The Canadian Council of Professional Engineers

Providing leadership which advances the quality of life through the creative, responsible and progressive application of engineering principles in a global context

Engineering in Canada

- There are over 160,000 professional engineers in Canada
- Canada's system for the formation of an engineer is world renowned
- Canada is the 4th largest exporter of engineering services in the world

A Self-governing Profession

- Section 92 (13) of the Constitution Act, 1867, places professions under provincial and territorial jurisdiction.
- Delegation to professions - self-governance
- Licensing, discipline and enforcement
- Associations/ordre formed to protect the public and govern the profession
- Legislative framework established
- No industrial exemption: all those practising engineering must be registered

The Practice of Engineering

The practice of Professional engineering means any act of planning, designing, composing, evaluating, advising, reporting, directing or supervising, or managing any of the forgoing,

- that requires the application of engineering principles, and
- that concerns the safeguarding of life, health, property, economic interests, the public welfare or the environment.

CCPE Definition

CCPE Structure

- Board of Directors
- Standing Committees
  - Canadian Engineering Accreditation Board
  - Canadian Engineering Qualifications Board

Canadian Engineering Accreditation Board

- 1965 - CEAB established. In 2005, 235 programs in 36 engineering schools accredited (including seven software engineering programs).
- Objective: To ensure Canadian engineering education programs meet or exceed standards acceptable for professional registration/licensure in the Canadian provinces and territories.
- Purpose of Accreditation: to identify those engineering programs that meet the criteria for accreditation.

General Considerations

- applies to bachelor degree programs
- program must include engineering in the title
- all options and electives are examined
- CEAB curriculum content must be met by all students (minimum path)
- faculty teaching courses which are primarily engineering science and engineering design are expected to be professional engineers in Canada

Benefits of Accreditation

- credibility for program
- graduates meet academic requirements for professional registration
- international recognition of engineering credentials
- uniform quality of engineering programs
- fosters self examination and continuous improvement
- improvement or elimination of engineering programs which do not meet standards

Criteria For Accreditation

- Quantitative and Qualitative evaluation
- Accredited engineering programs must contain not only mathematics, sciences and engineering content requirements, but they must also develop communication skills and an understanding of the environmental, cultural, economic and social impacts of engineering on society and the concept of sustainable development

Minimum Curriculum Content

Basic Sciences……195AU
Mathematics……..195AU
BS + Math……420AU
Engineering Sciences (ES)…..225AU
Engineering Design (ED)…….225AU
ES + ED(total)……900AU
Complementary Studies……225AU
Program Minimum……..1800AU

Definition of Accreditation Unit (AU)
1 lecture hour (50 minutes) = 1 AU
1 lab or tutorial hour = 0.5 AU

Accreditation of Software Engineering Programs

- CEAB criteria are non-discipline specific
- CEAB developed a sample software engineering program that met criteria
- Held a workshop for all team chairs and software engineering program visitors in year of first visits (Fall 2000)
- Each software engineering program included two visitors; one from industry and one from academia
- Consistency report following decisions

University of Ottawa Example

CEAB Accredited Undergraduate Programs:

- Chemical Engineering
- Civil Engineering
- Computer Engineering
- Electrical Engineering
- Mechanical Engineering
- Software Engineering

U of O Example… cont'd

- Software Engineering Curriculum:
  - **The program prepares students for work on all types of software from real-time to business systems, with special emphasis on telecommunications software. The program also emphasizes communication and presentation skills, working in teams, management techniques and entrepreneurship. Students in the program work on industrially relevant software projects. They are taught how to use metrics to assess the quality of software and their own personal productivity.**

U of O Example… cont'd

- SE Program First Year
  - Principles of Chemistry
  - Technical Report Writing
  - Engineering Mechanics
  - Fundamentals of Engineering Computation
  - Calculus I

  - Fundamentals of Software Design
  - Introduction to Electrical and Computer Engineering
  - Calculus II
  - Introduction to Linear Algebra
  - Fundamentals of Physics for Engineers
  - Physics Laboratory for Engineers

