The Computer Science Graduate Program at Unicamp

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Contents

1. Introduction

Computer Science is broad subject that creates practical, cost-effective solutions to Computing and information processing problems, by applying scientific knowledge, and developing computing tools and systems in the service of mankind.

Unicamp's graduate program produces graduates who are well prepared for faculty positions to develop research and education activities, for research and development positions in industrial laboratories and organizations, and for leadership positions in development within software and information technology fields.

The Ph.D. degree is a certification by the faculty that the student has a broad education in Computer Science and has performed a substantial piece of original research in a specific study field. Currently, the program is structured into three concentration areas: Computing Theory (CT), Computing System (CS) and Information System (IS).

The MSc. Degree is a certification by the faculty that the student has a solid foundation and proficiency in Computer Science, and has performed some research independently under supervision in one of the concentration areas described above.

This document is an informal description of the Computer Science Ph.D. and MSc. program; herein "we" refers to all the faculty and staff involved in the graduate program. Currently, the Institute Head is Anderson Rocha, the Institute Vice-Head is Leandro Villas, the Director of the Graduate Program is Cecilia M.F. Rubira, the Vice-Director Graduate Program is Edson Borin and the Graduate Program Manager is Wilson Bagni.

The Graduate Program Committee (GPC) is composed of the following members: Cecilia M. F. Rubira (chair, faculty member), Edson Borin (vice-chair, faculty member), Pedro J. Rezende (faculty member), Guilherme P. Telles (faculty member), Ana Paula (student member) and Luã (student member).

As a graduate student registered with the University of Campinas, you are governed by the general regulations (in Portuguese) and the program regulations for the Computer Science graduate course (in Portuguese).

2. Outcomes

We expect that our graduate students:

(a) become faculty in universities in Brazil or abroad, and advisors in undergraduate and graduate program courses in Computer Science and related areas;
(b) be hired as researchers by industry, research centers, and public or private organizations;
(c) be hired as professionals by companies which have Computing as their primary or secondary goal, specially in tasks that require independent work in order to combine technical knowledge with problem solving; and
(d) be entrepreneurs capable of developing new tecnologies and exploiting innovation to promote social and research impact and transfer of knowlege to the society in general.

We expect that our graduate students: (i) have a solid background in Computer Science and be capable of developing independent research and generating scientific knowledge and innovation; (ii) be aware of the significance and responsability of their professional enrollment, acting ethically, respecting laws and regulations, including intelectual properties and authoring rights, and (iii) update continuously their competences according to the state of the art in Computing.

2.1. Outcomes of the Ph.D. Program

The Ph.D./MSc. is a research degree. Accordingly, its desired outcomes focus on capabilities in research and education, together with expectations of capabilities in the subject area of Computer Science (explained below from C1-C9); we, therefore, assume some level of the subject area capability in our entering students.

In particular, we expect that the following will be outcomes of the Ph.D. program:

(C1) Ability to do independent research. Ph.D.s must have the ability to carry out independent research – to select significant theoretical or practical problems, solve them in creative ways, evaluate them critically, demonstrate the validity of the solution, and gather the resources to carry out the work. This is the absolutely essential capability of a Ph.D.

(C2) Skill in several research methods. Ph.Ds will have broad knowledge with the research methods of the field, empirical and formal (symbolic) methods, together with the ability to evaluate the application of a research method and to select the appropriate research method for a specific research project.

(C3) Depth of knowledge in a chosen speciality. Ph.D.s should be deeply knowledgeable in their specialties. Within their specialties they can evaluate and critique material. They exercise this knowledge both within the discipline and in the public domain of activities/field.

(C4) Broad general knowledge of Computer Science. Ph.D.s are broadly knowledgeable in their field. They have specific skills, and they are familiar with issues in Computer Science at large. They exercise this knowledge both within the discipline and in the public field, and they seek relevant knowledge from other fields.

(C5) Ability to teach a range of Computing topics. Ph.D.s will be technical leaders. As such, they will be able to organize a body of knowledge so it can be taught to others and should be able to plan presentations and other activities to teach that material. This requires communication with non-experts as well as experts.

(C6) Communication skills. Ph.D.s will be able to communicate effectively about technical material both within and outside of their specialization, both to other researchers and also to policy makers and the public.

(C7) International Experience. Ph.D.s will ground their research in a deep understanding of practice and theory in Computer Science. Their research experience will be improved by collaborating with international research groups by means of activities, such as internships, technical visitis, participation in conferences and research groups. It is expected that different research environments have different procedures of conducting research. This experience will bring a positive impact in his/her formation, and international collaboration networks probably will be created and transfer of knowledge will be promoted.

(C8) Technology for innovation and transfer of knowledge. Ph.D.s will be prepared and encouraged to transfer their solutions to the society, by generating social and research impact to the community in general.

(C9) Broad, mature, multidisciplinary and ethical perspective. Ph.D.s will be prepared for interdisciplinary collaboration and professional leadership. This depends on their ability to view Computing Science critically; to understand how computing systems interact with larger issues in society, business, socio-economic impacts, and public policy; and to appreciate the perspective of both collaborators and competitors. Ethics and the balance between their personnal

opinion and a collective opinion (that is, consensus) will promote innovation and shape their individual critical perspective.

