Software Engineering

Professional Standards of a Bachelor

1. General characteristics of software engineering graduates

Software Engineering (SE) graduates should be high quality experts that are able to handle all aspects of modern software industry in the current setting of increasing demands. We expect the demand for high quality professionals to remain high in the forthcoming years.

SE degree programs can take various forms, each of which could prepare students for different, but valid careers. At one extreme, a degree program might provide opportunities for students to take courses on a wide range of topics spanning the entire area of software engineering. At another extreme, a program might have a specific emphasis on certain aspect of SE and cover it in greater depth. The objective of this program is to prepare students for Master of Science as well as postgraduate studies but also for immediate employment, and achievement of professional excellence in the high technology industries. The graduates from such bachelor programmes would typically tend to seek work opportunities in the areas of (software) industry, education, the public and private sectors, banking, healthcare, etc. Besides core SE skills, the bachelors in SE would have basic knowledge of economics, management, project working and marketing. They would be able to design, develop, implement, support, extend, adapt and localize computer and information technologies (C&IT).

SE graduates need to develop a high-level understanding of systems as a whole, have a good understanding of SE related theory and how this theory influences practice, possess a solid foundation that allows them to maintain their skills and knowledge as the field of SE evolves. For SE graduates it is especially important to develop a wide range of practical skill but to also understand that working in SE field requires one to constantly update one's knowledge and practical skills.

The curriculum covers the essential practical techniques, together with the deeper principles, which they are based upon. Students are expected to develop a wide range of knowledge and skills. These may be divided in three broad categories: theoretical knowledge, practical skills and additional skills.

2. Common skills

Software engineering graduates need to obtain expertise to:
- demonstrate knowledge and understanding of essential facts, concepts, principles, and theories relating to computer science and especially to software engineering;

- use such knowledge and understanding in the design of computer-based systems in a way that demonstrates comprehension of the tradeoff involved in design choices;
- identify and analyze criteria and specifications appropriate to specific problems; and
- deploy appropriate theory, practices, and tools for the specification, design, implementation and evaluation of C&IT.

3. Practical skills

Software engineering graduates need to acquire abilities to:
- specify, design, and implement software systems;
- work in software projects;
- evaluate (software) systems in terms of general (software) quality attributes;
- gather and apply new information from various kinds of sources, such as textbooks, lecture notes, Internet;
- apply and understand the principles and role of modern software interfaces (human-computer interaction, network techniques, etc) in the design and implementation of systems having software as part of them;
- deploy effectively the tools used for the construction and documentation of software;
- operate computer hardware and software systems effectively and efficiently.

4. Additional skills

These skills are not concerned with specific computer-related field of study. Instead, they are meant to satisfy general student interests in computing. They would be acquired throughout the whole course of study. These skills include the ability to:
- make succinct presentations to a range of audiences about technical problems and their solutions;
- work effectively as a member of a development team;
- understand and explain the quantitative dimensions of a problem;
- manage one's own learning and development, incl. time management and organizational skills;
- keep abreast of current developments in the discipline to continue one's own professional development.

5. SE Body of Knowledge

The SE graduates' education is based on:
- Fundamental training that includes studies in the following areas:

- o Mathematics
- o Programming Fundamentals
- o Discrete Structures
- o Principles of Management
- o Social & Professional Issues

- Specialized training that includes studies in the following areas:
  - o Algorithms, Data Structures & Complexity Analysis
  - o Computer Science Fundamentals
    - Computer Organization & Architecture
    - Operating Systems
    - Computer Networks
    - Databases
  - o Software Development
  - o Software Component Technologies
  - o Software Architectures
  - o Software Quality, Testing & Safety
  - o Programming Languages
  - o Human Computer Interaction
  - o Legal Aspects of Software Development

SE graduates are expected to be highly qualified and motivated, with in-depth knowledge and understanding of C&IT related to software engineering. They may be expected to take up positions such as, but not limited to: software developers, system programmers, software project managers, system analysts.

References:
IEEE Computer Society/ACM http://www.computer.org/education/cc2001
Bologna Declaration, Lisbon Recognition Convention
Diploma Supplement, ECTS

Software Engineering

Professional Standards of a Master

1. General characteristics of MSc in Software Engineering

An MSc in Software Engineering (SE) needs to able to carry out investigations; to design, assemble and utilize; to perform manufacturing, technological, company and service activities; to do small scale research and teaching in the SE field of computer science in view of their application in industry, science, education, the public and private sectors, banking, healthcare, etc. An MSc should possess professional expertise.

In order to develop a firm understanding of the scientific approach, students must have direct hands-on experience with hypothesis formulation, experimental design, hypothesis testing and data analysis. Student must develop an understanding of the scientific method and experience this mode of inquiry in courses that provide some exposure to laboratory work. They may acquire their scientific perspective in a variety of domains, depending on program objectives and their area of interest.

2. Common skills

Upon graduation, the MSc in SE should have the following common skills to:

- invent and present his/her own solutions to SE problems;
- apply creatively in practice the acquired knowledge;
- critically analyze and apply a range of concepts, principles and practices of the subject in the context of loosely specified problems, showing effective judgement in the selection and use of tools and techniques;
- adopt a complex technical and economical approach and use modern methods and tools when solving an assigned software engineering task.

3. Specific skills

Upon graduation, the MSc in SE should also possess the following more specific skills to:

- design, create, develop and maintain modern software applications for standard and specialised computer equipment;
- expand the functional capabilities of the software of modern computer systems;
- develop, adapt and implement modern computer technologies in different fields of application - industry, science, trade, education, banking, etc.;

- demonstrate a sound understanding of the main areas of the body of knowledge and the theory of SE, with an ability to exercise critical judgement across a range of issues;
- produce work involving problem identification, analysis, design and development of a software application, along with appropriate documentation. The work must show a range of problem solving and evaluation skills, draw upon supporting evidence, and demonstrate a good understanding of the need for quality.

4. Additional skills

These skills are not concerned with specific computer-related fields of study. Instead, they are meant to satisfy general student interests in computing. They would be acquired throughout the whole course of study. These skills include the following abilities:

- demonstrate the ability to work as an individual with minimum guidance and as a leader and as a member of a software team;
- follow appropriate practices within a professional, legal and ethical framework;
- identify mechanisms for continuing professional development and life-long learning;
- understand a wide range of applications based upon the body of knowledge.

5. SE Body of Knowledge

The SE Master's education is based on training in the following areas with in-depth studies in at least one of them:

- Advanced Mathematics for SE
- Advanced Data Structures and Algorithms
- Advanced Software Architectures
- Advanced Issues in Software Design and Development
- Advanced Testing & Verification Technology
- Distributed Systems & Computational Models
- Modelling & Simulation
- Embedded Systems & Real-Time Programming
- Internet Technologies & Multimedia
- Parallel Architectures & Programming

Research and Master's Thesis in accordance with the student's own interests, abilities and development perspectives in the areas of specialized training.

References:

IEEE Computer Society/ACM   *http://www.computer.org/education/cc2001*

Bologna Declaration, Lisbon Recognition Convention

Diploma Supplement, ECTS