Fab Academy 2016 Assignments and Assessment

During Fab Academy, you will learn how to envision, prototype and document your ideas through many hours of hands-on experience with digital fabrication tools. This document outlines:

- the assignments (what you'll do),
- what we want you to learn each week (why you're doing it)
- the base-line evidence/proof/things you need to show what you've learnt each week (what you did and how you did it).

As you work, check the information for each assignment in this document. Advise your local instructor when you've completed assignments so they include your work in their weekly round of assessment.

General essentials:

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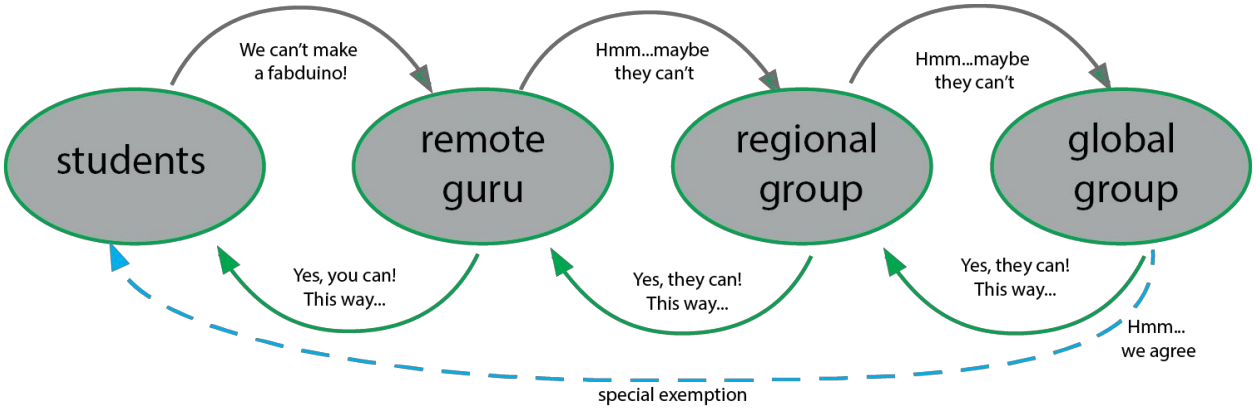
1. All design files and code must be present in the archive and in the original editable format (antimony, solidworks, eagle, CAD, etc).
2. The external hosting policy for large files will be discussed during class.
3. Minor changes will be made to this document during Fab Academy, but changes to assessment requirements will only be made to future assignments, not completed assignments.
4. Acknowledge work done by others.
5. Take photos, notes and screenshots as you work. Use these to explain and describe what you do. A 'hero shot' is the best photo showing your finished project.
6. All weekly modules must be completed before you are considered for Final Evaluation.
7. Follow the Commercial Board Policy
8. Final project must meet basic requirements.

Commercial Board Policy

Fab Academy is an experience where you can focus on developing your ideas and skills in a unique, hands-on way. Developing custom boards and building on previously Fabbed boards is part of this valuable process. Rather than using commercial boards (arduinos etc) for your final project, you will create your own personal fabduino-type board, by fabbing or modifying one of the existing designs available. If you make it early in the programme, you can troubleshoot and adjust before time becomes tight.
If there is no way you can build your own fabduino, you must speak with your remote guru about this. Please ensure that you actively seek to solve this before it affects your ability to participate in Fab Academy.

Commercial Board Exemption Process:



Using commercial boards can seem simpler in the very short term, but in the medium - long term, custom boards are more flexible and effective as development tools.

Acceptable use of Commercial Boards

Prefabricated Arduinos can be used only with networked, student-designed shields or connector boards.

Single board computers: Raspberry Pi, Beaglebone etc

They are super cheap computers capable of running full operating systems, like Linux and (recently) Windows. These can be used as a substitute for your desktop/laptop.

PRINCIPLES AND PRACTICES, PROJECT MANAGEMENT
Assignment:
Build a personal site describing you and your final project.
Plan and sketch a potential semester project and add it to your website.
Upload it to the class archive.

Learning outcomes:

- Explore and use website development tools
- Formulate a final project proposal
- Identify version control protocols

Have you:

- ❏ made a website and described how you did it
- ❏ introduced yourself
- ❏ made a sketch of your final project
- ❏ pushed to the class archive
- ❏ documented steps for uploading files to archive

COMPUTER-AIDED DESIGN
Model (draw, render, animate, simulate, ...) a possible final project, and post it on your class page with original 2D and 3D files.

