

# The 02830 Playbook

Jakob Eg Larsen, Andreas Bærentzen  
DTU Compute

The goal of this document is to describe how we run the course *Advanced Project in Digital Media Engineering*. The aim of the course is to hone your skills relevant to project work within the area of Digital Media Engineering. To be more specific, the course objective is

“to develop the student's abilities to carry out a large project in the area of digital media engineering. This involves a literature study, planning, implementation, testing, experiment and the writing of a report in the form of a scientific paper.”

## Rationale behind the course

There is no lack of project courses at DTU, and this course is an amalgamation of two such courses, but what sets it apart is the broad scope of “digital media engineering” as opposed to a focus on any particular topic. In this project course, you can pretty much work on any project that would make a suitable M.Sc. thesis in the Digital Media Engineering M.Sc. programme. However, the lack of specificity does not mean that the course is a wishy washy, untechnical course where we just talk about “stuff”. On the contrary, we expect you to have a very precise and technical goal in mind, and we expect that reaching this goal requires both using your existing competences in digital media engineering as well as expand your technical competencies in several areas.

One way to see 02830 is that this is a course where you get to do project work that is very similar to what you will do in your M.Sc. thesis or later in your professional life. In these scenarios there are colleagues that you need to work with and stakeholders who have a vested interest in your project, so we try to also introduce such elements in the course.

Another important aspect is that we want to help you learn how to plan. Planning is often misunderstood as an activity that takes part before a project begins in earnest and during the bulk of the project, you execute the plan. Now, that is great if you are a factory manager, but in a scientific project where the outcome is not known in advance, planning must be an activity that takes place all the time. You must revise the plan as you learn during the project.

Finally, this course is about communication. In your professional life, it is likely that you will need to convince people about the merits of some undertaking. Unless you are so much of an authority that people consider your ideas beyond questioning, you may need to convince people to come on-board with your proposals. Consequently, the formulation of clear goals and strong motivation for your project is a big part of the course. The motivation is really the set of

arguments for why something is interesting, and your goals is what you hope to achieve. Without knowing these two things, you cannot really do a great project.

At this point, someone might ask what about very exploratory projects. We concede that these can be important, but the aim of the course is not to help you work exploratorily but to help you steer in the direction of a clearly stated goal. Of course, this also means that testing is a rather important aspect of this course.

In the following pages, we will discuss in a bit more detail the sorts of projects that we encourage you to undertake as a student in the course on Advanced Project in Digital Media Engineering and then we will break down the elements of the course.

## Steering a Project

The basic mechanisms for steering a project are the following.

- Motivation - the reasons why the project is a meaningful undertaking.
- Goals - what you hope to achieve.
- Planning - the steps on the way to the goal.

Over the next few subsections, we will try to describe these three mechanisms. Both motivation and goals may change throughout the project, but hopefully they will settle down quickly whereas the plan is always in flux.

## Motivation

This is **not** about your personal motivation. It is about whether anyone, anywhere, at any point in time will **ever** care about your project. If the answer to this question is “no” then you might want to reconsider whether the problem is worthy of your attention. However, people care about a broad range of things. If you plan to look into the technical feasibility of a device that might provide clean water to millions of people, the motivation is rather obvious. If your work is about developing a technique for analysing online interactions that will allow websites to put up only commercials that they want, billions of people might care.

And then at the other end of the spectrum, maybe your work is about developing an algorithm that is extremely clever, but does something nobody wants. A good example of this is the case of developing a system for automatically detecting “portals” i.e. doorways in computer game levels. Often it is of value to know where the portals are, but once a game designer has spent hundreds of hours designing a level, the added effort to mark the portals is tiny, and the motivation for such a project is very small - even if it might be intellectually challenging.

Thus, it is really important to make sure that your project has a good motivation. The motivation is the story you tell in the beginning of the introduction of your report to explain why indeed people should care about your project.

## Goals

It is important to disentangle the motivation from the goals. Let us say that your project is about developing technology for something like a device that can be used in a medical diagnosis or possibly treatment.

As a student in this course, you would never be able to arrive at a product - even a sellable app. Your work might involve hardware and certainly coding, but you are developing a **prototype**, and your goals should reflect that.

In most realistic scenarios, a project will not even allow you to fully test whether the device or app is really feasible. You will however be able to test whether aspects of the idea make sense. Thus, you need to cut the big motivating idea into smaller pieces and select a piece (large or small) that is feasible. Your goal - then - is to work on that piece. In your report, we would also like you to very clearly state your goal. It is also prudent to specify what lies outside of your goal.

