

MCS: Multi Communication Systems Corp.  
Silver Spring, MD 20904  
301-622-7610

UNITE  
St. Clair Shores, MI 48041-2254  
313-771-4483

NASPA: The Association for Corporate  
Computing Technical Professionals  
Oak Creek, WI 53154  
414-768-8000

YamTech: YamTech Systems, Ltd.  
Accra, Ghana - Africa  
011-233-21-779-001

SCP: Society of Computer Professionals  
Secaucus, NJ 07094  
201-865-0466

*Accredited Business Partners*

SISE: Institute Peruano De Sistemas  
Lima 18 Peru  
4448297-448342

ACBSP: Association of College Business  
Schools & Programs  
Overland Park, KS 66211

Excelsior College  
Albany, NY



**Certified  
Computing Professional**

**Institute for Certification  
of Computing Professionals**

2350 E. Devon Ave., Suite 115  
Des Plaines, IL 60018-4610 USA  
1-800-u-get-ccp  
847/299-4227 • FAX 847/299-4280  
email: office@iccp.org  
www.iccp.org

## ICCP CERTIFICATION:

*Your Mark of Distinction*

There is no doubt: Certification is the way to the top of the computing profession. And the prestigious CCP designation... Certified Computing Professional... from ICCP is recognized worldwide by employers and peers as validation of its holders' computing knowledge and experience.

The CCP is the standard which others covet.

That's because ICCP, the Institute for Certification of Computing Professionals, is acknowledged throughout the information and technology sectors as the most important source of professional certification. Our CCP examination demands a high degree of professional competence from those who pass; consequently, the designation is powerful evidence of the high level of attainment of a true Certified Computing Professional.

It should be no surprise, therefore, that the ICCP is the standard in professional certification for 25 national and international professional computing societies — and for numerous individual employers.

Certification is the confidence-building proof that you have met specific requirements and possess high levels of knowledge and skills. And it is easier than ever to become certified, with the introduction of our innovative computer-based testing concept.

In tough economic times, certification adds to your professional credibility and gives you an advantage in the competitive job market. The recognition that comes with the CCP designation makes ICCP the industry's leading professional certification organization.

# YOUR GUIDE TO CERTIFICATION AS A COMPUTING PROFESSIONAL

*The next Step  
on Your Path  
to Success*



**Certified  
Computing Professional**

**Institute for Certification  
of Computing Professionals**

1-800-u-get-ccp  
www.iccp.org  
email: office@iccp.org

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## ICCP Constituent Societies

ACM: Association for Computing Machinery  
New York, NY 10036  
212-626-0500

AWC: Association for Women in Computing  
San Francisco, CA 94104  
415-905-4663

CIPS: Canadian Information Processing Society  
Toronto, ON M5E 1E5  
416-861-2447  
info@cips.ca

DAMA: Data Administration Management Assn.  
Bellevue, WA 98006  
425-562-2636  
www.dama.org

AITP: Assn. for Information Technology Professionals  
401 N. Michigan Ave.  
Chicago, IL 60611-4267  
312-245-1070  
800-224-9371

ISTE: International Society for Technology in Education  
Eugene, OR 97403  
541-346-2401  
iste@oregon.uoregon.edu

## ICCP Affiliate Societies

ABRIS: Chinachem Johnston Plaza  
Wanchai, Hong Kong  
852-2598-4811

BITS: Bureau of Information Tech. Studies  
Mith Chowki  
Malad (West) Mumbai 400 064  
91-22-882-3131  
011-9122-578-6174  
bits@giasbm01.vsnl.net.in

BTA: Business Technology Association  
Kansas City, MO 64145  
816-941-3100

CMG: Computer Measurement Group  
Westmont, IL 60559-5507  
630-655-1812

CPCI: Consejo Profesional en Ciencias Informaticas  
Buenos Aires—  
Republica Argentina  
951-7161-951-9548

FNUG: Federation of NCR User Groups  
Dayton, OH 45479  
513-455-3131

Gulf Institute for the Development of Human Resources  
Muscan, Sultanate of Oman  
968-695056

HKCS: Hong Kong Computer Society  
Wanchai, HONG KONG  
852-834-2228

IADP: The Institute of Applied Data Processing  
Port Harcourt, Nigeria  
084-333058,239606

ICCA: Independent Computer Consultants Assn.  
St. Louis, MO 63123  
800-774-4222  
execdirector@icca.org

ISCA: Information Systems Consultants Assn.  
Atlanta, GA 30346  
404-458-3080

IIT: International Information Technology  
Kehkashan, Clifton  
Karachi, Pakistan  
92-21-530-639

Certification Council and the Test Management Councils of the Institute for Certification of Computing Professionals. The Book's purpose is to provide a starting focus for the authors and instructors of exam preparation review courses, and to help certification candidates themselves get started if they choose to embark on a review of the referenced texts on their own. We intend the information presented here to be of use in preparation for all levels of the Institute's certification programs:

- CCP Certified Computing Professional
- CBIP Certified Business Intelligence Professional
- CDMP Certified Data Management Professional
- ISA Information Systems Analyst
- ACP Associate Computing Professional
- Expert Proficiency Credential

Please call us for further information concerning the ICCP certification programs or with specific comments to help us improve this book.

## Fellows of the ICCP

The ICCP Board of Directors, recognizing their accomplishments and contributions to the industry, has unanimously approved the awarding of the prestigious term "Fellow" to the following persons.

- 1981 Rear Admiral Grace M. Hopper, USNR\*
- 1982 Paul M. Pair, Ph.D.\*
- 1988 Coleman Furr, Ed.D., CDP
- 1998 Herb Safford, CCP
- 1998 Daniel McCracken, CCP
- 2003 George R. Eggert, CCP
- 2003 Roland Spaniol, CCP
- 2003 John Swearingen, CCP

\* Deceased

## ICCP Executive Committee

- President: Jacqueline Luciano, CCP
- Vice President: Brett Champlin, CCP
- Treasurer: Patricia Dymkar Cupoli, CCP
- Secretary: Ken Metcalfe, ISP
- Director of Certification: John Whitehouse, CCP
- Director of Advancement Services: Joanne Ward, CCP
- Executive Director: Kewal Dhariwal, CCP

## ICCP Board Members

- ACM: Joyce Currie Little, Ph.D., CCP  
Terry Linkletter, CCP
- AWC: Jacqueline Luciano, CCP  
Rita Johnson Lowe
- CIPS: Ken Metcalfe, I.S.P.  
Mark Heuman, CCP
- AITP: Larry Schmitz, CCP
- DAMA: Brett Champlin, CCP  
Pat Cupoli, CCP
- ISTE: Roland D. Spaniol, Ph.D., CCP
- Membership Services Director: Jim Bell, CCP
- Recertification Director: Keith Tennant, ACP, CCP

## SECTION I

### INTRODUCTION

#### Meeting the challenge of certification

Over 50,000 computing professionals have already earned the recognition and rewards gained from passing ICCP exams — the highest caliber of certification in the industry.

