

Faculty of Computer Science

PhD programme in COMPUTER SCIENCE

Duration: 4 years

Academic year: 2017/2018

Start date: 01/11/2017

Official programme language: English

Website: <https://www.unibz.it/en/faculties/computer-science/phd-computer-science/>

Programme contents:

The aim of the PhD programme is to allow students to acquire the ability to carry out independent research in the area of computer science. This also involves the ability to communicate ideas clearly and efficiently orally and in writing and the ability to work in groups.

To conclude the programme successfully, the PhD student has to elaborate a research topic independently and this research must contribute and add significantly to current knowledge in the area of computer science. Due to the time limits of the programme, PhD students must concentrate on their research work. To achieve this, they are supported by the structure of the PhD programme.

In the following, this structure is described in detail together with the procedures for the nomination of the supervisor, the definition of the research and study plan, and the examinations:

- The programme is divided into five phases, which end at months 6, 12, 24, 36, and 48 respectively.
- For each PhD student, the PhD Course Committee nominates a supervisor, who is preferably chosen among its members. It can also nominate a co-supervisor who will provide additional support. If the PhD student is enrolled in an international PhD programme with a double degree, also a second supervisor from one of the partners in the international PhD programme can be nominated.
- The PhD student prepares together with their supervisor(s) a Research and Study Plan, which defines the objectives of the research and the stages needed to complete it. These stages include the study of topics that are necessary for the student's research work. Periodically the PhD student must update the Research and Study Plan considering the progress made and the developments in the research area. The Research and Study Plan must be developed coherently with the phases of the programme, starting from the proposal for preliminary research (up to month 6), followed by the proposal for the complete research (up to month 12), by a preliminary thesis proposal (month 24), and by a revised thesis proposal (month 36).
- Each phase finishes with an assessment, where the PhD student presents his/her work to the PhD Course Committee, which evaluates the student's progress. For the first four phases, the student submits to the PhD Course Committee an updated Research and Study Plan. At the end of the final phase the PhD student has finalized his/her PhD thesis, and does not submit anymore the Research and Study Plan.

In the following, we provide a more detailed description of the five phases:

Phase 1 covers the first six months. The objective for PhD students in this phase is to identify, under the direction of their supervisor(s), a research area, a specific topic within that area, and one or more

methodological approaches to undertake the research. Students start by developing a solid understanding of the research area by attending classes and studying the recommended literature. Supervisors then insert PhD students into the Faculty's research activities that deal with the topic in question.

Phase 2 covers the second half of the first year. The objective of the PhD students in this phase is to arrive at a clear definition of the research problems, of the expected results, and of the approach to follow. The students spend time both in improving their skills and knowledge that are necessary for the research, and in making initial progress in their research.

Phase 3 covers the second year. The objective of the PhD students in this phase is to apply the chosen methodological approaches to find solutions to the research questions. Students are also expected to start publishing their results, if not done already earlier. During this phase, students should obtain results that will then form the basis of their thesis.

Phase 4 covers the third year. The objective of the PhD students is to deepen and extend the initial research results, obtaining original and significant research achievements that advance the state-of-the-art in their respective research field. The research results should be published in (or submitted for publication to) conferences and journals that are well known and of recognized quality in the respective research community.

Phase 5 covers the fourth year. The objective of the PhD students is to consolidate their research and to document the obtained results in a thesis.

Research areas:

Research at the Faculty of Computer Science spans three main research areas, which are being developed by research groups on a long-term basis. Within these three research areas, the group members investigate the following specific topics:

Information and database systems engineering:

1. SPATIAL AND TEMPORAL DATABASES
2. APPROXIMATION TECHNIQUES IN DATABASES
3. QUERY OPTIMIZATION IN DATABASES
4. COOPERATIVE INTERFACES FOR INFORMATION ACCESS AND FILTERING
5. DATA MINING TECHNIQUES FOR PREFERENCE ELICITATION AND RECOMMENDATION
6. CLOUD COMPUTING AND BIG DATA
7. AGILE DEVELOPMENT & HUMAN ASPECTS OF SOFTWARE ENGINEERING
8. SOFTWARE STARTUPS AND LEAN STARTUP METHODOLOGY
9. DESIGN BASED HARDWARE ENGINEERING
10. MATHEMATICAL AND SCIENTIFIC COMPUTING
11. INTERACTION DESIGN

Knowledge representation and databases:

