The Future of Information Processing

Data Science

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Focus of Presentation

We have the following three focuses on this event.

1. To share experience and thoughts of recent activities on data science.
2. To discuss possible collaboration in the future to effectively develop highly skilled data scientists.
3. To discuss possibilities to utilize digital technologies for mutual collaboration.

– Agenda
  ➢ The Challenge
  ➢ Who is the ICCP?
  ➢ What Drives Certification?
  ➢ Data Explosion
  ➢ How Does ICCP Develop Certifications?
  ➢ Data Foundations/Data Literacy
  ➢ Data Science
  ➢ Training and Collaboration
The challenges

• Data Science is a subset of Big Data, Databases, Data Warehousing, Business Intelligence and Computer Applications.
• High quality, accurate and organized data in a context provides actionable information desired by all organizations and society.
• However, in our world of escalating data volume, we face an acceleration in the manipulation of images, deep fake videos, “fake news” private forums, antivaxxers, falsification of identities, cyber terrorism, and ransomware theft aided by cryptocurrencies.
• We face diverse ethical practices and data privacy challenges, and
• We also face an industry rife with, delayed, overbudget “failed” computer applications and systems integration projects.
The challenges

Data Science & Machine Learning and Artificial Intelligence applications that process this data and information to deterministic resolution must be able to rely on accurate, unbiased sources of data.

Yet bias exists everywhere around us:

1. Who designs? Unknowingly biased
2. Who sets policy? Dominant hegemony, at a point in time
3. Where does Bias exist? Everywhere, embedded in precedence & law
4. Who abuses? Technocrats & Terrorists
The challenges

- Ethics derives from the constructed reality & organization of society and the derivation of religions.
- Stories in religions have set our morals, codes of conduct, rights, wrongs, principles, value systems, virtues & dictates of conscience.
- Legislated policies, procedures and penalties allowed us to live in peace and not violate neighbours’ rights, by giving up some rights to privacy.
- In the technocratic monarchy, for the sake of convenience, we have given up our rights to complete privacy: Facebook, Amazon, Apple, Google, Microsoft, IBM, Netflix, YouTube...

ACM Code of Ethics, governs conduct and professional practice of business, data and computer professionals.
The challenges

How do we control our data and protect it?

• The challenge for us is to provide Generally Accepted Data Management Principles/Practices (GADMP) standards, along with

• Generally Accepted Applications Development Principles (GAADP), elements of which must include:

1. A robust industry trusted model of security for our data, and general protection of our systems and applications.
2. Core reusable industry specific data models.
3. A global data ownership and transfer model - essentially a universal record governance model.
4. Re-think design of primary keys and use a TCP/IP approach for primary keys in databases, supported by blockchain technology for change and audit control - assure accuracy and reliability of data and its sources.
5. And ultimately, we need application frameworks and reusable interface designs so we can deliver robust systems on time and within budget.

We require an engineering production and continuous quality improvement approach to move from craft development to volume production.
The challenges

- In summary: Data Science is only as good as the unbiased and high-quality data it receives. When building applications, we need to assure their reliability and timeliness and delivery on budget.

- The challenge for IFIP and its global partners is to:
  - Establish Generally Accepted Data Management Principles
  - Establish Generally Accepted Application Development Practices
  - Establish rapid application development frameworks that are open source
  - Establish an IS 9000 style training, implementation, registration and audit process
  - Write new curriculum for the universities that focuses on these primary yet flexible open-source approaches, teach systems integration from the first class onwards, teach data literacy, core data models and unique global primary keys, record governance, teach ethics, teach awareness of bias, teach rapid production using reusable modules....
What is the ICCP?

- The ICCP was formed by The Canadian Information Processing Society (CIPS), the Association of Computing Machinery (ACM), the Institute of Electrical Electronic Engineers (IEEE), and the Data Processing Management Association (DPMA) and others.