By attaining certification through the ICCP, you join a growing, distinguished group of knowledgeable and expert computing professionals. They come from every area of the business, government and educational communities, and from around the world. Professionals certified with the ICCP serve as consultants; they work in local, state and federal government; in accounting and banking; in high schools, technical schools and universities; in the manufacturing industry; in insurance and numerous other fields. They have found that the benefits of certification extend to any job and industry where they apply their specialized skills.

We continue to expand the exams to reflect the changing nature of our profession. More than ever, you can make it a demanding, comprehensive test of your expertise. Those who pass know they have measured themselves against the highest standards in the industry — and set themselves apart as computing professionals. The ICCP examinations are available at over 250 test centers throughout North America. Alternate test arrangements can be made by contacting the ICCP Headquarters office. With the innovative computer-based format, you can test at your convenience throughout the year.

#### Enhance your standing as a professional

In addition to establishing your credentials as a computing professional, certification through the ICCP may offer you benefits that include:

- A practical means of assessing your skills and experience.
- Help in your career advancement and compensation.
- The satisfaction of measuring yourself against the highest industry standards.
- Membership in a distinctive peer group made up of your fellow professionals.
- Recognition of your specific areas of expertise by earning any of the ICCP's designations by sitting for the Core exam and two or more specialty exams.
- Recognition of your specific programming skills by earning the Certified Computing Professional (CCP) designation by sitting for the Core exam, a specialty exam and two programming language exams of your choice.
- An opportunity to test your knowledge in a specific area of the profession by sitting for a specialty exam to just earn a proficiency certificate.
- For people new to the industry, an entry-level exam designed to measure your standing and provide a starting point for building your professional careers through recognition as an Associate Computing Professional (ACP) or Information Systems Analyst (ISA)..

*Note: You do not have to take all examinations required for certification in one sitting. However, all examinations must be successfully completed within 36 months from the initial testing date.*

To receive an ACP designation, a candidate must pass the Core IT Skills examination and any other ICCP exam at 50%

## ACP Eligibility Requirements

Any person who has attained basic knowledge of Information Processing and one of the programming languages or specialty areas may apply for this certification.

**ICCP Codes:** Candidates must subscribe to the Code of Ethics, Conduct and Good Practice as described in this announcement.

## ISA Certification Criteria

Information Systems Analyst Certification is awarded to candidates passing the IS Assessment exam through their college.

The ISA Practitioner certification is awarded to graduates who scored above 50% on the IS Assessment exam.

The ISA Mastery certification is awarded to graduates who scored 70% or higher on the IS Assessment exam. Exams may be retaken to improve your score and go from the Practitioner to the Mastery certificate level. You may receive credit for the CCP Core exam when the IS Assessment exam is passed at the Mastery level. ISA certificate holders will be required to be in the ICCP Recertification Program.

## Additional ISA Certification Criteria

The following criteria must also be met in order to obtain an ISA: The ICCP would require transcript evidence of earning a baccalaureate degree or higher in a computing related field. There would not, however, be any requirement for professional experience, as is the case with the current CCP designator, so this would be an entry level certification, but positioned above the ACP.

## College Equivalency Accreditation

The American Council on Education (ACE) has recommended the awarding of college credits to those who pass the ICCP Examinations.

ICCP candidates can receive college credit hours for passing any ICCP examinations at 70% or better.

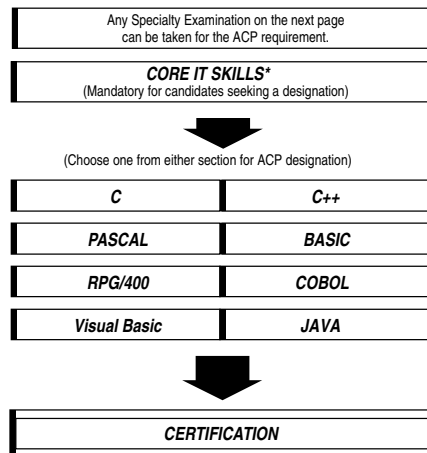
For further information on the ACE recommendations, contact ICCP headquarters.

Associate Computing Professional® (ACP)®  
 Certified Computing Professional® (CCP)®  
 are registered trademarks of the  
 Institute For Certification  
 Of Computing Professionals

## Exam Specifications

\*The **Core IT Skills examination** and each **Specialty examination** consists of 110 multiple choice questions with 1-1/2 hours allotted. Each **Language examination** consists of 66 multiple choice questions with 1 hour allotted

## Diagram of ACP Examination Structure



**3.5: Discretion:** One shall exercise maximum discretion in disclosing, or permitting to be disclosed, or using to one's own advantage, any information relating the affairs of one's present or previous employers or clients.

**3.6: Conflict of interest:** One shall not knowingly hold, assume, or accept a position or a client with which one's interests conflict or are likely to conflict with one's current duties or clients unless that interest has been disclosed in advance to all parties involved.

**3.7: Public Safety:** One has a responsibility to protect fundamental human rights and dignity and to respect cultural diversity. Those who design, develop and maintain computer systems shall be alert to and make others aware of any potential damage to the local and global environment. When developing information systems, computing professionals must ensure that their efforts are used to benefit humanity. Harmful effects to general health and welfare of the public shall be avoided.

**3.8: Violations:** One is expected to report violations of the Code, testify in ethical proceedings where one has expert or firsthand knowledge, and serve on panels to judge complaints of violations of ethical conduct.

## 4. Procedural requirements for revocation of certificate awarded

**4.1:** The ICCP may automatically revoke Certificates for non-compliance with mandatory recertification processes, providing the certificate was awarded subject to mandatory recertification requirements.

**4.2:** A Certification Council, on behalf of the Institute for Certification of Computing Professionals, has the right to revoke any Certificate which has been awarded by it in the event that the recipient violates the Codes, or engages in conduct which is a discredit or disgrace to the computing profession.

**4.3:** The grounds for revocation, except for failure to comply with mandatory recertification requirements, will be based upon the opinion of at least two-thirds of the members of the Council.

## 4.4: Procedure for handling revocation:

1. A formal written statement of charges alleging facts which constitute the grounds for revocation will be prepared.

2. A copy of said charges will be forwarded to the person accused, fixing a time within which such person may file with the Council answers to the charges.

3. If the charges are denied in the answer, the Council will fix a time for the hearing and give notice of the time and place of the hearing to the person accused.

4. Presentation of evidence in support of the charges will be made by the secretary (a nonvoting member) of the Certification Council.

5. Presentation of the evidence in defense of the charges will be made by the accused or the designated representative of the accused.

6. Ample opportunity for both sides to present facts and arguments will be allowed at the hearing.

7. At the conclusion of the hearing, the Council will determine whether or not the charges have been sufficiently established by the evidence and whether the Certificate should be revoked or should not be revoked.

8. The accused will be notified of the decision by registered mail.

9. The accused has the right to request review of the decision by the Executive Committee of ICCP, provided an appeal in writing is submitted to the President of ICCP within 30 days of the accused's receipt of the Council's decision.