Learning outcomes:

- Evaluate and select 2D and 3D software
- Demonstrate and describe processes used in modelling with 2D and 3D software

Have you:

- ❏ Modelled your proposed final project in 2D and 3D software
- ❏ Shown how you did it with words/images/screenshots
- ❏ Included your design files

COMPUTER-CONTROLLED CUTTING
Design and make a corrugated cardboard press-fit construction kit

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Learning outcomes:

- Demonstrate and describe 2D modelling processes
- Identify and explain processes involved in using the this machine.
- Develop, evaluate and construct the final prototype

Have you:

- ❏ Explained how you drew your files
- ❏ Shown how you made your press-fit kit
- ❏ Eaten fresh vegetables today
- ❏ Included your design files and photos of your finished project

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Vinyl Cutting

There is no specific project that is focussed on this very useful tool. There are a range of ways you might utilise it throughout the programme, or your local instructor may set a specific project. You might make:

- stickers
- flexible circuit boards
- a textured surface/relief pattern
- screenprint resists/stencils

Ensure that you have used it in some way during this time and met the objectives below.

Learning outcomes:

- Identify and explain processes involved in using this machine.
- Design and create the final object

Have you:

- ❏ Explained how you drew your files
- ❏ Shown how you made your vinyl project
- ❏ Included your design files and photos of your finished project

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ELECTRONICS PRODUCTION

Make the Fab (tiny)ISP in-circuit programmer.

Learning outcomes:

- Describe the process of production
- Demonstrate correct workflows and identify areas for improvement if required

Have you:

- ❏ Shown how you made the board
- ❏ Explained any problems and how you fixed them
- ❏ Included a ‘hero shot’ of your board

3D SCANNING AND PRINTING
Test the design rules for your printer(s) (group project)
Design and 3D print an object (small, few cm) that could not be made subtractively
3D scan an object (and optionally print it)

Learning outcomes:

- Identify the advantages and limitations of 3D printing and scanning technology
- Apply design methods and production processes to show your understanding.

Have you:

- ❏ Described what you learned by testing the 3D printers
- ❏ Shown how you designed/made your object and explained why it could not be made subtractively
- ❏ Scanned an object
- ❏ Outlined problems and how you fixed them
- ❏ Included your design files and 'hero shot' photos of the scan and the final object

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ELECTRONICS DESIGN (WEEK 1 OF 2)
Redraw the echo hello-world board and add a button and LED with current-limiting resistor or design your own.

Learning outcomes:

- Select and use software for circuit board design
- Demonstrate workflows used in circuit board design

Have you:

- ❏ Shown your process using words/images/screenshots
- ❏ Explained problems and how you fixed them
- ❏ Done fabbercise today
- ❏ Included original design files (Eagle, KiCad, Inkscape - whatever)

COMPUTER-CONTROLLED MACHINING
Make something big on a CNC machine.

Learning outcomes:

- Document the process of design and production to demonstrate correct workflows and identify areas for improvement if needed

Have you:

- ❏ Explained how you made your files for machining

- ❏ Shown how you made something BIG (setting up the machine, testing joints etc)
- ❏ Described problems and how you fixed them
- ❏ Included your design files and 'hero shot' photos of final object

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EMBEDDED PROGRAMING (WEEK 2 OF 2)
Read a microcontroller data sheet
Program your board to do something, with as many different programming languages and programming environments as possible

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Learning outcomes:

- Identify relevant information in a microcontroller data sheet
- Implement programming protocols

Have you:

- ❏ Documented what you learned from reading a microcontroller datasheet.
  What questions do you have? What would you like to learn more about?
- ❏ Programmed your board
- ❏ Described the programming process/es you used
- ❏ Included your code

MECHANICAL AND MACHINE DESIGN
Make a machine, including the end effector, build the passive parts and operate it manually. Automate your machine. Document the group project and your individual contribution.

Learning outcomes:

- Work and communicate effectively in a team and independently
- Design, plan and build a system
- Analyse and solve technical problems
- Recognise opportunities for improvements in the design

Have you:

- ❏ Explained your individual contribution to this project on your own website

On the group page, has your group:

- ❏ Shown how your team planned and executed the project
- ❏ Described problems and how the team solved them
- ❏ Listed future development opportunities for this project

- ❏ Included your design files, ‘hero shot’ photos of the machine and a short video of it operating

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The second half of the Fab Academy programme is designed to build on the previous weeks. You will be synthesising information and implementing skills that you were introduced to in the first half of the programme and encouraged to integrate these into your final project proposal.