- Founded in 1973 as an independent non-profit organization to develop and manage Professional Credentials for Business, Data and Computing Professionals. Focuses on job definitions (Dept. of Labor), workplace & ethical standards, professional status for overseas work, exam Development, testing and continuing education.

- Managed by a Board of Directors representing its constituent societies, ICCP tests working professionals in stringent vendor-agnostic industry fundamentals.

Certifications Offered

- The largest and longest serving certification body in the world

- **Business & Data**
  - Certified Big Data Professional – (CBDP),
  - Certified Business Data Management Professional (CBDMP),
  - Certified Business Intelligence Professional (CBIP),
  - Certified Data Professional – (CDP),
  - Certified Data Governance & Stewardship Professional (DGSP)
  - Certified Public Sector Data Governance Professional (PSDGP)
  - Certified Data Scientist – (CDS)
  - Certified Blockchain Professional (CBP)

- **Computers and Computing**
  - Certified Application Developer – (CAD),
  - Certified Computer Scientist – (CCS),
  - Certified Computing Professional – (CCP),
  - Certified Software Engineer (CSE),
  - Certified IT Consultant – (CITC)

Certified IT Professional (CITP)

At any time, any person may take any exam to qualify as a subject “Expert – Master” level credentials in specialized subject areas as well as programming languages. You need to pass one (1) exam in the specialized area that you are seeking acknowledgement of your expert skill level by passing with a score of 70% or more.

Others [http://iccp.org](http://iccp.org)
Certified Data Scientist (CDS)  
Associate Data Scientist (ADS)

<table>
<thead>
<tr>
<th>Exams</th>
<th>CDS</th>
<th>ADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information Systems Core</td>
<td>=&gt;70%</td>
<td>=&gt;50%</td>
</tr>
<tr>
<td>Data Science</td>
<td>=&gt;70%</td>
<td>=&gt;50%</td>
</tr>
<tr>
<td>Business Intelligence &amp; Data Analytics</td>
<td>=&gt;70%</td>
<td>=&gt;50%</td>
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</table>

Percentage score represents performance level required on the same exam for different level of qualification, plus experience requirements for more details visit: [https://iccp.org](https://iccp.org)
Entry Level Credentials?

- and (entry level); (2 + years of experience)
  - Associate Business Data Management Professional (ABDMP)
  - Associate Computing Professional-ACP;
  - Computer Science Associate (CSA) for graduates of 2- or 4-year university programs
  - Information Systems Analyst (ISA) for graduates of 2- or 4-year university programs in
    - Information Systems or
    - Information Technology or
    - Business & Technology management
Reasons for Seeking Certification

Source: ICCP Research Study (Athabasca University)
Primary Achievement Resulting from Certification

- "Greater Self-Esteem" 22%
- "More Credibility within Organization" 24%
- "Solve Problems Quicker" 19%
- "Increase in Salary" 11%
- "More Credibility with Customers" 24%
Who Benefits from ICCP Certifications

Benefits to Certification for Companies, Employee and HR departments

Employees become
• more productive
• able to solve problems faster
• more confident with their solutions
• more professional in the workplace
• more respected by their peers in the workplace
• more respected by clients
• more promotable within their organization
• lower cost access to training courses and conferences for required ongoing professional development
• protection from litigation: by showing currency in knowledge and skills
• external objective evaluation of skills and knowledge
• employees demonstrate that they fit with job titles and job definitions at hiring and promotion
Typical IS/IT/Data Careers

- Business Intelligence
- Big Data, Data Science
- Data Governance, Data Management
- I.T. Management
- Computer Science, Programmer-Analyst
- Business & Systems Analysis
- Database Administration
- Data Warehousing
- Linux/Unix Administrator
- Computer & Network Administrator
- Systems Support Analyst
- Service Technician
- Call Center Support
- Cloud Services Support
- ITIL
- Social Media
- Multimedia Developer
- Advertising & Image Design
- Web Master-Web Designer
- Radio TV Arts
- Printing and Publishing
- Graphics and Animation
- Cloud Computing
- Telecomm & Network Design
- Computer Engineering
- Network Engineering
- Processor Design
- Process Control and Design
- Software Engineering
Typical I.T. Careers