## ICCP Certification Councils

The ICCP certification programs are intended to establish recognized professional standards within the information systems and information technology industry. ICCP examinations are given at the candidate's convenience of computer workstations in test centers within the USA and Canada, and in paper exam booklets at locations in other nations.

The ICCP certification programs and examinations are administered under the auspices of the Councils of the Institute for Certification of Computing Professionals (ICCP).

These CCP Examination Review Outlines were prepared by all of us serving on the

been founded on adequate knowledge. One will state a qualified opinion when expressing a view in an area within one's professional competence but not supported by relevant facts.

**2.4: Identification:** One shall properly qualify oneself when expressing an opinion outside one's professional competence in the event that such an opinion could be identified by a third party as expert testimony, or if by inference the opinion can be expected to be used improperly.

**2.5: Integrity:** One will not knowingly lay claims to competence one does not demonstrably possess. One shall not take advantage of the lack of knowledge or inexperience of others.

**2.6: Conflict of Interest:** One shall act with strict impartiality when purporting to give independent advice. In the event that the advice given is currently or potentially influential to one's personal benefit, full and detailed disclosure to all relevant interested parties will be made at the time the advice is provided. One's employer especially should be made aware of any potential conflicts of interest. One will not denigrate the honesty or competence of a fellow professional or a competitor, with the intent to gain an unfair advantage.

**2.7: Accountability:** The degree of professional accountability for results will be dependent on the position held and type of work performed. For instance: A senior executive is accountable for the quality of work performed by all individuals the person supervises and for ensuring that recipients of information are fully aware of known limitations of their work are fully disclosed, documented and explained. Furthermore, information processing professionals have a responsibility to take appropriate action regarding any illegal or unethical practices that come to their attention. Charges should be brought against a person only when a reasonable basis for the allegations has been established, without regard to personal interest.

**2.8: Protection of Privacy:** One shall protect the privacy and confidentiality of all entrusted information. One shall have special regard for the potential effects of computer-based systems on the right of privacy of individuals whether this is within one's own organization, among customers or suppliers, or in relation to the general public. Because of the privileged capability of computing professionals to gain access to computerized files,

especially strong strictures will be applied to those who have used their position of trust to obtain information from computerized files for their personal gain.

Where it is possible that decisions can be made within a computer-based system could adversely affect the personal security, work or career of an individual, the system design shall specifically provide for decision review by a responsible executive who will thus remain accountable and identifiable for that decision.

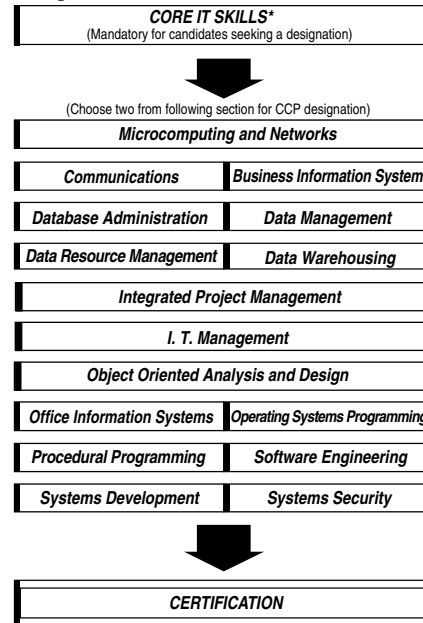
### 3. Code of Good Practice

**3.1: Education:** One has a special responsibility to keep oneself fully aware of developments in information processing technology relevant to one's current professional occupation. One will contribute to the interchange of technical and professional information by encouraging and participating in educational activities directed to both fellow professionals and to the public at large. One will do all in one's power to further public understanding of computer systems. One will contribute to the growth of knowledge in the field to the extent that one's expertise, and ability allow.

**3.2: Personal Conduct:** Insofar as one's personal and professional activities interact visibly to the same public, one is expected to support, respect and abide by the appropriate laws and in general to apply the same high standards of behavior in one's personal life as are demanded in one's professional activities. **3.3: Competence:** One shall at all times exercise technical and professional competence at least to the level one claims. One shall not deliberately withhold information in one's possession unless disclosure of that information could harm or seriously affect another party, or unless one is bound by a proper, clearly defined confidential relationship. One shall not deliberately destroy or diminish the value or effectiveness of a computer-based system through acts of commission or omission.

**3.4: Statements:** One shall not make false or exaggerated statements as to the state of affairs existing or expected regarding any aspect of information technology or the use of computers. In communicating with lay persons, one shall use general language wherever possible and shall not use technical terms or expressions unless there exist no adequate equivalents in the general language.

## Diagram of CCP Examination Structure



## CCP Eligibility Requirements

The CCP certification program is directed toward senior level personnel in the information processing industry. Candidates must pass at 70%.

Any person may take any examination. However, they will not receive a certification and be entitled to use the corresponding designation until the following requirements are met for experience, professional qualification and ethical practice.

**Experience:** A candidate must have at least 48 months of full-time (or part-time equivalent) direct experience in computer-based information systems. The 48 months need not be consecutive or in a single position. Acceptable forms of experience include data processing systems, programming, management, and teaching computer-based information systems. Systems and programming experience gained while

employed by computer equipment manufacturers, service centers, management consulting firms or educational institutions may be applied toward this requirement. Clerical, data-entry or experience gained in connection with formal classwork will not be considered acceptable.

### Academic and Other Certification

**Alternatives:** Candidates having less than 48 months work experience may substitute post-secondary academic work for up to 24 months of experience on the following basis, provided official transcripts of academic work are submitted to ICCP:

24 months	Bachelor's degree or graduate degree in information systems or computer science.
24 months	Associate Computing Professional (ACP) certification.
18 months	Bachelor's or graduate degree in related area including accounting, business, engineering, mathematics, sciences or statistics.
12 months	Bachelor's or graduate degree in non-related area.
12 months	Associate degree or diploma (2 year program) in information systems or computer science.

The maximum credit for academic alternatives toward the experience requirement shall not exceed 24 months.

**Examination:** All candidates must pass a combination of examinations as specified in the diagram. All examinations for the selected designation must be completed successfully within 36 months from the initial test date. Otherwise credit will be lost for any examination passed during the allowable time period and the candidate will be required to begin again.

**ICCP Codes:** Candidates must subscribe to the Code of Ethics, Conduct and Good Practice as described in this announcement.

## Expert Proficiency Certificates

Any person may take any examination on a stand alone basis. Those who successfully pass the Specialty Exam or Programming Language Exam at 70% or better may earn an Expert Proficiency Certificate declaring that they have knowledge and competence within that area. There are no pre-requisites for eligibility.

## CBIP Eligibility Requirements

**The Certified Business Intelligence Professional - Practitioner Level** is awarded when a person passes the following three ICCP Examinations at the 50% or higher score: CORE Information Technologies Examination, Data Warehousing, plus one of I.T. Management (Leadership and Management track), Business Information Systems (Business Analytics Track), Data Resource Management (Data Analysis & Design Track), Systems Development (Data Integration Track), Systems Security or Database Administration (Administration & Technology Track)

Track), Data Resource Management (Data Analysis & Design Track), Systems Development (Data Integration Track), Systems Security or Database Administration (Administration & Technology Track).

