The Department of Computer Science

Master's degree in computer science

Department objective

The computer science department offers programs of study toward the master's degree and PhD.

Academic studies combine theory and practice to prepare its graduates for successful integration into the academic world and into industry.

Tracks

Two tracks are available:

Track A – Research Track, which includes research in the selected focus area and thesis submission.

Track B – Non-Research Track, which includes familiarization with the focus area via coursework; In this track there is no thesis, but instead a departmental research project.

Focus areas

1. Algorithms and computability ('theory').

2. Cryptography and security.

3. Artificial intelligence (including data retrieval and robotics).

4. Data science and Artificial intelligence (as a formal certified track)

5.General (available only in the non-research Track B).

Different focus areas have different prerequisites, requirements and electives (see table below). Students must choose a focus area and then follow the corresponding program.

Students in the research-based track whose research area includes topics from other focus areas (for example, theory and security, artificial intelligence and security, artificial intelligence and algorithms), may have a study program

designed individually for them (by approval of the advisor and the academic advisor for the master's degree) modifying the required and elective course requirements so that they line up with the area of focus selected by the student. A necessary condition for the program is that it must include passing one of the required courses from each focus area included in the student's research domain.

Admission criteria for a master's degree in computer science

Please note that the criteria listed are a precondition for admission to be considered. Meeting these criteria does not guarantee admission.

A CV should be included with the application.

Grade point average – The Department of Computer Science will consider applicants with a bachelor's degree in computer science from an institution recognized by the CHE, with a minimum grade point average of 86. An official transcript (including the final grade point average for the degree) from the undergraduate academic institution must be provided. The cutoff for actual admission changes from year to year and may be higher than the standard set for submitting an application.

Ranking – An official confirmation must also be provided indicating the ranking of the student in their graduating class.

The Department of Computer Science will consider for admission of applicants to the background completion computer science program if they have a bachelor's degree in mathematics, physics or engineering from an institution recognized by the CHE, with a minimum grade point average of 90.
In such cases, admission is conditional, pending completion of background courses required by the academic authority for the master's degree in the department.

Completion of background courses in computer science
Applicants with an undergraduate degree in another discipline, or with a minor in computer science, must complete bachelor's degree courses in computer science. These courses are a precondition for admission to the master's degree as a standard enrolled student. Students must pass these courses with a minimum average grade of 85. Students who do not complete these courses, or who have not obtained their grades **before** applying for the master's degree program in computer science, are likely to be rejected automatically (even if they meet the average grade requirements).

	Course ID	Course title	Description	Semester hours
1	89-110	Introduction to Computer Science	C (programming language)	5
2	89-1200	Data Structures		5
3	89-1111	Introduction to Object-Oriented Programming	Object-oriented design and programming in Java	5
4	89-119	Introduction to Linear Algebra	Linear algebra I	4
5	89-118	Introduction to Calculus I	Infinitesimal calculus I	4
6	89-1195	Discrete Math I + II		6
7	89-220	Algorithms I	a follow-up course to Data Structures	5
8	89-231	Operating Systems	including knowledge of UNIX	5
9	89-1262	General probability		5
10	89-230	Computer Organization	an introduction to computer architecture	5
11	89-2226	Computability and complexity		4

Prerequisites, requirements and electives in the different focus areas

Below is the list of prerequisite courses and required courses for the different focus areas. Details on electives by areas of focus are available in the course catalogue on the Bar-Ilan website.

Students who have taken courses similar to the prerequisites prior to the start of study may request an exemption from the head of the focus area. Course exemptions are under the authorization of the School of Graduate Studies.
The list of required courses and elective courses is subject to change for the 2023-24 academic year.
Be sure to remain up-to-date on the master's degree rules and regulations prior to the opening of the 2023-24 academic year.