INPUT DEVICES

Measure something: add a sensor to a microcontroller board that you have designed and read it.

Learning outcomes:

- Demonstrate workflows used in circuit board design and fabrication
- Implement and interpret programming protocols

Have you:

- ❏ Described your design and fabrication process using words/images/screenshots.
- ❏ Explained the programming process/es you used and how the microcontroller datasheet helped you.
- ❏ Explained problems and how you fixed them
- ❏ Included original design files and code

3D MOULDING AND CASTING

Design a 3D mould, machine it, and cast parts from it.

Learning outcomes:

- Design appropriate objects within the limitations of 3 axis machining
- Demonstrate workflows used in mould design, construction and casting

Have you:

- ❏ Explained how you made your files for machining
- ❏ Shown how you made your mould and cast the parts
- ❏ Been surprised today
- ❏ Described problems and how you fixed them
- ❏ Included your design files and ‘hero shot’ photos of the mould and the final object

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OUTPUT DEVICES

Add an output device to a microcontroller board you've designed and programme it to do something

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Learning outcomes:

- Demonstrate workflows used in circuit board design and fabrication
- Implement and interpret programming protocols

Have you:

- ❏ Described your design and fabrication process using words/images/screenshots.
- ❏ Explained the programming process/es you used and how the microcontroller datasheet helped you.
- ❏ Outlined problems and how you fixed them
- ❏ Included original design files and code

COMPOSITES

Design and make a 3D mould (~ft^2 /300mm^2), and produce a fibre composite part in it

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Learning outcomes:

- Recognise the benefits and limitations of 3 axis machining
- Demonstrate workflows used in mould design and construction
- Select and apply suitable materials and processes to create a composite part.

Have you:

- ❏ Shown how you made your mould and created the composite
- ❏ Described problems and how you fixed them
- ❏ Included your design files and ‘hero shot’ photos of the mould and the final part

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EMBEDDED NETWORKING AND COMMUNICATIONS

Design and build a wired &/or wireless network connecting at least two processors

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Learning outcomes:

- Demonstrate workflows used in network design and construction
- Implement and interpret networking protocols

Have you:

- ❏ Described your design and fabrication process using words/images/screenshots.
- ❏ Explained the programming process/es you used.
- ❏ Outlined problems and how you fixed them

- ❏ Included original design files and code

INTERFACE AND APPLICATION PROGRAMMING
Write an application that interfaces with an input &/or output device that you made

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Learning outcomes:

- Interpret and implement programming protocols

Have you:

- ❏ Described your process using words/images/screenshots.
- ❏ Explained the protocols you used
- ❏ Had a fun time
- ❏ Outlined problems and how you fixed them
- ❏ Included original code

INVENTION, INTELLECTUAL PROPERTY, AND BUSINESS MODELS
Create and document a license for your final project. Develop a plan for dissemination of your final project

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Learning outcomes:

- Recognise the range of licenses available
- Formulate future opportunities

Have you:

- ❏ Summarised two kinds of licences and explained why you chose one.
- ❏ Dreamed of possibilities and described how to make them probabilities

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APPLICATIONS AND IMPLICATIONS
Propose a final project that integrates a range of units covered. Projects can be separate or joint, but need to show individual mastery of all of the skills. Where possible, you should make rather than buy the parts of your project.

Learning outcomes:

- Define the scope of a project
- Develop a project plan

Think of your project plan as an ‘installation and implementation guide’ for the future.

How will others be able to make your project by reading your documentation?

Have you answered these questions:

- ❑ what will it do?
- ❑ who has done what beforehand?
- ❑ what materials and components will be required?
- ❑ where will they come from?
- ❑ how much will it cost?
- ❑ what parts and systems will be made?
- ❑ what processes will be used?
- ❑ what tasks need to be completed?
- ❑ what questions need to be answered?
- ❑ what is the schedule?
- ❑ how will it be evaluated?

PROJECT DEVELOPMENT

Complete your final project. Track and document your progress. Create a final project slide in the archive according to the specifications provided.

Learning outcomes:

- Evaluate project plan
- Apply time management techniques
- Summarise and communicate the essence of a project

Have you answered these questions:

- ❑ what is the deadline? How much time do I have left?
- ❑ what tasks have been completed, and what tasks remain?
- ❑ how will I complete the remaining tasks in time?
- ❑ what has worked?
- ❑ what hasn't?
- ❑ what questions still need to be resolved?
- ❑ what have you learned?

Have you

- ❑ Made your slide