**The Certified Business Intelligence Professional - Mastery Level** is awarded when a person passes the following three ICCP Examinations at the 70% or higher score: CORE Information Technologies Examination, Data Warehousing, plus one of I.T. Management (Leadership and Management track), Business Information Systems (Business Analytics Track), Data Resource Management (Data Analysis & Design Track), Systems Development (Data Integration Track), Systems Security or Database Administration (Administration & Technology Track)

	CBIP Specialties				
	Leadership Mgmt	Business Analytics	Data Analys Design	Data Integration	Admin. & Technology
Core IT Skills	X	X	X	X	X
Data Warehousing	X	X	X	X	X
Business Information Systems		X			
Data Resource Mgmt.			X		
IT Management	X				
Systems Development				X	
Systems Security					X*
Database Administration*					X*

Either *Systems Security Exam* or *Database Administration Exam* may be used to satisfy the third exam requirement for Administration or Technology specialty

A confidential relationship with people served.

Public reliance upon the standards of conduct and established practice.

The observance of an ethical code.

Therefore, these Codes have been formulated to strengthen the professional status of certified computing professionals.

### 1. Preamble

**1.1:** The basic issue, which may arise in connection with any ethical proceedings before a Certification Council, is whether a holder of a Certificate administered by that Council has acted in a manner which violates the Code of Ethics for certified computing professionals.

**1.2:** Therefore, the ICCP has elaborated the existing Code of Conduct, which defines more specifically an individual's professional responsibility. This step was taken in recognition of questions and concerns as to what constitutes professional and ethical conduct in the computing profession.

**1.3:** The ICCP has reserved for and delegated to each Certification Council the right to revoke any Certificate which has been issued under its administration in the event that the recipient violates the Codes of Ethics, as amplified by the Code of Conduct. The revocation proceedings are specified by rules governing the business of the Certification Council and provide protection of 2. the rights of any individual who may be subject to revocation of a certificate held. The ICCP may bypass revocation proceedings and automatically revoke any Certificate for non-compliance with mandatory recertification processes, providing the certificate was awarded subject to mandatory recertification requirements.

**1.4:** Insofar as violation of the Code of Conduct may be difficult to adjudicate, the ICCP has also promulgated a Code of Good Practice, the violation of which does not in itself constitute a reason to revoke a Certificate. However, any evidence concerning a serious and consistent breach of the Code of Good Practice may be considered as additional circumstantial evidence in any ethical proceedings before a Certification Council.

**1.5:** Whereas the Code of Conduct is of a fundamental nature, the Code of Good Practice is expected to be amended from time to time to accommodate changes in the social environment and to keep up with the development of the

information processing profession.

**1.6:** A Certification Council will not consider a complaint where the holder's conduct is already subject to legal proceedings. Any complaint will only be considered when the legal action is completed, or it is established that no legal proceedings will take place.

**1.7:** Recognizing that the language contained in all sections of either the Code of Conduct or Code of Good Practice is subject to interpretations beyond those intended, the ICCP intends to confine all Codes to the matters pertaining to personal actions of individual certified computing professionals in situations for which they can be held directly accountable without reasonable doubt.

**1.8:** Certified computing professionals have a responsibility to respect intellectual property rights, including copyrights, patents and trademarks. Violation of copyrights, patents and terms of license agreements is prohibited by law in most circumstances. Even when not so protected, such violations are contrary to professional behavior. Software should be copied only with proper authorization. Unauthorized duplication of both printed and electronic materials must be discouraged including those cases where the work has not been explicitly protected by any means. Credit should not be taken for the work of others. The work of others should not be used without specific acknowledgement and authorization.

### Code of Conduct

**2.1:** Disclosure: Subject to the confidential relationships between oneself and one's employer or client one is expected not to transmit information which one acquires during the practice of one's profession in any situation which may seriously affect a third party.

**2.2:** Social Responsibility: One is expected to accept a responsibility to the public to diminish, through a continuing educational process, confusion and misconceptions surrounding the information processing industry. One is expected to be cognizant of and act in accordance with all procedures and regulations to improve public safety through the protection of information vital to the security of the nation and its people, both collectively and individually.

**2.3:** Conclusions and Opinions: One is expected to state a conclusion on a subject in one's field only when it can be demonstrated that it has

# SECTION V

## GENERAL INFORMATION

### Recertification

For the ICCP designations, successful candidates must maintain their professional competence. Evaluation is every three years on the anniversary of your certificate date. The Recertification process may be accomplished by either retesting or involvement in the Continuing Education programs. CCP, CBIP and CDMP certificate holders must earn 120 hours during each three-year cycle and pay the \$75 annual fee. ACP and ISA certificate holders must earn 60 hours during each 3 year cycle and pay the \$35 annual fee.

### Official Study Guides

The ICCP Complete Guide to Professional Computing may be purchased directly from the ICCP office. The cost is \$115.00 per copy (\$105.00\* + \$10.00 shipping/handling). International shipping additional, please call the ICCP Office or email office@iccp.org for details.

The Complete Guide includes an expanded outline of the Core IT Skills Exam, each Specialty Examination and the Programming Language Examinations. The expected depth of knowledge for each area is included. Also included is an analysis of the sample questions and answers. If you wish, you may charge the review outline to your MasterCard, VISA or Discover Card. Fill out the form found on the back cover and mail or FAX it to the ICCP. **We do not accept purchase orders. ALL SALES ARE FINAL.**

### Preparation Textbooks

Preparation Textbooks may be purchased directly from the ICCP office for \$41.50 (\$39.00\* + \$2.50 shipping/handling). **ALL SALES ARE FINAL.** International shipping additional, please call the ICCP Office or email office@iccp.org for details. \* Illinois residents add 8.25% sales tax.

The Preparation Textbooks are meant to be used in conjunction with the Official Exam Review Outline. There is a textbook for the Core Examination and each Specialty Exam. The textbooks are a series of separate study materials that cover subject matter related to the certification examination and that address the major theories and key concepts based on the Body of Knowledge defined for the ICCP examinations. Example questions are not included, they are part of the "Official Exam Review Outline."

Current Volumes are:

- Volume I Core Examinations
- Volume II Management
- Volume III Systems Development
- Volume IV Microcomputing and Networks
- Volume V Business Information Systems
- Volume VI Software Engineering

### ICCP Code of Ethics

Certified computing professionals, consistent with their obligation to the public at large, should promote the understanding of information processing methods and procedures using every resource at their command. Certified computing professionals have an obligation to their profession to uphold the high ideals and level of personal knowledge as evidenced by the Certificate held. They should also encourage the dissemination of knowledge pertaining to the development of the computing profession.

Certified computing professionals have an obligation to serve the interests of their employers and clients loyally, diligently and honestly.