You would expect the goal to be constant throughout the project. However, this is rarely the case. Very often people overestimate how big a piece they can handle - or simply do not know and start working from one end. This means that you are now officially at drift in the *project ocean*. In the beginning, this feels fine because you sense you are going in the right direction. However, as time passes it becomes a problem as you realize that either a) your original goal is not feasible or worse b) you are starting to lose the sense of what you need to do because the goal was too vague.

## Planning

It is generally very hard to steer a project where you are doing something that you have not tried before. Most people think that planning is important for the success but have a hard time making plans because the project is about something they have not tried before, and it is almost impossible to decide how much time to spend on activities that you haven't tried. The result of a carefully made plan could be a GANTT diagram that is never followed in any meaningful way and was largely a waste of time.

We opine that planning should be a very dynamic process. To successfully complete any endeavour that takes more than a few minutes, it is necessary to break it down into smaller pieces. In the case of your projects, you should probably break it down into tasks that can be handled in a day or two. However, you cannot say in advance what all those tasks are. The list is also likely to be far more detailed for the initial tasks than the ones that come later.

Thus, your planning document is going to *change all the time*. As you complete a task, it may be obvious that another task is no longer needed. It might also be obvious that you need to do a particular task right now. Thus, planning is something that is going on all the time. It is impossible to make an initial plan and then stick to it. Unless you happen to be a chicken farmer, and your project is about chicken farming - but that is outside the scope of the course and this document.

## Prioritizing tasks

In many cases, there is an element of choice. When you sit down to work, you could do different things, so how should you order tasks that are independent?

Arguably, the hard tasks are important to close first - but only if they are essential to the project. Hard tasks that are not essential are likely to never be completed, and it is foolish to attack them first. Hard tasks that are essential clearly need to be handled straight away. Thus it is paramount that you identify what is the most essential and hard problem and work on that problem first. If we call you at any point during the course we want you to be able to tell us what the most essential and hard problem is and tell us that is the one you are working on right now.

When it comes to easier tasks these should be postponed a bit until you can see the project is coming together. The non-essential easy tasks also need to be dealt with before the non-essential hard tasks since an easy task is more likely to pay off.

To sum that up: you have a bunch of tasks and you can order them according to how hard they are (risk) and according to how essential they are (gain). Tasks that have very high gain need to be handled early even if they are risky. Tasks with lower gain should be dealt with in order from least to most risky.

Now, it would be tempting to make a formula and use that to try to automate the task selection. However, that would only be meaningful if you were able to gauge the risk and gain of each task in a precise and quantitative way. Probably this estimation is really rather hard and a lot is left to your human judgement in any case. For this reason, formalizing the process seems to be useless, but thinking carefully about prioritization is not.

## Testing

Testing is crucial because it is through tests that you document the degree to which your goals have been reached. It can actually be very useful to think in terms of testing once you have established the goal of the project. The result of the test should be able to determine if you have reached your goal or not, or at least the level of goal fulfillment. So *even before* you start the design or implementation activities in the project you should think about testing. If you already at this point find it too difficult to describe tests that can determine if you have fulfilled the goal,

then you might have to rethink how you have phrased the goal. In that case you must rephrase the goal and redesign the test so that it will enable you to establish if you have reached the goal or not.

There is no direct relationship between how well you reached your goals and whether you get a high grade, but failure to document your results make it very difficult to understand whether your work was worthwhile. If the goals were not reached and this is clear from the testing and also you analyze why your results are negative, the report can still be excellent and fulfill all learning objectives. But only if you carefully document what you did.

However, if you did something that works really well (you think) but it is impossible to tell from your testing, this is likely to put your examiner in a foul mood. Essentially, it means that you are asking the examiner (or reader generally) to believe that you got great results without any tangible proof.

In a sense, testing serves the same purpose as evidence in a court of law. You would not expect the jury to believe an accusation if there is simply no evidence. In the same way, you cannot expect an examiner to believe that your results are good if you do not demonstrate them through testing.

But what sorts of tests should you do? From a practical point of view, there are many ways to test, but the tests should allow you to conclude whether the goals you have set were actually met. Probably your goal is related to the use of a particular method to solve a particular problem and probably it is quantifiable how well that goal was reached – how well it solves the problem. Thus, your tests should aim at quantifying how well the method works.

Going further, it is great if you vary the input data and test also subtle variations of the method or isolate sub-components and test them individually. In other words, the more you can use testing to drive a deeper understanding of what you have done, the better.

Although we are at a technical university with an emphasis on the technical sciences, we at the Technical University of Denmark always consider that technology in the context of “technology for humans” – the humans that are going to benefit from the technology. It is about quality of life and technology creating value for society and for individual humans. It is not about technology for the sake of technology itself. Thus in terms of testing it is worth considering the human that is the “user” of the technology. Can you directly test the value that is being created for that human user? Can you test to what level the human user can actually use the solution? That is, the usability of the system?

