Services what can you do about CAP?

- Explain the advantages of CAP to your services suppliers
- In requests for bids ask for information on which personnel have a CAP
- Tell your suppliers that you will begin to give preference...
 - to system integrators, supplier application groups, and engineering contractors whose lead personnel have a CAP
 - To individual contractors that that have a CAP



As an Automation Services Company what can you do about CAP?

- Identify an initial person in your organization to apply
- Build CAP into your strategic training plans
- Encourage professionals in your organization to become certified
 - Develop a policy of payment/part payment for application and/or preparatory training for CAP
 - Consider a one time bonus for becoming a CAP
 - Give preference in salary and advance to those who have taken the initiative to become CAPs
- Use CAP in your advertising
- Tell your customers about CAP and why CAPs on their projects will be better qualified



As an Automation Hardware or Software Supplier what can you do about CAP?

- Talk with your customers about CAP
 - Let them know that you support the CAP program because customers with a CAP will be better able to correctly apply your products
 - Encourage them to become certified
- Use CAP to satisfy pre-requisites for training you provide to customers as appropriate



Summary

- CAP is becoming the standard for demonstrating automation competence
- CAP will be used for hiring and advancement decisions
- CAP will be used by automation services providers to differentiate themselves in the market
- Users will require CAPs to do their outsourced work



For More Information

- Download the CAP Handbook and get other information at www.isa.org/CAP
- Email: cap@isa.org