Certified computing professionals must not engage in any conduct or commit any act which is a discredit to the reputation or integrity of the information processing profession.

Certified computing professionals must not imply that the Certificates which they hold are their sole claim to professional competence.

#### Code of Conduct and Good Practice for certified computing professionals

The essential elements relating to conduct that identify a professional activity are:

A high standard of skill and knowledge.

#### Core IT Skills Examination

Human and Organizational Framework  
Data and Information  
Technology

Systems Concepts  
Associated Disciplines  
Systems Development

#### Data Warehousing

Data Warehouse Infrastructure Creation/Maintenance  
Data Acquisition and Cleansing  
Data Warehouse Implementation and Operation

Data Warehousing Function  
Tools & Technology Types

#### Database Administration \*

Database Administration Function  
Physical Database Design  
Performance Tuning  
Backup and Recovery  
Management of data storage technologies

DBMS Concepts and Usage  
Distributed Data  
Storage  
Linking Process Logic and Data  
SQL Language Considerations

#### Business Information Systems (BIS)

BIS Applications  
The BIS Environment  
BIS Considerations

#### I.T. Management

General Management and  
Organizational Concepts  
Project Management  
Information Systems  
Management

#### Systems Development

System Analysis  
System Design and Implementation  
The Systems Analyst as a Professional

#### Communications

Data Communications Theory  
Networking Theory  
The ISO OSI Reference Model  
Established Communications  
Systems  
Hardware Usage and Design

#### Systems Security

Risk Management  
Recovery from Information Service Interruptions  
Information and System Security  
Security in System Design  
Security Management

#### Data Management

Data Management Function  
Data & Metadata Infrastructures Creation/Maintenance  
Data Analysis and Modeling  
Data/Metadata Infrastructure Management  
Information Quality Management

© CBIP credential is exclusive with TDWI

The Database Administration examination will be available in August 2004

## CDMP Eligibility Requirements

The CDMP Practitioner certification is awarded to professionals who scored above 50% on all three exams. These individuals can contribute as a team member on assigned tasks for they have a working knowledge of concepts, skills and techniques in a particular data specialization.

The CDMP Mastery certification is awarded to professionals who scored 70% or higher on all three exams. These individuals have the ability to lead and mentor a team of professionals as they have mastered the concepts, skills and practices of their data specialization. Exams may be retaken to improve your score and go from the Practitioner to the Mastery certificate level. You may receive credit up to one specialty exam for select vendor certifications.

CDMP Certification Criteria  
Three ICCP exams must be passed with the following scores:

Score	Credential Earned
Pass at 50% or higher	CDMP Practitioner Certificate
Pass at 70% or higher	CDMP Mastery Certificate

The following criteria must also be met in order to obtain a CDMP:

CDMP Certificate	Practitioner	Mastery
# Years Data Professional Experience	2	4+
Up to # Years – Substitute Bachelor or Master Degree in an appropriate discipline (criteria to be supplied by DAMA) for Work Experience	2	2
Recertification Required	Yes	Yes
Code of Ethics	Yes	Yes

### Recommended Exams To Take Based on Candidate's Work Experience

The following table shows the Data Management areas by which ICCP exam is required (R) or by which exam is the candidate's choice (C) for a total of three exams.

ICCP Exams	Management	Architecture	Data Analysis & Design	Database Administration	Data Warehousing	Metadata / Repository Management	Data / Information Quality (Future)
IT Core	R	R	R	R	R	R	R
<b>Specialty Exams</b>							
Data Resource Management <sup>1</sup> / Data Management <sup>2</sup>	R	R	R	C	C	R	R
Data Resource Management / Database Administration <sup>3</sup>		C	C	R	C	C	C
Data Warehousing		C	C	C	R	C	C
Integrated Project Mgmt	C				C	C	C
IT Management	C				C	C	
Systems Development		C	C	C		C	
Object Oriented Analysis & Design			C				
Systems Security				C			
<b>Future ICCP Exams</b>							
Information Quality			C	C	C	C	R (future)
Architecture		R (future)	C	C	C	C	
<b>Acceptable Exam Substitutes (Third Party)</b>	NA <sup>4</sup>	NA	NA	NA	NA	NA	RC (future: e.g. MIT or Berkeley – DQ programs)

## Refund Policy

**ALLEXAMINATIONFEESARENON-REFUNDABLE.** Candidates may reschedule through the ICCP Office at 847-299-4227 no less than 48 hours before the scheduled examination date and time. If a candidate fails to reschedule the examination, all fees are forfeited.

## SECTION IV TESTING CENTERS AND PROCEDURES

### Confirmation Letters

A Confirmation Letter, including the 800 telephone number for scheduling the time and date of the examination, will be sent after the application has been processed. Once the ICCP accepts the application, the candidate has 90 days to sit for the exam applied for. Be certain to notify the ICCP of any change in your mailing address.

Each candidate must present the Confirmation Letter and two forms of identification in order to be admitted to the examination.

**DANTES Candidates Only:** Military and civilian candidates who are connected with the Defense Activity for Non-Traditional Education Support (DANTES) program should apply to take the examination through the regular channels within their respective branch of service. The test control officer will provide information on locations, test center numbers, and financial arrangements.

## Testing Center Information

### Changes in Testing Centers

Any requests for change in testing center must be received at least 48 hours prior to the examination or additional fees will be required. All changes must be coordinated through the ICCP Office at 847-299-4227

### Applicants with Disabilities

The ICCP is interested in ensuring that no disabled individual is deprived of the opportunity to take the examination. Special testing arrangements may be made provided a request is submitted in writing at least sixty (60) days prior to the examination. A written description of the disability and verification from a licensed physician should be submitted with the application.

### Testing Center Regulations

The following regulations will be observed at all testing centers in order to insure uniform testing procedures:

1. Calculators cannot be used during the examination.
2. No test materials, documents or memoranda of any sort are to be taken from the examination room.
3. Any irregularities connected with the administration of the examination will be reported to the ICCP. Candidates suspected of giving or receiving assistance will be strictly observed with their names and ID numbers reported to the ICCP.
4. The examination will be held only on the day and time scheduled.
5. Visitors are not permitted in the examination room.
6. Candidates should use their complete names (e.g., John Thomas James, Jr.) on the application and any correspondence concerning the examination.

- 1.14 Junit
- 1.15 Xml With Java
- 1.16 Javascript
- 1.17 Uml
- 1.18 Awt
- 1.19 UtilPackage
- 1.20 Ejb
- 1.21 SqlPackage/Jdbc
- 1.22 Jms
- 1.23 Math Class
- 1.24 Dynamic Class Loading
- 1.25 Package Declarations
- 1.26 Import Declarations
- 1.27 Streams
- 1.28 Exception Handling

#### Pascal Language

- 1. Elementary Topics
- 2. Procedures and Functions
- 3. Control Structures
- 4. Defined Data Types
- 5. Arrays
- 6. Recursion
- 7. Text Files
- 8. General Files
- 9. Records
- 10. Pointers

#### RPG/400 Language

- 1. General Topics
- 2. Data
- 3. File Processing
- 4. Calculation Operations
- 5. Arrays and Tables
- 6. Program Control
- 7. Debugging

#### Visual Basic

- 1. Visual Basic Model
- 2. General Programming
- 3. Visual Basic Language
- 4. Visual Basic GUI
- 5. Advanced Topics

## SECTION III

### Applications and Fees

Applications may be filed at any time throughout the year. Upon acceptance of a candidate's application, the candidate will have 90 days to sit for the exam applied for. ICCP will issue a Confirmation Letter. The letter will include an 800 telephone number for scheduling of examination date and time at the most convenient location.