2.2. Outcomes of the Master Program

In a similar way, we expect that the following will be outcomes of the Master program:

- Demonstrate breadth in knowledge across the three foundational areas in Computer Science.
- Demonstrate the ability to identify, read, and understand relevant research literature, and to design a research study using an established research method under supervision.
- Acquire oral and writing communication skills in order to publish and present the results of their research work to the scientific community.
- Demonstrate capability of generating relevant results, not necessarily original and/or new ones.
- Produce some bibliographic and/or technical material as a result of your research work.
- Work as teaching assistants whenever it is possible as part of their graduate education.

3. Goals

The Computer Science graduate program at Unicamp has the following general goal:

To provide human resource capable of executing independent and cutting-edge research, in an academic enviroment together with excellence in teaching and serving the society, or in the industry with the creation of technical solutions that are applied to achieve a real societal impact.

In particular, the goal of the Ph.D. program is to provide ample and deep scientific, technological and cultural background, by developing the capability of original and independent research, consolidating the student's knowledge in the specific area of his/her thesis work, with original contributions to the research area and a proper publication of the results to the scientific community and public in general.

The goal of the M.Sc. program is to provide scientific and professional proficiency, by improving the student's capability of synthesing his/her findings based on the state-of-the-art, and his/her ability of executing scientific investigation under supervision.

4. Graduate Education Dimensions

The description of our program structure is based on the method "Referential Structure for Education Formation of the Brazilian Computing Society" [REF2][REF3], described in the document "Referenciais de Formação para os Cursos de Pós-Graduação Stricto Sensu em Computação 2019" [REF2] (Page 4, Figure 1), which defines seven graduate education dimensions: (D1) Research, (D2) Teaching, (D3) Information Organization, (D4) Technological Development &Innovation, (D5) Communication, (D6) Ethics, and (D7) Personal Development.

(https://www.sbc.org.br/educacao/referenciais-de-formacao-para-os-cursos-de-pos-graduacao-stricto-sensu-em-computacao)

[REF2] Araujo, R.M.; Simão, A.; Malucelli, A.; Zorzo, A.F.; Monteiro, J.A.S.; Chaimowicz, L. "Referenciais de Formação para os Cursos de Pós-Graduação Stricto Sensu em Computação". Sociedade Brasileira de Computação (SBC). 19p, 2019 (in Portuguese)
[REF3] Simão, A; Araujo, R; Malucelli, A; Vosgerau. D; Pós-graduação em Computação:Muito além de publicações, Computação Brasil, Nº 38, Edição 3/2018, páginas 39 a 42 (in Portuguese).

(D1) Research Dimension: conduct a scientific research project in a specialized and independent manner, generating new and original contributions to the discovery, advancement and communication of knowledge and/or scientific and technological development, by showing depth of knowledge and also being updated to novelties in a specific research area.

(D2) Teaching Dimension: manage educational activities, applying adequate resources in order to reach specific teaching and learning objectives, and achieve teaching excellence in a responsible way.

(D3) Information Organization Dimension: manage information, resources and documents effectivelly in order to produce evidences for supporting his/her research questions, exploiting the results extracted from data, information and idea synthesis.

(D4) Technological Development and Innovation Dimension: explore the potential of technological development and innovation generated by his/her findings, in order to transfer knowledge to the society and/or build products in organizations.

(D5) Communication Dimension: communicate clearly the results from his/her studies, by using the scientific language of his/her research field in order to express this knowledge, and choosing appropriate elements to achieve oral and written communication according to different context, either academic or professional, national or international ones.

(D6) Ethics Dimension: behave in an ethical and responsible way, uphold standards of honesty and integrity, and respect laws, intelectual properties, and confidentiality agreements, as well as, follow good practices of research, and practice self-reflection and autonomy.

(D7) Personal Development: to be committed to a continuous process of learning and improvement by focusing on enhancing acquired competences and knowledge, while keeping a balance between professional activities and personal life.

5. Graduate Education Dimension to Competences Mapping

Generally speaking, Table 1 provides a correspondence between the education dimensions and our program competences. In the table, the symbol "X" indicates that the competence on the left is an important contributor to the above dimension. A specific competence can contribute to one or more education dimensions.

Dimensions / Competences	D1 Research	D2 Teaching	D3 Info. Org.	D4 Tech. Dev.	D5 Comm.	D6 Ethics	D7 Person. Dev.
C1-Indep. Research	X				X	X	X
C2-Research Method			X				
C3- Depth of Know.	X	X		X			
C4- Broad Know.	X	X		X			
C5- Teaching Disc.		X		X	X		
C6- Communication		X			X		
C7- Intern. Experience					X		X
C8- Tech.Innov. & ToK				X			
C9- Maturity&Ethics		X	X	X	X	X	X

Table 1 – Graduate Education Dimensions to Program Competences Mapping

Table 2 provides a correspondence between the program competences/outcomes and the program requirements. In Table 2 the "X" symbol indicates that the program requirement on the left is a contributor to the outcome above.