- Business Intelligence
- Big Data, Data Science
- Data Governance, Data Management
- I.T. Management
- Computer Science, Programmer-Analyst
- Business & Systems Analysis
- Database Administration
- Data Warehousing
- Linux/Unix Administrator
- Computer & Network Administrator
- Systems Support Analyst
- Service Technician
- Call Center Support
- Cloud Services Support
- ITIL

Certifications

- ICCP: CBIP, CCP, CDP, I.S.A., I.S.P., ACP, ITCP, CCS, SWE
- ICCP: CCP, I.S.P., CDP, CBIP, ACP, ITCP
- ICCP: CCP, I.S.P., CDP, CBIP, ACP, ITCP
- ICCP: CCP, I.S.P., CDP, CBIP, ACP, ITCP

Systems Development

- Cloud Computing
- Telecomm & Network Design
- Computer Engineering
- Network Engineering
- Processor Design
- Process Control and Design
- Software Engineering

Media

- Social Media
- Advertising & Image Design
- Multimedia Developer
- Web Master-Web Designer
- Radio, Film & TV Arts
- Printing and Publishing
- Graphics & Animation

Operations

- Networks Engineering
- Processor Design

ICCP: CCP, I.S.P., CDP, CBIP, ACP, ITCP

Engineering

- Network Engineering
- Processor Design
- Process Control and Design
- Software Engineering
Who takes ICCP Exams?

By Industry

- 15% Business Services / Consulting/ Ecommerce/Internet/ Computer Services
- 10% Computer / Network Consulting/ Communications Carriers
- 7% Computer Related Retailer / Wholesaler / distributor/Service Provider
- 7% Construction / Architecture / Engineering /Mining Oil & Gas/ Agriculture, Forestry, Fishing
- 12% Education
- 7% Finance / Banking / Accounting
- 14% Government: Federal, State, Local
- 4% Health / Medical / Dental Services
- 9% Insurance / Real Estate / Legal Services
- 7% IT General & Data Processing Services
- 7% Manufacturing of Computer Hardware or Software, VAR, VAD, Systems Integrator
- 10% Manufacturing Process Industries
- 1% Publishing/Broadcast/Advertising/PublicRelations/Marketing/Travel/Recreation
- 2% Research / Development Lab/ Aerospace
- 4% Transportation / Utilities
Data-Explosion

DAMA International DMBok
Data-Related Jobs growth

Business Roles
- Executive: Chief Data Officer
- Data Governance
- Data Manager
- Data Stewardship (business & technical)
  - Metadata Management
  - Master Data Management
- Business Analysts
- Business Process Analysts
- Business Process Architects

IT Roles
- Data Architect
- Data Modeler
- Data Model Administrator
- Database Administrator
- Data Warehouse DBA
- Data Security Administrator
- Data Integration Architect
- Data Integration Specialist
- Analytics/Report Developer
  - Application Architect
- Technical Architect
- Technical Engineer
- Help Desk Administrator
- IT Auditor

Hybrid Roles
- Data Quality Analyst
- Metadata Specialist
- Business Intelligence Architect
- Business Intelligence Analyst/Administrator
- Business Intelligence Program Manager
- Data Scientist
- Data Engineer
As a topic, Data has confounding characteristics

Complex & detailed
- Outsiders do not want to hear about or discuss any aspects of challenges/solutions
- Most are unqualified re: data architecture or data engineering

Taught inconsistently
- Focus is on technology
- Business impact is not addressed

Not well understood
- (Re)learned by every workgroup
- Lack of standards / poor data literacy/ unknown dependencies

