# Study guide 2WH40 – Bachelor Final project for the bachelor Applied Mathematics

The bachelor final project (BFP) is a literature study or research project on a subject from applied mathematics. It may be a theoretical deepening of a subject from a course or an earlier assignment. It may also concern a new subject. In the bachelor final project, emphasis is on applied mathematical knowledge and on individual work.
Normally, the duration of the project is two quartiles. Just after the start of the project, the student will participate in the training Information Skills Phase 3 (IV002) which is given by the IEC (library).
The bachelor final project is concluded with writing a report, giving a presentation and writing a summary for a general audience (the so-called A4 popular statement) as well as a reflection on the almost completed bachelor Applied Mathematics.

**Scope**; 10 credits, i.e. 280 study hours.

**Entrance requirement**: all first year credits and at least 75 credits of courses belonging to the second and third year must be obtained.

**Choice of project**:
To be able to make a choice for a bachelor project, it is important that the student is aware of the different research programs in the Mathematics department.
Three main research areas (sections) within our department, can be found at https://www.tue.nl/en/our-university/departments/mathematics-and-computer-science/research/research-programs-mathematics/. On this website, also the chairs within each section are listed. On the websites of the chairs, information can be found on the research conducted within the chair (research group).

To get an impression of possible subjects, it is also possible to take a look at some reports on bachelor final projects from the past at the library website https://www.tue.nl/en/our-university/library/library-a-z/. Find a researcher and filter on supervised work, student theses. A list with links to the reports from 2015-2017 can also be found here.
The research groups Applied Analysis, Scientific Computing and Mathematical Image Analysis (CASA) have a number of possible bachelor projects on the website http://www.win.tue.nl/casa/research/intranet/projects/
The research group Combinatorial Optimization also has some project descriptions on their website http://www.win.tue.nl/~jkeijspe/onderwijs/bep/coprojects.html.
For the research groups Probability and Statistics, some generic project descriptions are available through their Canvas 2WH40 information pages.

To be informed on time, register for the course 2WH40 (Bachelor final project) on Osiris student, and on Canvas (pick the variant of the course that corresponds to the quarter in

which you would like to start your project) already at the start of the third year of your bachelor, and carefully read all the information available there.

To find a subject and a supervisor for the bachelor project, the initiative lies with the student. If you are interested in a particular specialization within mathematics, you should join the corresponding `research group' under people in Canvas 2WH40, and approach the BFP-coordinator of that research group with the question whether he/she can match you with a suitable project and supervisor in that group. You can also suggest a particular subject yourself.

The BFP-coordinators are:
CASA: Arris Tijsseling
CASA-Scientific computing: Arris Tijsseling
CASA-Applied Analysis: Jan-Cees van der Meer
CASA-Mathematical Image Analysis: Luc Florack
DM: Aart Blokhuis
DM-Discrete Algebra and Geometry: Aart Blokhuis
DM-Combinatorial Optimization: Judith Keijsper
DM-Coding&Crypto: Tanja Lange
STO:
STO-Statistics:
STO-Stochastic operations research: Marko Boon
STO-Probability theory: Julia Komjathy

Once you have found a supervisor and meet the above entrance requirements, you can start the project.

**Start of the project:** At the start of the final bachelor project, the bachelor coordinator must be informed about your plans. This should be done by completing the quiz `Bachelor final project Information for coordinator' on Canvas 2WH40. In this quiz, you are simply asked to answer the following questions:
Identity number:
Family Name:
First Name:
Initials:
Starting year bachelor Applied Mathematics:
Possible combined bachelor program: (also indicate it here if a BFP in Applied Physics will be combined with a BFP in Applied Mathematics, and mention the supervisor from Applied Physics involved)
(Working) Title Project:
Supervisor:
Research group (of your supervisor):
Starting date project:
Estimated completion date project:

Soon after the start of the project, the student should participate in the training Information Skills Phase 3 (course code IV002) of the IEC (library). You are advised to

register on Osiris Student soon after you have started the project. You will have to register for a specific period in which you want to complete the (online) training. One day before the start of the period you will receive an email from iec.education@tue.nl with further instructions.

In this training, it is convenient if you have available 3 to 5 documents from the literature (articles, books, chapters from books, proceedings or dissertations) in PDF format that are relevant to your bachelor project. The practical knowledge and skills acquired in this training will be directly applicable to the literature research for the project and the proper citing of literature in your final report (make sure you practice referencing in Latex!).

**Finalization and assessment**: The project is concluded with a report, a presentation of about 25 minutes, and subsequently a `defense' of the results (critical questions concerning the presentation and the report).
The report, presentation, defense, and the execution of the entire project are assessed by the supervisor and by a second assessor.