Competences / Program Requir.	C1 Ind. Res.	C2 Res. Meth	C3 Depth of Know.	C4 Broad Know.	C5 Teach.	C6 Comm.	C7 Intern. Exp.	C8 Tech. Innov.	C9 Matur. Ethics
R1- Course: CS			X	X				X	
R2- Course: IS			X	X				X	
R3- Course: CT			X	X				X	
R4- Electives			X	X				X	
R5- General Seminar	X			X			X		X
R6- Research Seminar	X		X				X		X
R7- Keep an average grade > = 3 (out of 4)									X
R8- Directed Research	X	X	X				X	X	
R9- Scientific Method	X	X	X				X	X	
R10- Scientific Writing	X					X	X		
R11- General Exam				X					
R12-Thesis/Dissert Proposal (EQE/EQM)	X	X	X						
R13-Teaching Assistant (PED)					X				X
R14-English Examination						X	X		X
R15-Paper/Poster Presentations	X					X	X		X
R16-Conference Paper/Journal Article Publication	X	X				X	X		X
R17- International internships, Visits, Exchanges.						X	X		X
R18- Thesis or dissertation defense	X	X	X						

Table 2 – Competences/Outcomes to Program Requirements Mapping (university units + formation activities)

To complete the Ph.D. degree, we require that each student:

- Develop a broad foundation in Computer Science and specific intelectual skills by passing 24 (~5 courses of 60 hours each) university units worth of graduate courses, until the end of the fourth semester, with certain distribution requirements based on the three concentration areas: Computing Theory (CT), Computing System (CS) and Information System (IS) (R1-R6).
- Keep an average grade in her/his marking, equal or higher to 3 considering a range from 1 to 4 (R7).

- Contribute to scientific knowledge in Computer Science by engaging in directed research. This is the central element of the Ph.D. program, and students should spend part of their time on research, starting at the first semester, and throughout their academic life in a continuous form (R8-R10).
- Pass in the general examination corresponding to each concentration area (Computing Theory, Computer System, and Information System); however, students can ask for exam liberation when their grade score in graduate courses are above a threshold (R11).
- Present a thesis proposal in advance in order to support effective planning and ensure that the student's research topic is viable (R12).
- Acquire and demonstrate teaching skills by serving as a teaching assistant at least once (R13),
- Demonstrate proficiency in English by passing in the English exam offered by the Institute or in an equivalent one, such as TOEFL, ELTS, Cambridge First Certificate, and so on (R14),
- Acquire and demonstrate oral and written communication skills by writing about research and presenting results in scientific events and conferences. For instance, we encourage our students to participate in the Ongoing Thesis and Dissertation Workshop (WTD), preferebly every year, as a means of demonstrating her/his progress, to submitting papers to conferences and journals, and so on (R15-R16),
- Acquire international experience by exploiting opportunities for international collaboration with other research centers, by means of international exchanges and internships, international research projects and research groups, participation in international events, etc (R17).
- Write and orally defend a thesis, a significant piece of original research related to Computer Science (R18).

To complete the Master degree, we require that each student:

- complete 22 university units, which is the equivalent of 5 standard 60-hour courses: 20 units should be taken in regular disciplines excluding seminars, direct research studies, until the end of the second semester,
- present and pass his/her dissertation proposal until the beginning of the second semester,
- fulfill the communication skills by passing in an English exam until the end of the second semester or in an equivalent one, such as TOEFL, ELTS, Cambridge First Certificate, and so on,
- enroll to serve as teaching assistant until the third semester (at least once),
- keep an average grade of equal or higher than 3 (out of 4),
- to complete the program within 12-36 months, ideally in 24 months.

Moreover, we encourage students to engage in research as soon as possible in the

Institute and in order to help students fulfill the requirements of our program, we provide these educational opportunities:

- An active research environment, with experienced and dedicated faculty advisors,
- A large number of graduate courses covering various topics in all concentration areas,
- Various research laboratories are available so that usually a student can become a member of a laboratory.
- Support for innovation and technological development is provided by INOVA office at Unicamp (in Portuguese) that executes procedures related to patent acquisition, software record, intelectual propriety, creation of startups and capacitation for entrepreneurship.
- Support for graduate students who are or will be serving as teaching assistant. The Unicamp EA2 Center (in Portuguese) offers various educational activites for graduate students that wish to prepare for the teaching component of an academic career, such as, training on educational innovation methodologies such as PBL (Problem-Based Learning ou Project-Based Learning) and learning management systems, such as Moodle and ClassRoom, that support distance learning.

A student demonstrates progress by passing courses, doing directed research, teaching, fulfilling the skills, and doing thesis/dissertation work.
Because each student's path can be different, the order in which students complete the various requirements of the program may vary, though directed research progress is expected every semester.
Some milestones are established in order to guide their path and to help them to monitor their timeline.
A timeline showing how a typical student in our program might go through the program elements is available in Appendix A.
Financial support and permission to continue in the Ph.D./Master program depend on making satisfactory progress each semester in one or more of these requirements.

6. Graduate Program Community and Student Leadership Representation

We are committed to a sense of community within the Institute of Computing. In practice, our graduate students, faculty, and staff volunteer their time, and other skills to participate in activities and events that contribute to the welfare of the Computing Institute community.

These efforts include volunteering to:

(i) organize our internal workshop "WTD: Workshop on Ongoing Thesis, Dissertation and Scientific Initiation" once a year,
(ii) be student representative of the graduate committee,
(iii) be student representative of the Institute Board,
(iv) manage the shared study space dedicated to graduate students,
(v) serve as teaching assistant,
(vi) serve as tour guide when the institute receives visitors (e.g. UPA: University with Open Doors to high school students), etc

In general, decisions regarding graduate program policies are made by the Graduate Program Committee (GPC), and the students elect their leadership representation within this committee.