Candidates may sit for examinations as often as desired, although a thirty day wait is required to retake the same examination; in addition to payment of examination fee.

ALL Examination Fees are  
Non-refundable.

All examination fees are payable when the application is filed. If necessary, candidates may reschedule the examination. **All rescheduling must be coordinated through the ICCP Office at 1-847-299-4227 no less than 48 hours before the scheduled examination date and time.**

### Exam Fees

Core IT Skills Exam	\$250.00
Specialty Exams	\$250.00
Language Exams	\$145.00

The entire amount due in U.S. funds must accompany the completed application. Make check or money order payable to ICCP. Do NOT send cash. Applications accompanied by charge information may be transmitted by FAX 847/299-4280.

<sup>1</sup>The Data Resource Management exam will eventually be phased out and replaced with the Data Management and Database Administration exams.

<sup>2</sup>The Data Management exam is scheduled for release in 2004.

<sup>3</sup>The Database Administration exam is scheduled for release in 2004.

<sup>4</sup>NA – Information Not Available

### Certified Data Management Professional (CDMP) Professional Exams

The CDMP requires three ICCP exams: IT Core, one specified data oriented exam, and one other exam. Please note that the Data Resource Management (DRM) exam will eventually be replaced by Data Management and Database Administration exams. A candidate can take the DRM exam in the interim period to count as a data specialty exam.

If you already passed one or more ICCP exams, these exams can be used toward a CDMP if considered current by ICCP standards, and the exams are listed within your CDMP area of specialization. For information on your status, contact the ICCP.

If you want to show expertise in one exam specialty area only, the ICCP will issue Expert Certificates if you pass one specialty exam at 70% or higher.

Institute for Certification of  
Computing Professionals  
2350 E. Devon Avenue, Suite 115  
Des Plaines, IL 60018-4610 USA  
1-800-U-GET-CCP FAX 847-299-4280  
email: [office@iccp.org](mailto:office@iccp.org) [www.iccp.org](http://www.iccp.org)



Data Administration and  
Management Association  
P O Box 5786, Bellevue WA 98006-5786 USA  
425-562-2636 [www.dama.org](http://www.dama.org)

## SECTION II

### Examination Subject Outline

#### CORE IT SKILLS EXAMINATION

1. Human and Organization Framework
  - 1.1 Business Environment
  - 1.2 Management
  - 1.3 Technology Transfer
  - 1.4 Interpersonal Communication
  - 1.5 Professional Issues
2. Systems Concepts
  - 2.1 Types of Systems
  - 2.2 Systems Configuration
3. Data and Information
  - 3.1 Data Architecture
  - 3.2 Data Management
4. Systems Development
  - 4.1 Systems Development Cycle
  - 4.2 Systems Integration
  - 4.3 Tools and Techniques
5. Technology
  - 5.1 Hardware
  - 5.2 General Purpose Software
6. Associated Disciplines
  - 6.1 Financial Management and Analysis
  - 6.2 Management Science
  - 6.3 Information Systems Auditing
  - 6.4 Mathematics
  - 6.5 Statistics

### Specialty Examinations

#### BUSINESS INFORMATION SYSTEMS

1. Business Information Systems Applications
  - 1.1 Financial Planning/Decision Support
  - 1.2 Accounting
  - 1.3 Organizational Performance
  - 1.4 Marketing and Sales
  - 1.5 Materials Management

- 1.6 Production and Distribution Management
- 2. The Business Information Systems Environment
  - 2.1 System Analysis/Design Function
  - 2.2 Data Base Design Function
  - 2.3 Application Programming Function
  - 2.4 Computer Operations Function
  - 2.5 Systems Programming Function
  - 2.6 Quality Control Function
  - 2.7 Information Center Function
- 3. Business Information System Considerations
  - 3.1 User/IS Relations
  - 3.2 Business Economics
  - 3.3 IS Resource Management
  - 3.4 EDP Equipment Use
  - 3.5 Software Development Environment

## INTERNETWORKING & COMMUNICATIONS

- 1. Data Communications Theory
  - 1.1 Information Theory
  - 1.2 Protocols
  - 1.3 Layering
  - 1.4 Interfaces
- 2. Networking Theory
  - 2.1 Topology
  - 2.2 Connectivity
  - 2.3 Queuing Theory
  - 2.4 Flow and Capacity
- 3. The ISO OSI Reference Model
  - 3.1 Physical Layer
  - 3.2 Data Link Layer
  - 3.3 Network Layer
  - 3.4 Transport Layer
  - 3.5 Session Layer
  - 3.6 Presentation Layer
  - 3.7 Application Layer
- 4. Established Communications Systems
  - 4.1 Standards Organizations and Standards

- 4.2 Telecommunications
- 4.3 Data Communications
- 4.4 Computer Communications and Networks

## 5. Hardware

- 5.1 Data Switches
- 5.2 Modems/Codecs
- 5.3 Multiplexors/Concentrators
- 5.4 Communications Controllers
- 5.5 Front-End Processors
- 5.6 Buses and Channels
- 5.7 Fiber Optical Devices
- 5.8 Connectors and Cables
- 5.9 Telephone Systems
- 5.10 Computer Terminals
- 5.11 Installation of Equipment
- 5.12 Diagnostic Equipment

## 6. Usage and Design

- 6.1 User Needs
- 6.2 Access Rights and Privacy
- 6.3 Security
- 6.4 Costs
- 6.5 Analysis Tools, Software
- 6.6 Comparisons
- 6.7 Reliability and Pathology

## DATABASE ADMINISTRATION

\*Available after August 2004

## DATA MANAGEMENT

- 1. Data Resource Management Functions
  - 1.1 Data Administration
  - 1.2 Database Administration
- 2. Data Analysis
  - 2.1 Planning for Data
  - 2.2 Data Modeling Concepts
  - 2.3 Data Standards
  - 2.4 Data & Business Systems
  - 2.5 Management of the Data Infrastructure
- 3. Database Design
  - 3.1 DBMS Concepts & Usage
  - 3.2 Decision Support vs. Operational Databases
  - 3.3 Distributed Data
  - 3.4 Performance Tuning
  - 3.5 Storage
  - 3.6 Backup & Recovery