At least one week before the final presentation takes place, the assessment committee for the project must be announced to the exam committee. To this effect, the student together with his/her supervisor should complete the form "AssessmentCommittee2WH40", which can be found in the course 2WH40 on Canvas, and send it to the secretary of the examination committee by email: Examination.Committee.MCS@tue.nl (the secretary of the examination committee will supply the last required signature on this form).
The following rules apply:
- The supervisor is a lecturer, a professor, an associate professor or a full professor in the Mathematics capacity group within the Faculty of Mathematics and Computer Science.
- The assessment committee consists of at least two voting members including the supervisor. The voting members together determine the grade for the bachelor project. The voting members of the evaluation committee are appointed as examiners. A PhD student can be a voting member.
- Advisory members can be included in the committee.

The supervisor determines the grade (scale 0 to 10, in halfs), after consultation with the second assessor. The A4 popular statement and the reflection on the bachelor program are assessed by an appointed lecturer A4 popular/reflection.
The assessment of the project consists of the following aspects: report, presentation and defense of the results, execution of the project. In addition, the summary for a general audience (A4 popular statement) and the reflection assignment should be graded at least `satisfactory'.
- The assessment must be recorded on a prescribed assessment form, which can be found as 'AssessmentForm2WH40' on Canvas 2WH40. The supervisor and the second assessor have to sign part 1 of the assessment form and send it to the student administration by email: CSA.MCS@tue.nl. Either H.J.M. Sterk or J.C.M. Keijsper (Lecturers A4 popular and reflection) has to sign the assessment form part 2 and send it

to the student administration by email. The student signs a statement that his or her final bachelor project has been established in accordance with the TU/e code of conduct for science: also this declaration can be found on Canvas 2WH40.

**Processing of results**: In order to process the results, the fully completed assessment form (this may be sent in two separate parts) should be submitted to the Student Administration (csa.mcs@tue.nl) by the supervisor and the lecturer A4 popular, respectively. A PDF with the final version of the report and a PDF file of the approved A4 popular statement must also be submitted to the Student Administration (csa.mcs@tue.nl) by the student. Together with these, the student sends the signed Declaration Code of Scientific Conduct form to the administration.
The grades cannot be processed by the administration until everything has been submitted and the PDFs have been received. In addition, the professional skill Searching and processing scientific information phase 3 must be achieved (training Information Skills 3, IV002).
The final reports will be made accessible through the library.

**A4 popular statement and Reflection Assignment**: Detailed information about these two components can be found in the 2WH40 Canvas assignment `Reflection on Bachelor Applied Mathematics'. The purpose of the reflection assignment is that the student will gain insight into his/her own development and the steps taken during the bachelor Applied Mathematics and also in how his or her ideas about mathematics and its application have changed since starting the bachelor.
The objective of the A4 popular statement is that the student experiences writing for a larger, mathematically less educated audience. The Word document 'A4 popular statement' gives additional explanation, and when using Word, it is also a useful template for the A4 to be delivered.
A concept of the A4 pop statement should be delivered as a submission to the corresponding assignment on Canvas 2WH40. One of the lecturers A4 popular gives feedback on the concept. Perhaps some improvements may be required before the A4 popular statement is approved (receives a grade VO, satisfactory, or GO, good, on Canvas). Similarly for the reflection assignment.
The writing of the A4 popular statement and the reflection does not have to wait until the bachelor project is completed.

**Professional skills**: The four phase 3 professional skills presenting, writing, reflecting and processing of information are part of the bachelor final project. The skill PRV23 concerns presentation and is assessed at the final presentation of the BFP by the supervisor. The skill PRV33 concerns writing and it is assessed on the basis of the BFP report by the supervisor. The skill PRV43 concerns reflecting, and this is assessed by means of the A4-popular and the reflection assignment by the lecturer A4 popular/reflection. Finally, PRV63 concerns the ability to search for and process scientific information and this skill is assessed by the IEC (library), based on the IEC training Information skills 3 (IV002).

If the completion of the bachelor project / A4-popular is in the summer months, the student should contact all concerned in time in order to make arrangements which agree with absence due to holidays. The student must make sure that all the information needed for the processing of the results is submitted to the Student Administration in time. In time means that the results of the bachelor final project must be registered at least 10 business days prior to the examination meeting in which the student wants to be declared successful for the bachelor's exam.

**Student Research Conference**: the SRC welcomes students who have completed a bachelor's program at a Dutch or Flemish university (of applied sciences).They can submit a paper about their research. A review committee will select the candidates who will be given the opportunity to present their work at the conference. Students from TU/e who are selected to present at the SRC will automatically be nominated for the TU/e Bachelor Research Award. For more information, see http://www.studentresearchconference.nl/

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