7. Role of the Graduate Program Committee (GPC)

The committee is composed of 6 members: 4 faculty representatives (3 voting members) and 2 graduate students (1 voting member). Graduate student representatives are elected by the graduate students and serve for 1-year terms. All representatives are voting members and decisions in the committee are in general made by consensus.

The Graduate Program Committee (GPC) serves the following functions:

- Review requests for time extensions on program requirements,
- Provide ongoing assessment and review of the graduate program, proposing changes as needed.
- Approve thesis/dissertation committee members for proposals and defenses,
- Monitor students' progress during their academic life cycle according to the planned program requirements for each semester.
- Associate a temporary advisor to first-year graduate students in order to advise them on course selection and other academic matters until a permanent research advisor is selected.
- Manage financial support for students to attend conferences and publish articles in journal and other venues.

When an immediate action is required, the chair of the Graduate Program Committee may act for the Committee. The chair is also available to advise students or faculty on matters that they may wish to bring to the GPC.

8. Advisors

By the end of the first semester, each graduate student should have a faculty advisor charged with guiding the education and monitoring the progress of the student through the program. During the first semester, a temporary advisor can be responsible for providing educational activities guidance while a permanent advisor is defined.
This personal student-advisor relationship ensures that every student receives the necessary faculty mentoring. Throughout the program, the advisor is responsible for guiding the student's research and education.

Early in the program, the advisor guides the student along some research initiative and helps with strategic planning for courses and other educational activities. Later, the advisor helps to focus the student's research interests towards a thesis/dissertation topic.

Toward the end of the program, the advisor chairs the student's thesis/dissertation committee, and helps to select the other members of the committee.

How are advisors initially chosen? When students first arrive at Unicamp, students are expected to identify faculty with related interests and set up meetings with those faculty in order to discuss a potential advising relationship. This initial contact can occur before the formal entrance/admission of the student.

Some students have a co-advisor. Occasionally evolving research interests and other factors motivate changes in advising relationships.

In this case, the student can request a change in advisors. Such changes are approved by the Program Director with agreement from the new advisor.

9. Directed Research Study

The Computer Science Ph.D./Master is a research degree, and carrying out directed research study is a very important activity for students in the program. We expect students to spend their time on research throughout the program as soon as possible.

Different students, and different advisors, have different ideas of how directed research study can be conducted and how progress can be demonstrated. It is the responsibility of both the student and his/her advisor to formulate a set of reasonable goals, plans, and criteria for success in conducting a directed research study.

By the beginning of the second semester, a M.Sc. student should present his/her dissertation proposal.
By the end of the fourth semester, a Ph.D. student should present his/her thesis proposal.

The proposal should be orally presented to an evaluation committee which defines whether this requirement was achieved or not. Also, a written report should be delivered describing the motivation, problem, solution, and research method to be explored in the chosen topic (reference for Section 13).

10. Course Requirements

The purpose of completing graduate courses at Unicamp is to get a broad understanding of Computer Science and closely related fields, a core set of research skills, and a deep understanding of topics that lead into the student's thesis/dissertation research.

10.1. Course Types

Our courses are classified into:

(i) regular/standard courses: they can be grouped into three main areas: Computing Theory (CT), Computing System (CS) and Information System (IS),
(ii) specialized courses: their units are computed to the total number of credits to be completed, but do not cover any of the three main areas,
(iii) advanced topic courses: Topics in different Computing fields,
(iv) Research Writing for Graduate Students (MO903): It is a scientific writing course planned to teach scientific writing guidelines for structuring of papers, abstracts, references, etc., preferably in English,
(v) Applied Research Method courses (MO430): It is designed to prepare graduate students to do research in Computer Science. It introduces important ideas about different research strategies and methods. Research Methods: Qualitative and Quantitative, Empirical Methods,
(vi) MO911: Students will learn to critique research papers, to evaluate their claims and evidences; they will also learn to define the ideas and developments to the specification of research questions,
(vii) Teaching Assistant internship course (PED),
(viii) General seminars and research seminars.

Regular courses provide grounding in a topical area or set of research skills within Computer Science. Usually they provide a broad introduction to a topic or skills

relevant to Computer Science research, while being deep enough to be appropriate for graduate study, and assume only an undergraduate background in the relevant area.

10.2. Concentration Areas

Each category captures a particular set of knowledge and skills that every Computing student should possess. At the same time, the choice of courses within the categories gives students the flexibility to customize their course selection to their individual needs.

We provide for each area a set of courses so that diversity is leveraged.
Moreover, the program director is responsible for planning that each semester leverages a set of course offerings covering all areas so that students can have a concrete opportunity to make their individual choices for covering them.

Three main areas: Computing Theory (CT), Computing Systems (CS) and Information Systems (IS), described below:

- CT: This area concentrates on theoretical aspects of Computing Science, including Algorithms and optimization, Bioinformatics and Computational Biology, Graphs, Combinatorics and Theory of Computation, Cryptography. Courses with primary focus on: Graph Theory, Graph Algorithms, Algorithm Complexity, Computational Geometry.