1. LOGIC-BASED LANGUAGES FOR KNOWLEDGE REPRESENTATION
2. INTELLIGENT DATA ACCESS AND INTEGRATION
3. SEMANTIC TECHNOLOGIES
4. CONCEPTUAL AND COGNITIVE MODELLING
5. DATA-AWARE PROCESS MODELLING, VERIFICATION, AND SYNTHESIS
6. BUSINESS PROCESS MONITORING, MINING, AND CONFORMANCE
7. TEMPORAL ASPECTS OF DATA AND KNOWLEDGE
8. EXTENDING DATABASE TECHNOLOGIES
9. VISUAL AND VERBAL PARADIGMS FOR INFORMATION EXPLORATION
10. REASONING WITH UNCERTAIN AND IMPRECISE KNOWLEDGE

Software Engineering:

1. EMPIRICAL SOFTWARE ENGINEERING
2. MINING SOFTWARE REPOSITORIES
3. SOFTWARE RELIABILITY AND TESTING
4. AUTOMATIC IMPROVEMENT AND EMPIRICAL INVESTIGATION OF SOFTWARE QUALITY ATTRIBUTES

5. RECOMMENDATION SYSTEMS IN SOFTWARE ENGINEERING
6. SOFTWARE SYSTEM BEHAVIOR
7. SOFTWARE EVOLUTION AND MAINTENANCE
8. SOFTWARE VISUALISATION
9. AGILE AND LEAN PROCESSES
10. LEAN STARTUP AND SOFTWARE STARTUPS

Among these topics, the following research projects are being proposed:

Possible research projects and respective supervisors	
Title	Supervisor
Efficient querying of data under temporal constraints	Alessandro Artale
Change and evolution in ontologies	Alessandro Artale
Description logics for conceptual modeling	Alessandro Artale
Techniques and Tools for Ontology-based data access	Diego Calvanese
Evolving graph-structured data	Diego Calvanese
Data and knowledge aware dynamic systems	Diego Calvanese
The internet of gamified things for learning contexts	Gabriella Doderò
Tangible interaction design for learning contexts	Gabriella Doderò
Knowledge driven information access	Enrico Franconi
Intelligent conceptual modelling of information systems	Enrico Franconi
Designing knowledge base systems	Enrico Franconi
Optimizing query processing in temporal and spatial databases	Johann Gamper
Seamless and scalable integration of data streams in relational databases	Johann Gamper
Big data analytics and prediction	Johann Gamper
Query processing and optimization	Sven Helmer
Itinerary and route planning	Sven Helmer
Micro data center management	Sven Helmer
Big-data quality	Werner Nutt
Model-driven planning of industrial processes	Werner Nutt
Knowledge-base enrichment	Werner Nutt
Software architecture	Claus Pahl
Cloud and IoT systems and technologies	Claus Pahl
Software performance engineering	Claus Pahl

Human choice models and recommendations	Francesco Ricci
Preference modelling and Internet of Things	Francesco Ricci
Software Testing and Reliability	Barbara Russo
Monitoring Software System Behavior	Barbara Russo
Data mining in Empirical Software Engineering	Barbara Russo
Explanations and transparency in recommender systems	Markus Zanker
Persuasive information systems	Markus Zanker
Online Decision Support Systems	Markus Zanker
Intelligent management of business processes and data	Marco Montali
Declarative distributed computing	Marco Montali
Process mining	Marco Montali
Software startups and lean startup methodology	Xiaofeng Wang
Agile and lean software development methods and practices	Xiaofeng Wang
Innovation in software business	Xiaofeng Wang
Ontological Foundations for Enterprise Architecture and Business Modeling	Giancarlo Guizzardi
Ontology Validation via Visual Simulation	Giancarlo Guizzardi
Complexity Management in Large-Scale Ontology-Driven Conceptual Models	Giancarlo Guizzardi
Efficient algorithms in optimal transport problems	Omar Lakkis
Computational aspects of the Monge-Kantorovich problem	Omar Lakkis
Adaptive algorithms modeling hydrogeological flows	Omar Lakkis
Logics for computational creativity and cognition	Oliver Kutz
Almost certainly: combining similarity and probability	Oliver Kutz
Coherence and argumentation for concept evaluation	Oliver Kutz
Error-tolerant reasoning over ontologies	Rafael Penaloza Nyssen
Efficient approaches to supplemental reasoning	Rafael Penaloza Nyssen
Periodic and limit consequences of dynamic knowledge bases	Rafael Penaloza Nyssen

Admission requirements

To apply for the PhD programme in **COMPUTER SCIENCE** applicants must have knowledge of English. A prerequisite for the admission to the PhD is a deep knowledge of the fundamental techniques and methods used in computer science, which can be attested by a master's degree (or an Italian degree according to the old system) in Computer Science, Computer Engineering, Information or Electronic Engineering, or similar. This can also be attested by a master's degree (or an Italian degree from the

old system) in other subjects with experience working in the sector, or with a foreign qualification that has been deemed equivalent by the PhD Course Committee for the sole purpose of applying to this PhD programme.

