Competences Framework

Master of Science in Engineering: Computer Science

1. Body of Knowledge

Have in-depth knowledge and understanding of a structured body of knowledge, both transversal and specialised. Be capable of autonomously and critically following current trends and advances in this body of knowledge.

The graduate Master of Science and Engineering in Computer Science at ULB :

- has in-depth knowledge and understanding of a pluridisciplinary body of knowledge in the exact sciences with the specificity of their application to engineering ;
- is capable of applying advanced methods and theories to schematize and model complex engineering problems

In addition, the graduate
- can mobilize a body of knowledge specific to Computer Science. In particular, the graduate as a broad rather than deep background in the different subareas of Computer Science (machine architecture; algorithms and algorithm design; programming and programming languages; operating systems; networking and the internet; software engineering; computer security; data management; optimization; computational intelligence; human-machine interaction; computer graphics; and theory of computation)
- understands the principles underlying Core Computer Systems (networks, OS, DB, compilers, cloud);
- understands the limitations of computers and algorithms; knows the complexity trade-offs ;
- is aware of current trends, advances, and research topics in Computer Science;
- is able to evaluate new methods in a critical manner; and is able to learn how to use such new methods if necessary.

2. Problem solving skills

Be capable of formulating and solving complex or open-ended technical and scientific problems by using abstraction, modeling, simulation, and multi-disciplinary analysis while satisfying the requirements of university level research and responding to requirements, constraints, the set context and the technical, socio-economical ethical and environmental stakes—all with the purpose of obtaining concrete solutions.

The graduate Master of Science inEngineering: CS at ULB is capable of Computational Thinking (i.e. formulating and solving problems in such a way that computers can be used to execute the solutions).

In particular, given a problem, the graduate is capable of applying the above-mentioned Body of Knowledge for the purpose of:
- Identifying the components that are amenable to resolution by means of a computer.
- Modeling these components in a form that enable such solutions. (Abstraction, logical organisation and analysis of information, simulation).
- Identifying the algorithms required to automate solutions; design new algorithms if necessary.
- Use the principle of decomposition into sub-problems where appropriate.
- Identifying, implementing, analyzing and comparing possible solutions (on correctness, efficiency, maintainability, . . .).
- Critically evaluating the proposed solution in terms of functionality and quality.
- Translating multi-disciplinary aspects of a problem (i.e. problem components and constraints for which computer-based solutions cannot be directly identified) into a form that enables resolution by computers.

3.   Design and development

Design, develop, realize, and exploit solutions (products, systems, services, software etc) in the domain of Computer Science.

The graduate Master of Science in Engineering: CS at ULB is capable of organizing and executing the development of a new computing system that corresponds to client requirements.

This comprises:
- Problem analysis; formulation of cahier de charges.
- Design of the architecture of the computing system.
- Identification, analysis, comparison and selection of the technologies to be used.
- Prototype implementation; testing; and evaluation.
- Product followup and maintenance.

4.   Innovation and research

Innovate, by combining rigor and creativity, using a critical and demanding scientifical methodology (including state-of-the-art, problem statement, fixing hypothesis, modeling, validation, argumentation, and peer-review).

The graduate Master of Science in Engineering: CS at ULB is capable of

- organizing and executing, in a critical and rigorous manner, a research plan in order to understand an open-ended problem that involves computer science.

  This comprises:
  – Formulating the exact problem statement; modeling its key components.
  – Finding and synthesizing the state of the art.
  – Identifying, analyzing and comparing possible solutions.
  – Implementing the most promising solutions and validating them experimentally.
  – Synthesizing, in a report, the conclusions of his research with a description of the key problem parameters; the solutions considered; their experimental performance; and recommendations for further development and implementation of technically innovating Computer Science solutions concerning the studied problem.

5.   Project management and execution

Define, plan, manage, and execute projects taking into account their objectives, the available resources and constraints; assuring the coherence and quality of the work and deliverables..

The graduate Master of Science in Engineering: CS at ULB can :

- Define, plan, manage and execute projects taking into account their objectives, the available resources and constraints; assuring the coherence and quality of the work and deliverables. In particular, the graduate has in-depth knowledge and understanding of the different development methodologies used for Computer Science projects.
- Select the methodology/methodologies best suited for the project at hand.
- Identify and deploy suitable tools to aid the project's development (project management software, versioning systems, . . .).
- Coordinate the project's tasks and human resources.
- Evaluate the project's development and take remediary action where necessary.
- Do task assignment, taking into account the capabilities of the project's human resources to match capabilities with tasks.

- Identify, anticipate and manage risks and uncertainties.

6.   Group work

Work efficiently with other professionals (in group, in partnership, or in competition), make decisions and develop leadership, in a variety of professional contexts, disciplines, and cultures.

The graduate Master of Science in Engineering: CS at ULB :

- Is capable, thanks to his multi-disciplinary background, of acting as a bridge between domain-specialists and CS experts.
- Possess a sufficiently broad basis to be able to work in an interdisciplinary and multidisciplinary context in addition to having a recognizable domain-specific profile.
- Can reflect critically on his own performance and capabilities in the group and those of his team members.
- Is capable of selecting and deploying the correct set of tools to support group work in CS-related projects (versioning systems, communication systems, workflow, . . .).

7.   Communication

Communicate and share information in a structured manner: orally, graphically and written, in French and in one or more other languages. Communicate on scientific, technical and cultural aspects, adapting him/herself to the desired goal as well as the target audience.

The graduate Master of Science in Engineering: CS at ULB can:

- Communicate and share information in a structured manner: orally, graphically and written in both French and English.
- Communicate on scientific, and technical aspects, adapting him/herself to the desired goal as well as the target audience (client, user, colleague, superior, …).
- Make rigorous arguments and defend his/her viewpoint.
- Communicate effectively avec his/her colleagues taking into account the diversity of their profile (be it commercial, technical, …).

8.   Professional development

Act as an autonomous and reflective professional; do continuous professional development. • Develop a professional practice that is responsable and ethical, taking into account the societal challenges(deontological, societal, environmental and economical aspects)

The graduate Master of Science in Engineering: CS at ULB

- Acts as an autonomous and reflective professional
- Is committed to life-long learning:
  - Can remain up to date with advances in computer science and computing technology through extra courses, reading, …
  - Has a reflex towards self-evaluation and regularly identifies his limits and identifies ways to extend these limits
- Has an insight into the role and impact of computer science in industry and society.