	Algorithms and computability	**Communications and security**	**Artificial intelligence**	**No focus area**
Prerequisite courses for area of focus	Prerequisite courses for area of focus 89-322 Algorithms II 89-225 Complexity	No prerequisites	Prerequisite course for area of focus 89-570 Artificial Intelligence	No prerequisites
Required courses for area of focus	Required course: 89-755 Algorithm Analysis	At least 2 required courses must come from the following list: 89-656 Introduction to Cryptography; 89-350 Introduction to Communication Networks; 89-509 Safe Programming; 89-550 Communications Security; 89-657 Safe Calculations Research-based Track A students must take 89-656 Introduction to Cryptography	Required courses: 89-919 Feasible Probabilistic Models in Computer Science 89-950 Advanced Topics in Artificial Intelligence	Students must take three required courses: 89-755 Algorithm Analysis; 89-919 Feasible Probabilistic Models in Computer Science; and, 89-950 Advanced Topics in Artificial Intelligence Electives – any graduate-level course in the computer science department
Elective courses for area of focus	See bulletin	See bulletin	See bulletin	A combination of electives from the other areas

Track A – research-based track

Credit and seminar requirements

26 semester hours (26 semester-based credits) as specified below: 18 semester hours as follows:

- A minimum of 12 semester hours (12 SC) from focus area, including prerequisites and required courses of the focus area. Students must obtain these 18 credits from graduate-level courses offered by the department.

- Two graduate level seminars (each seminar 2 semester hours = 2 semester-based credits, total of 4 SC). At least on from the area of focus.

- Departmental colloquium – guest lecturers from computer science (4 semester hours = 4 semester-based credits). No tuition charges; must obtain a passing grade. Departmental colloquium schedule will be published in the course schedule bulletin.

By advisor approval, other authorized courses from the department may be recognized as prerequisites for the area of focus.

By advisor approval, up to 8 semester hours may be taken in other departments or other universities, if needed for specialization.

Requests are contingent upon School of Graduate Studies approval.

The primary effort of this track is the research focus – identifying a research problem, grappling with it using scientific tools, and publishing its outcomes. A large part of the final grade for the degree (75%) is based on the thesis, and only a small part (25%) on course work.

The department assists students in this track with obtaining scholarships to allow them to focus on their research. Students who work for a limited number of hours may apply for a department scholarship which includes tuition financing and subsistence support. An additional scholarship may be available per decision of the advisor. Application forms are to be submitted at the office. Please note that the schedule for choosing an advisor and submitting the research proposal are different for students who receive a departmental scholarship; specifics will be made available with scholarship approval.

The track consists of the following steps:

Finding an advisor

An advisor should be chosen by the end of the fall semester, and no later than the spring semester of the first year of study.

Students must obtain agreement by a senior department faculty member to serve as their thesis advisor. We recommend identifying potential advisors from among the senior faculty as early as possible, and to discuss suitability and requirements with them; in particular we recommend taking elective courses with advisors being considered.
Research and mentorship take considerable time, for students and for faculty. Students who work (or serve in the army) in parallel with their studies may find it challenging to make time for their research and for finding an advisor willing to guide them under such circumstances. Thus, we recommend making contact with potential advisors before applying.

Details on faculty members and their areas of interest are available on the department website.
Please note that the website lists past research, and thus only indicate a general direction of research interests. We recommend meeting with the advisors as early as possible, even before the start of the first semester or before applying.

Students without an advisor by the end of the first year of study, or who have not submitted their research proposal by the end of the fall semester of the second year, will be transitioned automatically to the non-research Track B.

Submission of research proposal

Research proposals are to be submitted by the end of the spring semester of the first year of study and no later than the end of the fall semester of the second year. Research proposals are to be submitted in accordance with the School of Graduate Studies Rules and Regulations, and the guidelines published periodically.

Thesis presentation

The final thesis exam is held in presentation format by the student before an examining committee composed of department faculty members. The examining committee includes the advisor or advisors, the head of the area of focus (who serves as the examining committee chair), a faculty member from the area of focus and an additional faculty member from a different domain, appointed by the chair of the departmental committee for graduate degrees. During the presentation and following it, the reviewers explore the depth of the student's knowledge and familiarity with the research conducted. Students must send the pdf file containing the thesis to the department office after approval by the advisor, to schedule the defense. **

Thesis submission

***The final version of the thesis is to be submitted together with the advisor's authorization to the central library.

Thesis guidelines

See School of Graduate Studies Rules and Regulations in the introductory chapter.