Peter Aiken, VCU
## The Need for Data Foundations / Data Literacy

### DATA FOUNDATIONS EXAMINATION

1. Data, Information & Knowledge (4%)
2. Describing, Understanding & Managing Data (20%)
3. Data Roles (5%)
4. Data Models and Relationships (19%)
5. Data Value and Quality (4%)
6. Data Access, Storage, Protection & Security (6%)
7. Data Atrophy, Renewal and Removal, Distribution (3%)
8. Data Uses (Historical, legal...) (8%)
9. Data Storage Technologies and purposes: (4%)
10. Evolving Business and Data Analytics (Tools) (13%)
11. Corporate mergers, data integration (5%)
12. Data Strategy & Planning (4%)
13. Document and Record Management (5%)
Data Industry

(a few examples)

- Big Data: Industry Leaders
  - iTechArt
  - ScienceSoft
  - Xplenty
  - IBM
  - HP Enterprise
  - Teradata
  - Oracle
  - SAP
  - EMC
  - Amazon
  - Microsoft
  - Google
  - VMware
  - Splunk
  - Alteryx
  - Cogito

- Data Science Companies
  - Numerator
  - Cloudera
  - Splunk
  - SPINS
  - Alteryx
  - Civis Analytics
  - Sisense
  - Oracle
  - Looker
  - Teradata
ML/AI Industry

➢ Machine Learning / Artificial Intelligence Companies
  ➢ Google – Cloud Learning, Deepmind
  ➢ IBM - Watson
  ➢ Nvidia - Deep Learning
  ➢ Microsoft - Azure Machine Learning
  ➢ InData Labs
  ➢ Indium Software
  ➢ MobiDev
  ➢ Fayrix
  ➢ Netguru
  ➢ iTechArt Group
  ➢ DogTown Media
  ➢ Xicom
  ➢ Altoros
  ➢ Neoteric
  ➢ Alberta Machine Intelligence Institute (AMII)
  ➢ AltaML

➢ Universities Leading in ML/AI
  ➢ Carnegie Mellon
  ➢ Tsinghua University
  ➢ University of Alberta
  ➢ Stanford University
  ➢ MIT
  ➢ University of California Berkley

➢ Thought Leaders
  ➢ Andrew Ng – Stanford, Coursera
  ➢ Richard Sutton – University of Alberta
  ➢ Yoshua Bengio – University of Montreal
  ➢ Geoffrey Hinton – University of Toronto
ICCP’s Data Science Exam Coverage

1. Business & Technology Issues: What problem are you trying to solve? (16%)
2. Data Storage, Big Data and Sources (25%)
3. Mathematics and Statistical Data Science (13%)
4. Programming Skills (3%)
5. The Data Analytic Question and Types of Data & Reporting (4%)
6. Tidying the data – Data cleaning and quality (6%)
7. Exploratory analysis (6%)
8. Statistical Modeling and Inference (7%)
9. Prediction and Machine Learning (8%)
10. Causality (identifying average affects between noisy variables) (2%)
11. Written Analysis (9%)
12. Reproducibility (1%)
Online Course Coverage
Data Science

Module 1. Business & Technology Issues: Starting with the Question first - What problem are you trying to solve? (16%)
1.1. Business
1.2. Technical/Scientific

Module 2. Data Storage, Big Data and Sources (25%)
2.1. Geo-position data
2.2. Devices’ data: Internet of Things and Sensor Data
2.3. Social media data
2.4. Primary data and Published research
2.5. Health research and data,
2.6. Open public data
2.7. Technologies: Hadoop, RDBMS, NoSQL
2.8. Cloud and agile
2.9. Structured and unstructured data
2.10. Databases, Data Marts, Data Lakes

Module 3. Mathematics and Statistical Data Science (13%)  
Mathematics and Statistics focuses on the science of learning from data.  
3.1. Uncertainty and the role of statistics
3.2. Algorithms and their development
3.3. Data Science Programming Languages
3.4. Data science uses
3.5. Data Science techniques (small sample provided)