- CS: This area concentrates on aspects of Computing Science related to Programing Languages and Compilers, Networks, Distributed Systems, Design of Computing Systems, Information and System Security.
  Courses with a primary focus on: Teleprocessing and Computer Networks, Network Security, Computer Network Management, Computer Architecture, Parallel Programming.

- IS: This area concentrates on aspects of Computing Science related Visual Computing, Software Engineering, Human-Computer Interaction, Big Data Management, Robotics and Machine Intelligence.
  Courses with a primary focus on: Software Engineering, Introduction to Artificial Intelligence, Introduction to Digital Image Processing, Image Analysis, Introduction to Computer Vision, Computer Graphics.

  Appendix B describes in detail each one of the research lines mentioned above.

10.3. Ph.D. Course Requirements

Our requirement is that Ph.D. students:

(i) complete 24 university units, which is the equivalent of 6 standard 60-hour courses, excluding seminars and directed research studies,
(ii) complete all the units by the end of the fourth semester,
(iii) either pass in the general qualification examination (GQE), including three main concentration areas (Computing Theory (TC), Computer System (SC) and Information System (SI)), or get the approval from the Program Director to substitute this requirement for taking at least one course in each of the three areas with an average grade of 3 (out of 4) or higher,
(iv) complete the general exam requirement until the end of the fourth semester, before presenting their thesis proposal at the beginning of fifth semester.

By taking a course in each of the three categories, graduate students acquire breadth through exposure to fundamental knowledge, concepts, and skills in Computer Science. Through the equivalent of three elective courses, students typically choose to gain more depth in the student's particular area of research.

10.4. M.Sc. Course Requirements

Our requirement is that MSc. students:

(i) complete 22 university units, which is the equivalent of 5 standard 60-hour courses: 20 units should cover standard/regular disciplines, excluding seminars and directed research studies,
(ii) complete all the units by the end of the second semester,
(iii) it is not required that the courses cover all the three concetration areas.

10.5. Evolution of the Course Curricula

Course curricula evolve over time, due to the advancing state of knowledge, the changing background and needs of students, or the inclusion of a new research area in the program. Once a year the program curriculum is re-examined by the faculty. Faculty can request the creation of new courses and/or other modifications of existing ones. Those requests should be approved by the GPC.

10.6. Seminar Series and Research Seminars

All graduate students are expected to register for the "Seminar Series in Computer Science" and actively participate in it each semester. The seminar course is an opportunity to learn about current research topics in the area of Computer Science

since various speakers from academia and industry are invited to participate.

Research seminar courses are associated to one of the three concentration areas (Computing theory, Computing Systems or Information System), and help students to gain presentation skills and research capabilities.

10.7. Elective Units

Students can take university units worth of elective courses from graduate courses offered by the Institute of Computing. However, students can take graduate courses offered by the rest of the University or other universities as long as their formal request are approved by the Graduate Program Committee.

Students may use electives to gain additional depth of knowledge in the student's research area, e.g., to complement their directed research or to prepare them for choosing a thesis topic.

We strongly advise students to choose electives in consultation with their advisors. The student and his/her advisor are both responsible for making sure that through these elective units the student gains new knowledge, perhaps to fill gaps or to prepare for thesis research. Students are free to take more than the required number of elective units.

10.8. Credit for Prior Coursework

Students may request that the GPC aproves equivalent graduate-level courses they have already taken. Ph.D. students can require the equivalence of up to 3 Master-level courses.
A student must submit a request to the Graduate Program Committee within their first year in the program, in order to apply for the course equivalence.
The prior course needs to be equivalent in content and substance to one of the approved courses in the same area.
The student must make a case for how prior courses are equivalent in substance, submitting a self-contained justification, a syllabus, and a transcript.
The student can provide additional support for the case by providing slide excerpts, reading lists, homework assignments, work products, or other supporting artifacts.
These requests will be considered by the Graduate Program Committe, typically delegated to a faculty member with expertise in the corresponding area. The final decision is reached by the GPC based on the evaluation form provided by the faculty member and the student's performance in the course.

11. Teaching Requirement

The ability to teach is an important skill for all scientists, not only for those who plan to teach after completing their degrees. Teaching skills include the ability to communicate technical material ranging from elementary to advanced, and to communicate technical material to audiences ranging from general to specialized. Thus, we expect students to develop and exercise teaching skills as part of their graduate education.

Students have various opportunities to present advanced material while working on research projects, by participating in research seminars research seminars and by giving international and national conference talks. To gain experience in presenting material at an introductory or intermediate level, we require that all graduate students help teach at least one undergraduate course by serving as teaching assistants.

Usually students teach one course focused on introductory material in Computer Science, but it is possible to teach advanced undergraduate course depending on their interest and knowledge. Teaching assistants typically spend 8-12 hours per week.

The student should enroll in the Teaching Assistant Internship course (PED) in order to receive credits for the teaching requirement.
After serving as a teaching assistant, both students and course instructors should fill in teaching assistant evaluation forms. A general evaluation committee at Unicamp makes a judgment whether the teaching requirement was satisfied. After this evaluation process is finished, if the outcome is positive the student receives the credits; otherwise, not.