# Elements of the course

Course 02830 is a bit unusual in that we do not teach you a specific curriculum. Instead, we ask that you work on projects. Thereby you will train previously acquired technical skills, and, importantly, you also train work method. While your projects are going to be very different, we believe that you will all benefit from the following activities which form the recurring elements of the course.

## Teacher Consultation

Throughout the 13 week period, the two teachers will act as project supervisors and be available every Wednesday for consultation. Often (but not always) both of us. Our role is often to provide technical guidance, but even more importantly, we try to understand the current state of your project and help you plan.

## Presentations

There will be a number of presentations throughout the course given by the teachers and also guests. The invited presenters in the course will typically talk about topics including project management, writing articles (or executive summaries) and giving presentations. In addition we usually invite have a couple of presenters from industry to give examples of projects and work methods from industry.

While you might not see the immediate benefit from these presentations for the project you are doing in the course, remember that these presentations are also meant to help prepare you for carrying out your master's thesis project, as well as for your work in the future.

## Student presentations

All students are asked to give presentations at certain points during the course. These presentation have very specific themes. Initially, they will be related to motivation and goals, later they will be about results.

## Peer-to-peer discussions

Discussions with other students is a very important part of the course. In many cases, we are not our own best critics. You may believe you have a good idea for a project, but if it is impossible to convince your peers that the motivation is compelling or the goals feasible, it might be good to rethink these two core elements.

We use peer discussions early on in the course to help you shape your project ideas and make the goals precise. Later on, your fellow students will also help you do a pre-mortem of your project. A pre-mortem is a technique for risk assessment where you try to think through what might go wrong

## Test stuff on your peers

All engineering projects require some sort of testing, and all projects in Digital Media Engineering should be beneficial to people and, consequently, human testers are nearly always needed for projects in this course. Unfortunately, finding a group of test subjects can be a challenge. For this reason, we ask that students help each other out with testing and set aside time during several of the sessions for this purpose.

## The report and passing the course

At the end of the semester –one week after the last lecture– is the deadline for handing in the report documenting the work you have done in the project. The report is a scientific paper with a limited number of pages. This is an exercise in writing a short and concise “story” about the work that you have carried out. It can be challenging to put all the work that has been carried out into only a limited number of pages in a paper. However, this is an extremely good exercise as this is something you will be required to do throughout your career. Whether that will be putting things into scientific writing or summarizing key project findings for a decision maker in a large organization. Also in terms of preparing you for writing a master’s thesis it’s important to be able to phrase your findings in a short and concise way.

The project and report will be assessed based on the learning objectives for the course. So make sure that you carefully study the course learning objectives.

## Learning objectives

A student who has met the objectives of the course will be able to:

- Analyze a technical problem and extract a concrete goal.
- Collect information about a problem domain.
- Describe the most recent methods in a concrete area of digital media technologies.
- Select suitable methods for a given problem.
- Describe scenarios to derive requirements for a solution.
- Construct a design based on requirements.
- Plan a project, carrying out risk analysis and time management.
- Deal with a larger amount of content and/or source code.
- Carry out a larger practical task in digital media.
- Test whether a given goal has been reached.
- Prepare a report in the form of a scientific paper.

# Course plan

This is the overall plan for the 13 week duration of the course. The first week we start out with an introduction to the course and presentations from external stakeholders. During the course there will a handful of lectures. Final projects are due in week 14, that is, at noon Wednesday after in the week after the last lecture. During the course activities include student group presentations, student group peer-to-peer discussions, feedback, and testing. The lectures/teachers will act as project supervisors will be available each week for consultations with the groups.

Week	Supervisor consultations	Activities (lectures, group presentations, peer-to-peer discussions)
1	X	Introduction and presentations from external stakeholders Peer-to-peer discussion of project ideas and motivation
2	X	<b>Group presentations:</b> Project idea and motivation Peer-to-peer discussion of motivation, goals and testing
3	X	<b>Group presentations:</b> Project idea and motivation Presentation on test methods
4	X	Peer-to-peer discussions of testing
5	X	<b>Group presentations:</b> Goals and testing Peer-to-peer discussion of pre-mortem
6	X	<b>Group presentations:</b> Goals and testing Peer-to-peer discussion of pre-mortem
7	X	Peer-to-peer testing
8	X	Peer-to-peer testing
9	X	<b>Group presentations:</b> Preliminary results Peer-to-peer discussions of testing
10	X	<b>Group presentations:</b> Preliminary results Peer-to-peer testing
11	X	Peer-to-peer testing
12	X	Peer-to-peer testing
13	X	<b>Final group presentations (all groups)</b>
14		Hand in project