Module 4. Programming Skills (3%)
4.1. Computer programming with R, including JSON
4.2. Substantive Expertise/ Experience

Module 5. The Data Analytic Question and Types of Data & Reporting (4%)
5.1. Summary data
5.2. Descriptive data
5.3. Exploratory data
5.4. How Data are affected

Module 6. Tidying the data – Data cleaning and quality (6%)
6.1. Components of a data set
6.2. Common mistakes
6.3. Checking the data

12 weeks Instructor-led live online or Self-Study https://onlinecourses.iccp.org
Module 7. Exploratory analysis (6%)
7.1. Summarizing and visualizing data prior to analysis
7.2. Interactive analysis
7.3. Common Mistakes

Module 8. Statistical Modeling and Inference (7%)
8.1. Best estimate
8.2. Level of uncertainty
8.3. Size
8.4. Exploratory and confirmatory analysis
8.5. Defining population, sample, individuals and data
8.6. Unrepresentative sample, confounders, distribution of missing data, outliers,
8.7. Small or very large samples
8.8. Multiple hypothesis tests and correcting for multiple tests
8.9. Smoothing data over space and time
8.10. Real sample size
8.11. Common mistakes

Module 9. Prediction and Machine Learning (8%)
Creation of training sets from sample data and some variables become features, others become outcomes with the goal to build an algorithm or prediction function taking a new set of data from an individual data set and best guess (estimate) the outcome value.
9.1. Splitting data into training and validation sets
9.2. More data versus better algorithms
9.3. Features versus algorithm
9.4. Definition of error and measure
9.5. Overfitting and validation
9.6. Prediction accuracy and multiple models
9.7. Prediction trade-offs

Module 10. Causality (identifying average affects between noisy variables) (2%)
10.1. Causal data and non-randomized experiments
10.2. Difficulties associated with interpreting cause
10.3. Confirming randomization worked
10.4. Avoiding causal language or techniques
10.5. Common mistake(s)

Module 11. Written Analysis (9%)
11.1. Communicating the message
11.2. Components

Module 12. Reproducibility (1%)
12.1. Reproduction of results by third parties for verification
12.2. Data, Figures, R Code, Text
12.3. Literate programming and version control
# Career Planning & Professional Development
## Employee Skills and Performance Gap Analysis

### ICCP Official Performance Profile

**TEST DATE:** dd/mm/yyyy

Test taker ID
First Name, Last Name
Address 1
Address 2, Province/State, Postcode/ZIP
Country

### Seeking ACP Designation
CORE IT Skills Exam
Status: PASS at CCP Level

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<tr>
<th>YOUR CONTENT</th>
<th>DESCRIPTION</th>
<th>SCORE</th>
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<td>PROFESSIONAL ISSUES</td>
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<td>2.01</td>
<td>TYPES OF SYSTEMS</td>
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<td>2.02</td>
<td>APPLICATION STRATEGIES</td>
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<td>4.03</td>
<td>TOOLS AND TECHNIQUES</td>
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<td>5.01</td>
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<td>6.05</td>
<td>STATISTICS</td>
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</table>

**TOTALS**

|                         | 77 | 100 |

Criteria: Any item scoring less than 70% has been identified as an area of review and/or continuing professional development (PD) and this can now be used by you to build/negotiate your PD plan.
Dear Exam Taker:

You have achieved an **ACP credential** with specialty examinations in **Data Base Administration** and **Systems Development**. In order to achieve the CCP level, you need to improve your scores in each of your specialty examinations to 70% or higher.

Your total scores were:

- **a. Information Systems CORE** 77 (CCP Level)
- **b. Data Base Administration** 56 (ACP Level)
- **c. Systems Development** 64 (ACP Level)

Your strengths are shown on each of the examinations in detail on the following pages. The areas where additional review/study work is required are identified below.