- 9.1 Security
- 9.2 Software Installation
- 9.3 Software Tailoring

## SYSTEMS SECURITY

- 1. Risk Assessment
  - 1.1 Organization
  - 1.2 Systems and Data Asset Valuation
  - 1.3 Threat Characteristics
  - 1.4 Risk Assessment
  - 1.5 Dealing with Risk
- 2. Recovery from Information Service Interruptions
  - 2.1 Recoverable Storage Management
  - 2.2 Business Continuity Planning
  - 2.3 Disaster Management
- 3. Information and System Security
  - 3.1 Telecommunications
  - 3.2 Database Security
  - 3.3 Cryptography
  - 3.4 Operating Systems
  - 3.5 Microcomputers and Local Area Networks
  - 3.6 Physical Security
- 4. Security in System Design
  - 4.1 System Security Objectives and Functions
  - 4.2 Data Integrity Assurance
  - 4.3 Life Cycle Approach
- 5. Security Management
  - 5.1 Policy Setting, Implementation and Administration
  - 5.2 Security Awareness
  - 5.3 Information Ethics
  - 5.4 Personnel Issues
  - 5.5 Evaluation of Security Measures

## Programming Languages

### BASIC Language

- 1. Characteristics of a BASIC Program
- 2. Data

- 3. Expressions and Assignments
- 4. Input and Output
- 5. Control Statements
- 6. Functions
- 7. Arrays
- 8. String Manipulation

### C Language

- 1. Data Types
- 2. Operators and Expressions
- 3. Flow Control
- 4. Functions
- 5. Pointers and Arrays
- 6. Structures and Unions
- 7. Standard I/O Library
- 8. Library Functions and Environment
- 9. The Preprocessor

### C++ Language Examination

- 1. Basic Language Elements
- 2. Expressions and Operators
- 3. Flow Control
- 4. Arrays and Pointers
- 5. Object-Oriented Programming
- 6. Functions
- 7. Exception Handling
- 8. Standard Libraries
- 9. The Pre-Processor

### COBOL Language

- 1. General
- 2. Compiler Commands
- 3. Divisions and Sections
- 4. Debugging

### Java Language

- 1.1 Basic Java, variable and method declarations
- 1.2 Variable Arrays
- 1.3 Method Calls
- 1.4 Operators
- 1.5 Program Flow
- 1.6 Class Declarations
- 1.7 Interfaces And Abstract Classes
- 1.8 Design Patterns
- 1.9 Garbage Collection
- 1.10 Javadoc
- 1.11 Threads
- 1.12 Swing
- 1.13 Servlets And Jsp
- 1.0 Java Language

7. Software Testing Techniques
  - 7.1 Software Testing Fundamentals
  - 7.2 White Box Testing
  - 7.3 Basis Path Testing
  - 7.4 Loop Testing
  - 7.5 Black Box Testing
  - 7.6 Proof of Correctness
  - 7.7 Automated Testing Tools
  - 7.8 Strategic Approach to Software Testing
  - 7.9 Unit Testing
  - 7.10 Integration Testing
  - 7.11 Validation Testing
  - 7.12 System Testing
  - 7.13 Debugging
8. Software Maintenance and Configuration Management
  - 8.1 Maintenance Characteristics
  - 8.2 Maintainability
  - 8.3 Maintenance Tasks
  - 8.4 Maintenance Side Effects
  - 8.5 Software Configuration Management

## SYSTEMS DEVELOPMENT

1. Systems Analysis
  - 1.1 General System Theory
  - 1.2 Preliminary Studies
  - 1.3 Definition of Objectives
  - 1.4 Data Gathering and Analysis
  - 1.5 System Requirements
2. Systems Design and Implementation
  - 2.1 Alternative Systems Design
  - 2.2 Logical Design
  - 2.3 Detailed Design
  - 2.4 Privacy, Security and Controls
  - 2.5 System Implementation
  - 2.6 System Evaluation and Maintenance
3. The Systems Analyst as a Professional
  - 3.1 Organizational Roles of the Systems Professional
  - 3.2 Interpersonal Roles of the Systems Professional
  - 3.3 Communication Skills
  - 3.4 Identifying Key Individuals

## SYSTEMS PROGRAMMING

1. Languages
  - 1.1 Assembly Language Concepts
  - 1.2 Higher Level Language Structures
2. Operating Systems
  - 2.1 Processor Dispatching
  - 2.2 Interrupt Handling
  - 2.3 Paging Supervisor
  - 2.4 Resource Allocation
  - 2.5 Input/Output Spooling
  - 2.6 Operator Communication
  - 2.7 Program Loading
  - 2.8 Memory Protection and Privileged Instructions
3. Language Processing
  - 3.1 Parsing and Syntactic/Semantic Analysis
  - 3.2 Code Generation and Optimization
  - 3.3 Module Collection and Address Resolution
  - 3.4 Development Techniques
4. Concurrent and Distributed Processing
  - 4.1 Communication Protocols
  - 4.2 Network Architecture
  - 4.3 Multi-Tasking
  - 4.4 Dynamic Resource Allocation
  - 4.5 Fault-Tolerance and Recovery
  - 4.6 Security
5. Data Management Systems
  - 5.1 Physical Data Structure
  - 5.2 Logical Data Models
  - 5.3 Concurrent Access Control
  - 5.4 Data Integrity
6. Computer Architecture and Implementation
7. Performance Evaluation
  - 7.1 Performance Measurement
  - 7.2 Modeling and Simulation
  - 7.3 Tuning
8. Software Tools
9. System Management

- 3.7 Linking Process Logic & Data
- 3.8 Mgmt. of Data Storage Technologies
- 3.9 SQL Language Considerations

## DATA RESOURCE MANAGEMENT

1. Data Resource Management Functions
  - 1.1 Data Administration
  - 1.2 Data Base Administration
2. Data Analysis
  - 2.1 Planning for Data
  - 2.2 Data Modeling Concepts
  - 2.3 Data Standards
  - 2.4 Data and Business Systems
  - 2.5 Management of the Data Infrastructure
3. Data Base Design
  - 3.1 DBMS Concepts and Usage
  - 3.2 Decision Support vs. Operational Data Bases
  - 3.3 Distributed Data
  - 3.4 Performance Tuning
  - 3.5 Storage
  - 3.6 Backup and Recovery
  - 3.7 Linking Process Logic and Data
  - 3.8 Management of Data Storage Technologies
  - 3.9 SQL Language Considerations

## DATA WAREHOUSING

1. Data Warehousing Function
  - 1.1 Planning
  - 1.2 Organization
  - 1.3 Roles and Responsibilities
2. Data Warehouse Infrastructure Creation / Maintenance
  - 2.1 Data Warehouse Architectures
  - 2.2 Data Warehouse Informational Database Architectures Types
  - 2.3 Tools and Technology Types
3. Data Warehousing Analysis and Design
  - 3.1 Requirements Analysis
  - 3.2 Data Warehouse Model Types and Components
  - 3.3 Data Modeling for the Data Warehouse

4. Data Acquisition and Cleansing
  - 4.1 Source Data Acquisition
  - 4.2 Source Data Cleansing
5. Data Warehouse Implementation and Operation
  - 5.1 Development
  - 5.2 Deployment
  - 5.3 Ongoing Support and Maintenance