U of O Example… cont'd

Second Year

- Data Structures
- Engineering Economics
- Computer Architecture I
- Logic for Computing
- Software Design II
- Technology, Society and Environment since 1800 or Scientific Thought and Social Values

- Introduction to Business Management
- File Management
- Elements of Discrete Mathematics
- Probability Statistics for Engineers
- Software Design III
- Professional Software Engineering Practice

U of O Example… cont'd

- Third Year
  - Computer Architecture II
  - Design and Analysis of Algorithms I
  - Database Management Systems
  - Introduction to Telecommunications Systems and Services
  - Software Development for Large-Scale Systems
  - Science elective

  - Operating System Principles
  - Advanced Object Oriented Analysis and Design
  - Analysis and Design of User Interfaces
  - Telecommunications Software Engineering
  - Complementary Studies elective

U of O Example… cont'd

- Fourth Year
  - Design of Secure Computer Systems
  - Software Evolution and Project Management
  - Software Engineering Project (full year)
  - Science elective
  - Complementary Studies elective
  - Technical elective

  - Higher Layer Network Protocols
  - Software Quality Engineering
  - Two technical electives

Canadian Engineering Qualifications Board

Mandate:

- to provide guidelines for admission standards for the practice of engineering
- to provide a syllabus for examinations for candidates other than CEAB graduates to ensure that they meet the educational requirements for licensure
- to encourage the adoption of common standards for professional engineering registration in Canada
- to act in a coordinating role on matters of professional practice

CEQB

- National guidelines on professional engineering qualifications
- National guidelines on standards of practice, continuing competence and ethical conduct
- Common Professional Practice Exam
- Examination syllabus and list of international engineering institutions
- Environmental practice and issues
- Internal mobility agreement

National Guidelines for Licensing

- Types of Candidates:
  - CEAB graduates
  - CEAB recognized graduates (MRA and SE)
  - Non-CEAB recognized graduates
  - Related-discipline graduates

Requirements for Licensure

- Academic
- Experience
- Professional Practice Exam
- Language
- References

Role of Regulatory Body

- setting standards (academic, experience, references) for admission to the profession and issuing licenses to those who qualify
- enforcement activities for those practicing engineering who are not licensed or those claiming to be engineers who are not licensed
- investigation of complaints against licensed engineers

Role… cont'd

- discipline activities against members who perform incompetently, breach the Code of ethics, code of conduct;
- preparation of guidelines relating to various practice issues for the benefit of the public or the membership;
- Practice standards, not Engineering standards
- continuing competency programs

Legal Responsibility

- Responsible for regulating the profession via provincial legislation
- From the definition of engineering

  "…that concerns the safeguarding of life, health, property, economic interests, the public welfare or the environment…" (CCPE definition)

What is the Practice of Software Engineering?

- Designing a system not simply constructing it
- Deals with Architecture
- Has a Process
- Application of a science (CS) to real world problems
- Not a craft simply because it requires creativity

What is the Practice of Software Engineering? (cont'd)

- Practice of engineering vs. software development
- Software Engineering is a maturing discipline
  - Doesn't disqualify it from being engineering
- Deals with external factors also
  - Public good
  - Ethics
  - Environment

Examples: Professional Engineering Practice

- Safety-critical systems
  - Transportation, nuclear industry, biomedical, etc….
- Legal issues
  - Licensing, IP, etc...
- Security: privacy, authentication, etc.
- Telecommunications
- Human factors, ergonomics

Examples: Not Professional Engineering

- Network design or management
- System administration
- Just *use* of software
- Multimedia design
- Pure technology investigation
- Work lacking software elements
- Work lacking engineering duties or responsibility

The Bottom Line

- Not all software developers are SEs and not all software development needs to be done by an SE
- Software developers and Software Engineers are not going away and need to be able to work together
- Provincial Associations have the legislated responsibility to regulate the engineering profession including software engineering