Final exam for the master's degree

The exam is based on the thesis and its underlying bibliography.

Track B – non-research track

Credit and seminar requirements

44 semester hours of lectures (44 SC) as specified below:

- 36 semester hours as follows:
  A minimum of 16 semester hours (16 SC) from area of focus, including prerequisites and required courses of the focus area.
  Students without an area of focus: at least five required courses from the three focus areas.

(Students may consult with the focus area coordinator about other authorized courses offered in the department and about prerequisite courses for the focus areas offered as part of background completion studies).

Students must obtain these 36 credits from graduate-level courses offered by the department.

- Two graduate level seminars (each seminar 2 semester hours = 2 semester-based credits, total of 4 SC).
- The course "Workshop for Advanced Projects" (4 semester hours = 4 SC).
- With the approval of the chair of advanced degrees, it is possible to study up to 8 semester hours in courses from other departments.

Transitioning from the non-thesis track to the thesis track is conditional upon:

1. Agreement in principle by the chair of the departmental committee for graduate degrees (per availability of advisors in the department).

2. A minimum average grade of 85 (in at least 4 courses) in the first year of study.
   3. Finding a thesis advisor and submitting a thesis proposal.

Students who wish to change tracks must meet all three conditions above, and only once those are met should students submit a **School of Graduate Studies "request form" to the department** along with the thesis proposal**.**

Requirements common to both tracks (Track A and Track B)

Jewish studies

As per general requirements for the master's degree (see introductory chapter).

Language proficiency

English at the master's degree level (details on placement tests, course levels and exemption eligibility criteria – see introductory chapter).

PhD

Admission criteria

1. **Standard track** – for holders of a research-based master's degree in Computer Science from a recognized university, with a minimum thesis grade of 90 and a minimum master's degree grade point average of 85. In exceptional cases, applicants from related disciplines may be admitted, with approval of the department PhD advisor or a research area coordinator.

2. **Direct track** (without a master's degree) **or combined track** (master's degree+PhD) – per Bar-Ilan PhD policy. Admission to the direct track or the combined track requires approval of the department PhD advisor or a research area coordinator.

3. These criteria are in addition to the guidelines specified in the general policy document of Bar-Ilan's PhD committee.

4. Agreement by a faculty member of rank senior lecturer or higher, to serve as advisor.

Curriculum:

1. **Course requirements**: In each semester of PhD study students must accumulate at least 2 semester hours = 2 SC (1 AC) in computer science department courses, up to a maximum of 16 semester hours = 16 SC (8 AC). Courses should be selected in consultation with the advisor. Students in the direct PhD program are required by university policy to complete all master's degree courses in computer

science, and thus are exempt from PhD courses in their first two years. They must begin accumulating at least 2 semester hours = 2 SC (1 AC) in computer science department courses from their third year onward.

2. **Course exemption in lieu of teaching**: A request must be filed each semester. The exemption may be approved only for teaching a course in that same semester (as instructor or teaching assistant), and when considerable effort is required in preparation for teaching, for example when the course is being offered for the first time. Recommendations by the advisor and the course instructor are to be attached to the exemption request form.

3. **Departmental colloquium attendance.**

4. **Submission of detailed research proposal** and approval by the department head followed by approval by the Bar-Ilan PhD committee, within the first year of study.

5. **Submission of a progress report** (approved by the advisor) at the end of each year, to the department and to the Bar-Ilan PhD committee.

Jewish Studies and English as per general requirements for the PhD.

For further details

contact the department by phone at 03-5318866

or via email to masters@cs.biu.ac.il

www.cs.biu.ac.il

The list of faculty members and their areas of specialization

as well as further information on programs may be found on the department website