## INTEGRATED PROJECT MANAGEMENT

\*Available after August 2004

## I.T. MANAGEMENT

1. General Management and Organizational Concepts
  - 1.1 Business Functions
  - 1.2 Business Economics
  - 1.3 Management Systems
  - 1.4 Management Functions
  - 1.5 Managerial Roles
  - 1.6 Politics and Pressure Groups
  - 1.7 Business Ethics and Organizational Values
2. Project Management
  - 2.1 Project Staffing and Roles
  - 2.2 Defining Project Objectives
  - 2.3 Determining Project Activities
  - 2.4 Estimating
  - 2.5 Planning and Scheduling
  - 2.6 Monitoring and Control
  - 2.7 Project Evaluation
  - 2.8 Tools for Project Management
  - 2.9 Consultants
3. Information Systems Management
  - 3.1 The Information Systems Organization
  - 3.2 Information Center/User Services
  - 3.3 Technical Services
  - 3.4 System Performance Criteria
  - 3.5 Capacity Planning and Procurement
  - 3.6 Security, Protection and Controls
  - 3.7 Contingency Planning

- 3.8 Information Systems Human Resource Management
- 3.9 Critical/Key Success Factors

## MICROCOMPUTING AND NETWORKS

- 1. Resource Management Functions
  - 1.1 General Administration
  - 1.2 Technical Administration
  - 1.3 End User Support
- 2. Microcomputer Architecture
  - 2.1 System Unit
  - 2.2 Peripherals
- 3. Microcomputer Software
  - 3.1 Applications
  - 3.2 Systems Software
- 4. Network Technology
  - 4.1 Networking Concepts
  - 4.2 Local Area Networking (LAN)
  - 4.3 Wide Area Networking (WAN)
  - 4.4 Value Added Networks (VAN)

## OFFICE INFORMATION SYSTEMS

- 1. Established Communications Systems
  - 1.1 Centralization/Decentralization
  - 1.2 Environmental Engineering for Efficiency
  - 1.3 Technology Evaluation
- 2. Office Technologies
  - 2.1 Internal/External Communications
  - 2.2 Image
  - 2.3 Storage Media
  - 2.4 Public Access Technologies
  - 2.5 Installation, Maintenance and Security of Information Systems
  - 2.6 Records Management
  - 2.7 Managing to Prevent Obsolescence
- 3. End-User Computing
  - 3.1 Product Evaluation, Analysis and Support
  - 3.2 Information Center
  - 3.3 Coordinating and Supporting End-User Application

- Development
- 3.4 Managing Resistance

## OBJECT ORIENTED ANALYSIS & DESIGN

- 1. Object Theory
  - 1.1 Definition of Objects
  - 1.2 Objects In the Data World
  - 1.3 Methods
- 2. Models and Modeling
  - 2.1 Designing the Model
  - 2.2 Assigning Object Responsibilities
  - 2.3 Designing the Classes
- 3. Objects and Classes
  - 3.1 Abstraction and Encapsulation
  - 3.2 Composition
  - 3.3 Inheritance
  - 3.4 Classification
  - 3.5 Polymorphism
  - 3.6 Overloading
- 4. Objects Models
  - 4.1 Definition and Background
  - 4.2 Essential Elements
  - 4.3 Design Considerations
  - 4.4 Advantages and Disadvantages of Using Object Models
- 5. Development Methodologies
- 6. Object Oriented Development Life Cycle
  - 6.1 Analysis
  - 6.2 Design
  - 6.3 Construction
  - 6.4 Testing
  - 6.5 Maintenance
  - 6.6 Security Considerations and Disaster Planning

## PROCEDURAL PROGRAMMING

- 1. Data and File Organization
  - 1.1 Data Formats, Internal and External
  - 1.2 Data Structures
  - 1.3 File Structures
  - 1.4 Database Models
- 2. Program Design
  - 2.1 Process
  - 2.2 Methods

- 2.3 Representation

- 3. Procedural Programming Structure
  - 3.1 Data Definition
  - 3.2 Control Structures
  - 3.3 Subprograms
- 4. Procedural Programming Considerations
  - 4.1 Order of Implementation
  - 4.2 Exception and Interrupt Handling
  - 4.3 Style
  - 4.4 Program Efficiency
  - 4.5 Testing and Debugging
  - 4.6 Maintenance Procedures
  - 4.7 Fundamental Algorithms
- 5. Integration with Hardware and Software
  - 5.1 Hardware Components
  - 5.2 Language Paradigm Selection
  - 5.3 Utilities
  - 5.4 Operating Systems Interface
  - 5.5 Communications and Distributed Processing

## SOFTWARE ENGINEERING

- 1. Computer System Engineering
  - 1.1 Computer-Based Systems
  - 1.2 Computer-System Life Cycle Modeling
  - 1.3 Hardware Considerations
  - 1.4 Software Considerations
  - 1.5 Human Considerations
- 2. Software Project Planning
  - 2.1 Project Planning Objectives
  - 2.2 Software Scope
  - 2.3 Resources
  - 2.4 Metrics for Software Productivity and Quality
  - 2.5 Software Project Estimation
  - 2.6 Decomposition Techniques
  - 2.7 Empirical Estimation Models
  - 2.8 Automated Estimation Tools
  - 2.9 Software Project Scheduling
  - 2.10 Software Acquisition
  - 2.11 Organizational Planning
  - 2.12 The Software Project Plan

- 3. Software Requirements
  - 3.1 Analysis Principles
  - 3.2 Object-Oriented Analysis
  - 3.3 Software Prototyping
  - 3.4 Systems Analysis
  - 3.5 Requirements Analysis Methodologies
  - 3.6 Data Flow-Oriented Analysis Methods
  - 3.7 Data Structure-Oriented Methods
  - 3.8 Data Structured Systems Development
  - 3.9 Jackson System Development
  - 3.10 Automated Tools for Requirements Analysis
- 4. Software Design
  - 4.1 The Design Process
  - 4.2 Design Fundamentals
  - 4.3 Modular Design
  - 4.4 Data Flow-Oriented Design
  - 4.5 Data Structure-Oriented Design
  - 4.6 Object-Oriented Design
  - 4.7 Real-Time Design
  - 4.8 Model-Based Design
  - 4.9 Procedural Design
  - 4.10 Design Documentation
- 5. Programming Languages and Coding
  - 5.1 The Translation Process
  - 5.2 Programming Language Characteristics
  - 5.3 Programming Language Fundamentals
  - 5.4 Language Classes
  - 5.5 Programming Aids
  - 5.6 Coding Style
  - 5.7 Efficiency
- 6. Software Quality Assurance
  - 6.1 Software Quality and Quality Assurance
  - 6.2 Software Reviews
  - 6.3 Formal Technical Reviews
  - 6.4 Software Quality Metrics
  - 6.5 Software Reliability
  - 6.6 Software Quality Assurance Approach