Students are encouraged to teach more than once. The Unicamp EA2 Center (in Portuguese) offer teaching workshops and training courses, and we encourage graduate students to take advantage of this facility.

12. Written and Oral Communication Skills

Student should have acquired basic knowledge and the abilities:

(a) to communicate technical ideas clearly in writing, and
(b) to communicate technical ideas clearly orally.

Students should demonstrate speaking proficiency through presentations they can give in research seminars, in our internal academic workshop, course lectures and other venues.

Graduate students are encouraged to enroll in the following courses in order to improve their writing proficiency:

(a) Scientific Writing Course (MO903) to enhance their writing skills, and
(b) Scientific Methods and Proposal Writing (MO911) to support them to define their research proposal, and also to enhance their writing and oral skills, preferebly in English (reference to Section 10).

We expect students to take these courses within their first 2 years, and prior to their thesis/dissertation proposal.
Graduate students should also pass in the English Proficiency exam until the end of the second semester.

In general, students are encouraged to participate in the following events:

(i) our internal workshop (WTD) which is organised every year by the students themselves with the coordination of a faculty as the general chair of the organising committee, and the purpose of the WTD is to disseminate, especially to the Institute of Computing community, the research work under development at the institute.
The target audience of the event are the professors and students of the graduate and undergraduate IC who wish to present their work and research projects in progress or recently concluded.

(ii) EPPC: It is a one-day meeting for Master's and PhD students in Computing in the State of São Paulo to exchange ideas and encourage new research collaborations. The first three editions of the event were held by ICMC-USP (2017), Unicamp (2018) and IME-USP in 2019.

In order to get a formal approval to defend his/her thesis, Ph.D. students should publish a paper on a conference or a journal in order to improve their writing proficiency and satisfy the publication requirement.

13. The Thesis/Dissertation Process

The thesis must describe a significant piece of original research. It is evidence of proficiency, high attainment, and ability to do research in Computer Science.
A more extensive checklist with specific information on the thesis proposal and thesis defense is available in the site of Program [1](in Portuguese).
Every student must read and adhere to the process rules related to the

[1] https://ic.unicamp.br/pos-graduacao/informacao-para-docentes-e-pos-graduandos/vida-academica-da-pos-graduacao/procedimentos-e-formularios-para-defesa-de-mestrado-e-doutorado/

thesis/dissertation proposal and defense.

13.1. Thesis/Dissertation Proposal

The student submits a written proposal to the faculty. The student also orally presents it to a thesis committee in a public colloquium for the Computing Institute community.
A thesis proposal should:

- Explain the basic idea of the thesis topic (e.g., the problem to be solved and the approach to solving it),
- Argue why that topic is interesting (e.g., what contributions to the field would be made in carrying out the proposed work),
- State what kind of results are expected,
- Argue that these results are obtainable within a reasonable amount of
- time, and
- Demonstrate that the student is qualified to perform the proposed work, including an understanding of the area and its literature.

The main purpose of the thesis/dissertation proposal is to convince the faculty committee that the chosen thesis topic is significant and that the student's approach has a reasonable chance of success.

A thesis proposal gives the faculty committee the opportunity to pass such judgment at the start of the work and not at the end. The idea is to minimize the chance that a thesis will be turned down when almost completed. Ph.D. students should present their proposals until the end of the fourth semester or before, not halfway through writing the thesis.

M.Sc. students also should present a dissertation proposal.

A thesis proposal should be short, about 15–20 pages, and the oral presentation should take about 30 minutes, not including questions.
the student's personal qualifications.

13.2. Thesis/Dissertation Committee

The composition of the thesis committee members, including the external member, usually is suggested by the advisor. All thesis committees are subject to the GPC approval.

The student's advisor cannot be the chair of the thesis committee or be a member of it; however, they are the chair of dissertation committees.

All other committee members should declare no conflicting interests to participate in the evaluation process.
The Thesis Committee must consist of two Computing Institute faculty member, and an external committee member.

The thesis committee is consulted to set up a date for the proposal presentation. The Program Administrator posts the public announcement of the presentation for the Computing Institute community.

Thesis proposal may be held remotely in an exceptional way, with at least two Unicamp members (including the chair) physically present for the thesis proposal. The thesis proposal must be held at Unicamp.

13.3. Thesis/Dissertation

The thesis must describe clearly a significant piece of original research work. It is on this basis that the Institute certifies the qualifications of the new Ph.D. Furthermore, it is the most important basis on which the scientific community judges the initial achievement and potential of that individual.
The dissertation does need to generating relevant results, not necessarily original.

13.4. Thesis/Dissertation Defense

The student's thesis committee decides whether to accept the thesis based on its content and the outcome of the thesis defense, which is a public presentation describing the contributions of the thesis.

Before the thesis defense, the entire thesis committee is expected to have read the entire thesis, and to have given approval for scheduling the public defense. The Program Administrator posts the public announcement of the thesis defense.

The presentation by the candidate is normally about 30-40 minutes, followed by a question-and-answer period which may be as long as needed.
As with the thesis proposal, at least three thesis committeee members (including the Chair) must be physically present for the thesis defense, with some exceptions described above.
The thesis committee chair (advisor) determines who may ask questions and in what order and brings the discussion to a close at the appropriate time. The question-and-answer period is followed by a closed-door session attended by only the members of the thesis committee.