To apply to the PhD programme, applicants must include the following:

- photocopy of a valid means of identification;
- color photo (*passport size, 5:4, min. 290x230, max. 100 KB, jpg recommended*);
- master's degree or equivalent with the final mark (if foreseen) and the transcripts of exams taken with their marks (*transcript of records*);
- curriculum vitae (*with date and signature*);
- motivation letter (*personal statement letter, not longer than one page of typed A4*);
- international English-language certificates or alternatively a declaration signed by the applicant listing the English courses followed at secondary schools, universities or private institutions with the respective marks obtained, periods spent in English-speaking countries with details of the activities undertaken while there or other evidence of English-language knowledge, such as having gone to secondary school in an English-speaking country.

Other documents to be included in the application if available:

- a list of the publications with the respective links to the online files (up to a maximum of 4 publications from the past 5 years);
- up to a maximum of 3 reference letters provided by the applicant's work or research supervisors, describing the work carried out and the quality of the same (*the letters MUST be signed and scanned!*).

Evaluation criteria for examinations/qualifications:

The selection is based on:

- the evaluation of each applicant's profile as specified in the curriculum, in the study titles and in the publications,
- the evaluation of the motivation letter and of the reference letters, and
- an interview.

The curriculum submitted by the candidate must include:

- a) the curricular exams passed and other exams taken;
- b) a list of publications, if available;
- c) the work and research experience, if available;
- d) evidence of knowledge of English (*language certificates*).

For the evidence of knowledge of English, the applicant may certify:

- courses followed at high school, university, or private institutes with relative marks;
- periods spent abroad in English-speaking countries with details of activities carried out there;
- further proof of knowledge, such as having attended secondary school in English.

The level of English will also be assessed during the interview.

The Evaluation Committee will select the best applicants on the basis of a comparative assessment. For those applicants that satisfy the pre-requisites, the Evaluation Committee will first evaluate the applicant's application documents, which include the curriculum vitae, their qualifications, including publications and reference letters (if any), the motivation letter, and the coherence between the curriculum and the proposed research areas.

For the evaluation of the application documents, the following points will be awarded:

- up to a maximum of 40 points for the curriculum and qualifications, including publications and reference letters;
- up to a maximum of 10 points for the motivation letter;
- up to a maximum of 15 points for the coherence between the curriculum and the research areas in the call.

Candidates that have obtained at least 45 points in the evaluation of their application documents will be admitted to the next stage of the selection process. This will consist of an interview in which also the knowledge of English of the applicant will be assessed. The interview can make use of telecommunication media such as video-conferencing, telephone and the like. Up to a maximum of 35 points will be awarded for the interview.

The interviews with the selected candidates will take place **on July 12 and (if needed) July 14, 2017**, at the Faculty of Computer Science of the Free University of Bozen-Bolzano, or via a remote video connection, using Skype. The precise date and time of the interview will be communicated per email **by July 8, 2017**. Candidates who wish to be interviewed via Skype, should indicate this in their application letter, and must include in the contact information also their skype id.

The *final score* is the sum of the score for the evaluation of the application documents, and of the score for the interview. The maximum score is 100.

Applicants that have obtained a final score of at least 70/100 are considered *eligible*. Eligible applicants will be ranked according to their final score. The top eligible applicants will be admitted according to the number of available places with and without grant, according to their order in the ranking list. The remaining eligible applicants will be put in a waiting list. Applicants in the waiting list will be admitted to the program in case an already admitted applicant is not available, or withdraws their application.

Grants funded by external parties

Candidates that intend to apply to one of the grants funded by external parties, must explicitly indicate their interest in the personal statement letter, by mentioning the specific topic and motivating why they are interested in the topic associated to the grant. For these grants, separate ranking lists can be established. Such ranking lists will contain candidates who are appropriately ranked in the general ranking and who in addition have a scientific profile that is particularly suited to the specific topic associated to the grant.

If two or more applicants have the same score, a lot will be drawn to decide on the allocation of places. The ranking list will be published on the University webpages of the PhD programmes.

Intake and grants:

Total intake: 13 places
 Intake with grants from the University: 9 places
 Intake with other grants of external parties (FBK): 1 place

PhD scholarship bound to a specific research topic: 1		
Topic	Positions	Funding body
<i>Business process discovery and alignment</i>	1	FBK - Foundation Bruno Kessler (TN) Referent: Dr. Chiara Ghidini

Intake with no grant: 3 places