Final Bachelor Project – Joint Bachelor Data Science

Planning
The final bachelor project is 10 ECTS (280 hours) and takes place during one semester.
(start in February or September)
Students who want to do an external final Bachelor Project and want to start in February need to submit their proposal **before December 8.**
Preferably; This proposal needs to be accessible for at least 2 students. Working together on the related topics is more useful for a students than working individually. Project supervision will also be done in so-called **circles** than. Supervision in circles aims to encourage students to learn from each other and simultaneously diminishes the supervisor's workload. Within a circle, students review each other's work and provide feedback to each other.

Goal and Requirements
Each student writes an *individual thesis* and is *assessed individually*. The aim of the BEP is that a student shows that, for a perceived data science problem, (s)he is able to *develop and formulate a research question*, and *analyze the problem* making a *justified choice* for methods and techniques from the data science domain, with *great level of independence*.

The assignment needs to be such that that the above stated is possible, and that a set of learning outcomes can be assessed. The following learning outcomes need to be met and assessed:
- Integrate and apply theoretical knowledge and practical skills acquired during the bachelor program Data Science on a research assignment.
- Develop and formulate a research question, including a well-defined description of the scope of the research question.
- Make a research plan under supervision, taking into account the required study load and fixed period, and can organize the activities to execute the research according to plan
- Explore and make use of scientific literature (for this type of research question and business problem).
- Make a justified choice for methods and techniques for data collection and data analysis.
- Work (with limited supervision) independently on a project.
- Reflect on decisions made during the execution of the research assignment.
- Present the results of the project both orally and in writing.

Supervision
Students are supervised during their research by a lecturer who is actively involved in the curriculum of the Bachelor Data Science. Each student will be also assigned to the 2nd assessor from TU/e or TiU.
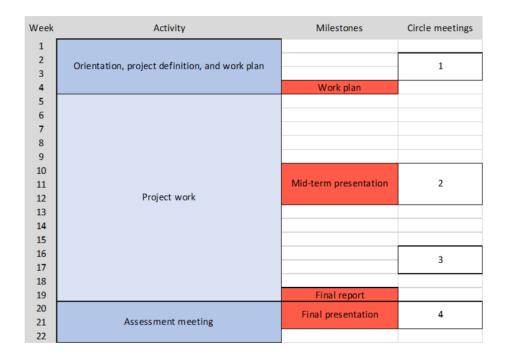
In case the student does the project at an external company or organization, we expect that (s)he will also get a company supervisor who will be responsible for providing input from this company or organization, helping establishing relevant contacts, organizing access to dataset(s) and further facilitating the students' project. While the main burden of the student supervision is with the university, having a dedicated company supervisor will help your organization make the best out of this Final Bachelor project.
Supervision in general costs the supervisor max. 20 hours during one semester.

Below you will get an impression about the deadlines and the required terms for having a meeting.

Week	Activity	Milestones	Circle meetings
1	Orientation, project definition, and work plan		
2	Orientation, project definition, and work plan		1
3	Orientation, project definition, and work plan		
4		Work plan	
5	Project work		
6	Project work		
7	Project work		
8	Project work		
9	Project work		
10	Project work		
11	Project work	Mid-term presentation	2
12	Project work		
13	Project work		
14	Project work		
15	Project work		
16	Project work		3
17	Project work		
18	Project work		
19	Project work	Final report	
20	Assessment meeting	Final presentation	4
21	Assessment meeting		
22	Assessment meeting		

Company Collaboration Requirements

There are two important requirements for a Final Bachelor Project. Firstly, the TU/e must have *access to and retention of* the Final Bachelor Report, so that the report can be assessed by the supervisors. Also, it must also be possible to submit the internship report or final thesis for quality-control purposes to the Examination Committee and/or the review committee (NVAO).
Second, there must be a time limit on the duty of confidentiality, in relation to the Final Bachelor Project. The maximum confidentiality period of two years.

The agreements needed to formalize a Final Bachelor Project at an external organization can be found here (only available for students)

Examples of Data Science Final Bachelor Projects

1. **Improving processes of users within a multi-sided market platform**

In this project there will be investigated how processes within Company X can be improved using techniques from Data Science. Company X is a platform that unites families and nannies within the Netherlands. Their business is to make sure that the nannies are trusted by families. The goal of this project is to get an insight on what factors influence the acceptance of a request by a family and to improve request acceptance ratio.

This will probably be facilitated by changing their matching algorithm on families and nannies.

2. Calculating location-specific headway buffer norms for railway timetabling

Company X and Company Y (the national rail infrastructure manager) use planning norms to design robust and safe train schedules. An example thereof is the headway time of circa 3 minutes between two trains in the same direction on the same track. This headway time is composed of circa 2 minutes of technical minimal headway (may differ locally) and 1 minute of buffer. The buffer norm should prevent minor delays from one train carrying over to other trains, and is fixed to 1 minute on a 'one size fits all' basis.

However, in some situations this buffer might be smaller or rather greater, depending on the punctuality of trains at that location. For example: the Nijmegen – Den Helder and Venlo – Schiphol intercity services use the same track between Utrecht Centraal and Amsterdam Bijlmer with minimal headway in between.

From railway hub Utrecht Centraal, departures are carefully aligned, leading to high punctuality (low variance in passing times) and thus requiring only a small buffer. In the other direction, the trains from Schiphol and Den Helder merge onto the same track at Amsterdam Bijlmer but have already travelled some distance since the last major hub, causing higher variance in passing times and thus requiring a larger buffer.

ProRail has created a dataset of so-called "realization data": registrations of trains passing points of measurement throughout the country, with information on (among others) moment of passage, delay, signal image (was the signal green or yellow when the train passed?) and route (which tracks and points did the train use?). Using these data I aim to find relations in the variance of real headway times. This may be used to determine the buffer norm more accurately, allowing for a more robust timetable which better utilizes the scarce capacity on the Dutch railway network.

Research question
Main research question (RQ): How should the headway buffer norm account for variance in train delays at critical locations in the Dutch railway network?
Sub-questions (SQ

1. *Which locations have the highest and lowest variance (bandwidth) in delays?*
2. *How does the delay bandwidth relate to the bandwidth of real headway times?*
3. *Which variables from the ProRail dataset influence the variance in real headway times?*
4. *Where and how should the headway buffer norm be adapted locally?*

If your company is willing to provide a bachelor project for our Data Science students, please compose a proposal and make sure that the intended learning outcomes can be assessed. Please find the assessment form on our education guide

The student must deliver the project proposal in cooperation with the supervisor from the university before **December 8**
The project proposal should include:
- an introduction to the topic;
- the proposed methodology;
- the proposed research question and, if necessary, some sub-questions;
- a proposed timeline for the BEP;
- solid proof that you have reviewed the checklist (see BEP presentation) and reply positively on all 4 points.

Note that the proposal does not yet have to be definitive; changes can still be made.

Looking forward to a productive collaboration! For any further questions you can an email to n.o.i.v.d.hemel@tue.nl