The options of the committee are:

- To approve without corrections,
- To approve subject to minor changes, to be approved later by the thesis chair only,
- To require a resubmission after major changes and reapproval of the entire committee, and
- Not to approve the thesis.

All members of the committee are required to sign a Final Oral Examination document, indicating that the student has passed the thesis oral examination.
The final version of the thesis should be submitted within 3 months of the thesis defense. When the student submits it, the final certification sheet is signed by the Dean.

13.5. Time to Degree Policy

Ph. D. students must complete all requirements for the Ph.D. degree within a maximum of six years (12 semesters) from original entrance as a doctoral student, unless terminated earlier by conferral of the degree or by academic or administrative action.

M.Sc. students must complete all requirements for the M.Sc. degree, within a maximum of 3 years (6 semesters) unless terminated earlier by conferral of the degree or by academic or administrative action.

Time spent in leaves of absence or in-absentia do not count towards the limits above soecified, for the maximum of 2 semesters. Once this time-to-degree limit has finished, the student may resume work towards a doctoral degree by requesting a new admission as long as your Ph.D. thesis/dissertation text is completely written and the student is ready to defend it.

13.6. Graduation Certification

The Program Administrator certifies fulfillment of requirements for graduation only when the final version of the thesis has been submitted.
The Program Administrator maintains a checklist of procedures for scheduling the thesis oral presentation and completing the other requirements for graduation.

14. International Experience Requirement

Students are encouraged to spend from a few months to a year at renowned institutions abroad in order to foster international cooperation.
In particular for Ph.D. students, we recommend that he goes abroad after submitting his thesis proposal so that he have all main program requirements fulfilled before his departure.
The student has to take care of taking the English exams that are required for scholarship selection processes.

15. Evaluation of Students' Progress

Evaluation and feedback on a student's progress are important both to the student and to the faculty.

The graduate committee together with the advisors measure each student's progress against the goal of completing the graduate program in a reasonable period of time. Overall, we expect Ph.D. students to complete the program within 4-5 years, and M.Sc. students to complete within 2-2 ½ years

Some requirements need be fulfilled in a particular order. Each student must show reasonable progress each semester toward satisfying the set of requirements planned for that period.
The "Computer Science Graduate Program Regulation" specifies checkpoints to be certified each semester in order to control the completion time of the program. In an individual basis, a student can postpone the execution of a specific requirement when approved by the graduate program committee.
The graduate program committee monitors the student progress each semester.
A student's progress in the Ph.D. program is measured along multiple dimensions. One of these dimensions is the student's performance in courses. At Unicamp, it is required that graduate students keep an average grade 3 (out of 4) or better; otherwise, the student is automatically dropped from the program by the academic system.
One of the critical paths to completing the graduate program is the acomplishment of the disciplines.
Other critical path is the directed research, making regular research progress is a very important consideration.
The graduate committee can specify for each student recommendations for future work or requirements that must be met for continued participation in the program.

The evaluation considers components of the program using indicators and information source. Some of them will be applicable in any given semester; each

student will progress through the requirements following an overall framework, that can be adapted to individual needs as long as these modifications are approved by the graduate committee:

- Directed research: Evaluated by research supervisor.
- Courses taken: Evaluated by the course instructor.
- Teaching: Evaluated by the course instructor and approved by a teaching committee. Two different teaching evaluation forms are considered (one filled out by the course instructor, other by the student). The teaching committee is responsible for the final approval of the activity and for deciding when a consensus is unclear between both evaluation forms.
- Skills: Writing and speaking, by presentations and lectures given, papers written, participation in our internal workshop (WTD).
- Thesis/Dissertation: having her/his thesis/dissertation proposal approved by the thesis committee.

Permission to continue in the Ph.D. program is contingent on whether or not the student continues to make satisfactory progress toward the degree. If a student is not making satisfactory progress, the GPC may choose to drop the student from the program.

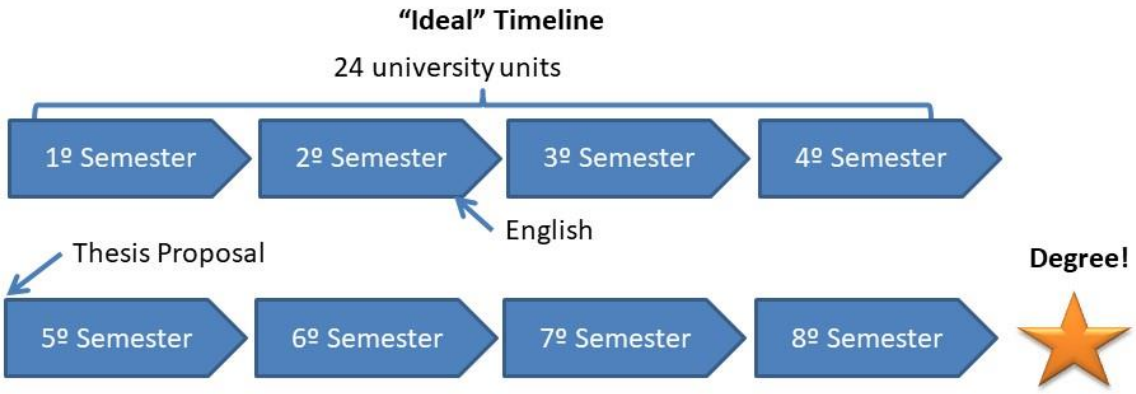
Termination of support does not always mean termination from the program.