**Criteria:** Any item scoring less than 70% has been identified as an area of review and/or continuing professional development (PD) and this can now be used by you to build/negotiate your PD plan (next page)

Courses can be taken at a local university, other regional colleges and Universities as suggested below.

**Recommended study:**

1. **Database Administrations:** Self Study or University of NearestU; Community or Technical College; Athabasca University (Online); ICCP Online or Excelsior College (online)
2. **Systems Development:** Self study or ICCP Online Systems Development course; University of NearestU; Athabasca University (MSc. Program) online; Community or Technical College. It is recommended that you take some self study modules, then prepare for and retake this examination.

**Recommended Textbooks:** Data Base Administration (Craig Mullens or Michael Mannino); Systems Development (Charles Wasson or Shelley or Whitten or Kendall) – available from most online bookstores (Amazon, Chapters, etc.)
Infosys: Where do we start?
People – Potential – Purpose

- An integrated HR (re)skilling and (re)starting model:
  - A central hub with training partners and an eco-system (curated curriculum, individual mapping to learning best-fit matches)
  - Behavioural science backed assessments and opportunity matching
  - External, validated and registered testing assessment and certification

- A guided journey – potential and skills assessment – reskilling and career pathways – employment and career progression

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Where do we start?
People – Potential – Purpose

- An integrated HR (re)skilling and (re)starting model: Central – Cloud based

- A guided journey – potential and skills assessment – reskilling and career pathways – employment and career progression
Core Competencies – Digital Team

Eight core competencies at the heart of Customer Service in the Digital Age

1. Values customers
2. Anticipates and mitigates problems
3. Understands needs.
4. Continuously learns and improves.
5. Identifies opportunities for process improvement
6. Tech-Savvy and ethical.
7. Data-driven decision making
8. Understands how tech improves customer outcomes
Examination Route – Canadian Information Processing Society (CIPS)

- First complete and pass three ICCP Examinations (Core plus 2 Specialties at 70% or higher level)
- Then complete the I.S.P. Application form and submit to CIPS (www.cips.ca)

Choose this route if you:
- have passed either the Institute for Certification of Computer Professional (ICCP) exams leading to the Certified Computing Professional (CCP) or equivalent (CBIP, CDP) at Expert-Mastery Level or the British Computer Society (BCS) Diploma or Professional Graduate exams.

- **Note:** Applicants also require a certain number of years of professional experience (typically five).
## Certified Business Intelligence Professional (CBIP) - TDWI

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<thead>
<tr>
<th>Examinations</th>
<th>Leadership &amp; Management</th>
<th>Business Analytics</th>
<th>Data Analysis &amp; Design</th>
<th>Data Integration</th>
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## Certified Data Professional (CDP)

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<td>Big Data</td>
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<td>Zachman Architecture</td>
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X* indicates optional choice

ICCP Examination Procedures

1. Submit application and fees for computer-based exam
2. Receive eligibility and admission information
3. Contact ICCP to schedule examination time
   - world-wide testing available with an exam proctor
   - remote proctored testing available using web-conferencing (requires a web camera and reliably fast internet access)
4. Results are received immediately upon completion of exam. (knowledge gap analysis of strengths and weaknesses, an official performance profile, is mailed to the exam taker).
Remote Proctoring

1. Examinations can be taken from your own laptop
2. Government issued Photo-ID
3. Need reliable internet service
4. Web-Camera on the computer – your photo will be taken along with your ID and you are monitored during the exam
5. Microphone
6. Web-conferencing with a live proctor/monitor
7. Call 1.800.843.8227 to schedule your exam
Collaborations & Digital

The universal need for Generally Accepted Data Management Principles (GADMP)

1. Core Data Models (with an inbuilt security model) by industry

2. A different way of creating Unique record identifiers (UIDs) for the global Industry

3. Record governance protocols – ownership and transfer protocol (Enterprise Networks – “EnterNet”)

4. Secure Data Exchange – using Blockchain processes

5. Rapid creation of new applications - Application frameworks and APIs
Questions

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