We encourage students to get a balance between their focus on research and coursework.

Appendix A

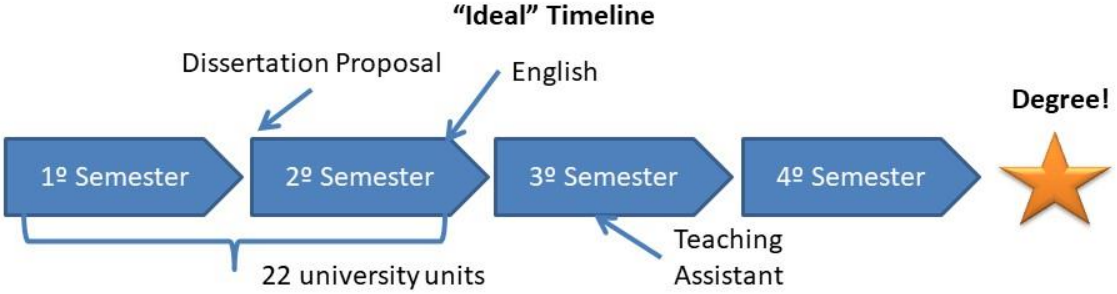
Ph.D. degree requirements

• to complete the program within 24-72 months, ideally in 48 months.
• complete the general exam requirement until the end of the fourth semester, before presenting their thesis proposal at the beginning of fifth semester
• Demonstrate proficiency in English until the end of the second semester,
• enroll to serve as teaching assistant until the fifth semester (at least once),
• keep an average grade of equal or higher than 3 (out of 4),
• complete 24 university units, which is the equivalent of 6 standard 60-hour courses excluding seminars, direct research studies, until the end of the fourth semester,
• Writing about research and presenting results in scientific events and conferences.



Master degree requirements

• to complete the program within 12-36 months, ideally in 24 months.
• present and pass his/her dissertation proposal until the beginning of the second semester,
• Demonstrate proficiency in English until the end of the second semester,
• enroll to serve as teaching assistant until the third semester (at least once),
• keep an average grade of equal or higher than 3 (out of 4),
• complete 22 university units, which is the equivalent of 5 standard 60-hour courses: 20 units should be taken in regular disciplines excluding seminars, direct research studies, until the end of the second semester



Appendix B

Research lines	Research lines details	
1 - Algorithms and Optimization	A - Approximation algorithms, B - Online algorithms, C - Randomized algorithms, D - Integer linear programming,	E - Operational research, F - Game theory, algorithmic, G - combinatorial optimization, H - Computational geometry
2 - Bioinformatics and Computational Biology	A - Rearrangement of genomes,	B - Phylogeny
3 - Graphs, Combinatorics and Theory of Computation	A - Theory of graphs, B - Graph algorithms,	C - Formal languages and automata
4 - Cryptography	A - Cryptographic algorithms, B - Cryptographic engineering, C - Secure programming,	D - Hardware security assessment, E - Elliptical curve cryptosystems
5 - Design on computing systems	A - Approximate computing, B - High performance computing, C - Energy efficient computing, D - Programming languages and code generation,	E - Embedded systems, F - Operating systems, G - Parallel computing H - Parallel programming
6 - Computer Networks	A - Network Management, B - Internet of things, C - Cellular networks, D - Cognitive networks, E - Optical networks, F - Wireless networks,	G - Vehicle networks, H - Quality of service, I - Software-defined networks (SDN) J - Virtualization of network functions (NFV)
7 - Information and Systems Security	A - Malware analysis, B - Defenses against Advanced Persistent Threat (APT), C - Access control,	D - Internet of Things (IoT) security, E - Cloud Security
8 - Distributed Systems	A - Distributed algorithms, B - Resource allocation, C - Smart cities, D - Cloud Computing,	E - Mist Computing, F - Staggering, G - Orchestration of services, H - Remote sensing
9 - Visual Computing	A - Computer Vision (Recognition of Complex Events in Videos, Segmentation and Classification of Images)	B - Computer Graphics (Volumetric Processing in Multiple Levels of Details, Image Processing) C - Information Display
10 - Software Engineering	A - Software Architecture, B - Adaptive Systems, C - Cyber-physical systems D - Model-Oriented Software Engineering,	E - Experimental Software Engineering, F - Software Quality and Warranty, G - Agile Methods, H - Fault Tolerance
11 - Human-Computer Interaction	A - Interaction design; B - Universal and Participative Design; C - Usability / Accessibility; D - Evaluation of interfaces; E - Cross-modal interfaces;	F - User Experience; G - Natural and Tangible Interfaces; H - Semantic Web; I - Pragmatics of the Web J - Organizational Semiotics
12 - Big data management	A - eScience; B - Information Retrieval; C - Ontologies;	D - Interoperability; E - Open linked data; F - Open Science / Open Science, etc.
13 - Robotics and Machine Intelligence	A - Robotics B - Learned Vision - Learned Computer Vision (Stabilization of videos, Analysis of images and videos, Super-resolution of images and videos)	C - Machine intelligence (Representation learning, Probabilistic learning)