UAlberta Engineering Plan Visualizer Tutorial

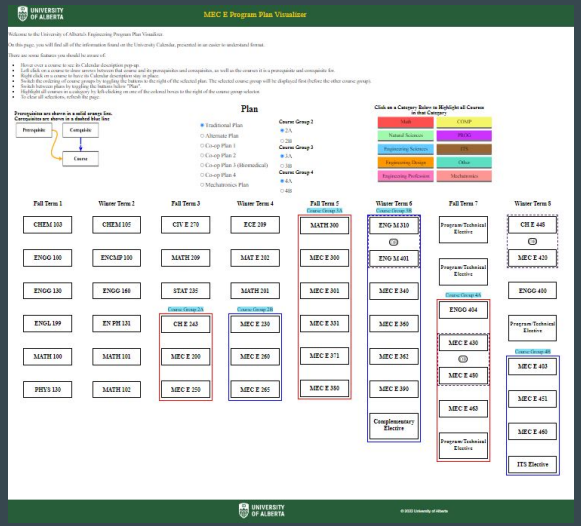
By: Zachary Schmidt, Jason Kim, Moaz Abdelmonem

Developers

All materials discussed in this tutorial were developed by Jason Kim, Moaz Abdelmonem, and Zachary Schmidt under the supervision of Dr. David Nobes in the Summer of 2022 at the University of Alberta.

Purpose

The goal of this presentation is to provide a step-by-step explanation of how to generate the Engineering Plan Visualizer webpage. This webpage is meant to lay out the sequencing of courses for a specific engineering discipline in a format that is easy to understand.



Complete Mechanical Engineering Program Plan Visualizer

Background

- The Program Visualizer is a program written in Python that generates an interactive webpage displaying the program sequencing of a specific Engineering discipline.
- It can either take the form of a script (*main.py*), which requires Python 3.6 or higher to run, or a portable executable (*programVisualizer.exe),* which does not require Python. In the current state of the program, the executable can only run on Windows 64-bit machines.
- The source code and more information about the program can be found here: https://github.com/jaskim9824/Program-Visualizer

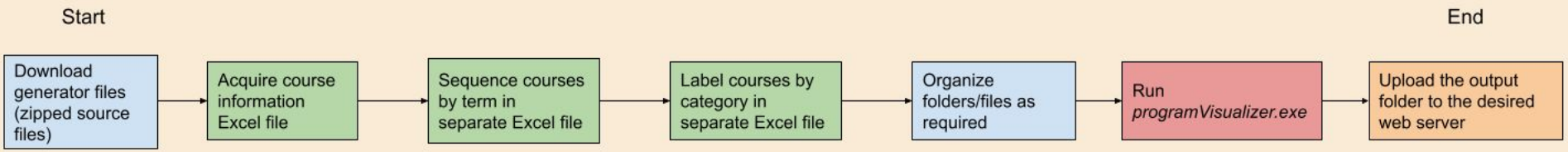
Required Files

To begin, you will need three Excel files that the program uses to generate the website. These include:

- An Excel file that contains the course information; can be formed from Beartracks
- An Excel file that specifies the sequencing of courses within the discipline. This must be constructed by the user
- An Excel file that specifies the colour coding of the courses according to certain user defined categories

The naming and location of these files are not relevant, however, the formatting is of utmost importance, which will be covered in the following slides.

Tasks Outline

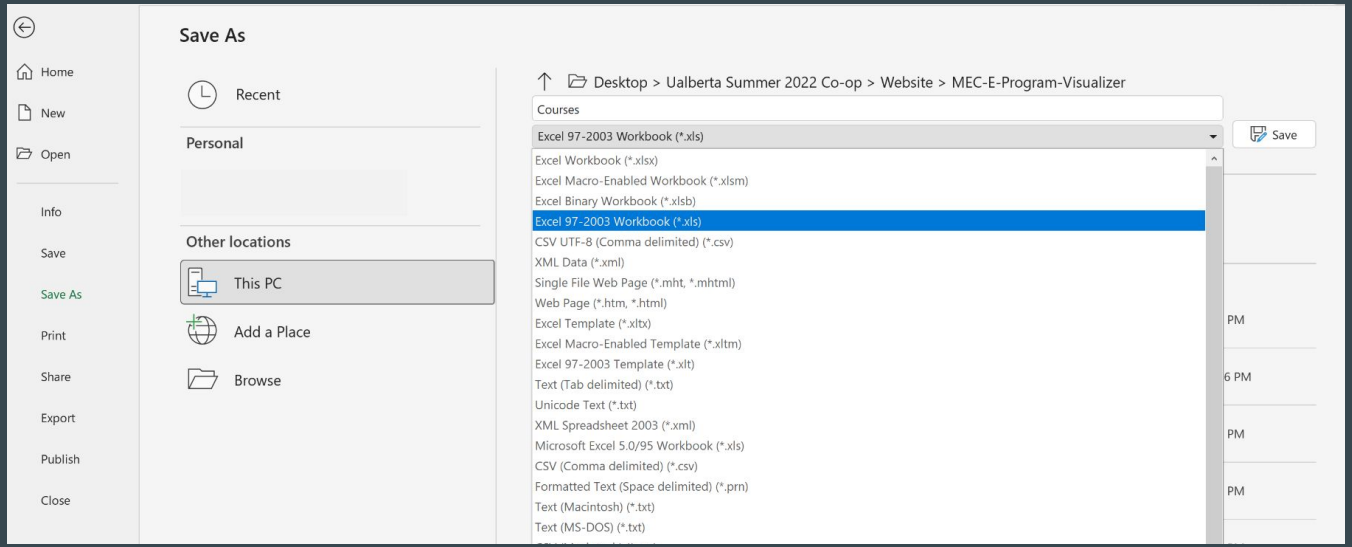


Outline of the process to generate the webpage. First, download the .zip file containing the source files (should contain *programVisualizer.exe* along with some folders). Then, acquire/create the Excel files that provide course info, sequencing info, and category info. Then, organize the files and folders as specified later in this tutorial. Finally, run the executable *programVisualizer.exe* and the webpage should be generated in the *output* folder.

Excel File Format

All Excel files must be saved in the .xls format and NOT in the standard .xlsx format.

To save an Excel spreadsheet as a .xls file, enter the save menu, navigate to “save as” and choose the file format as Excel 97-2003 Workbook (*.xls)



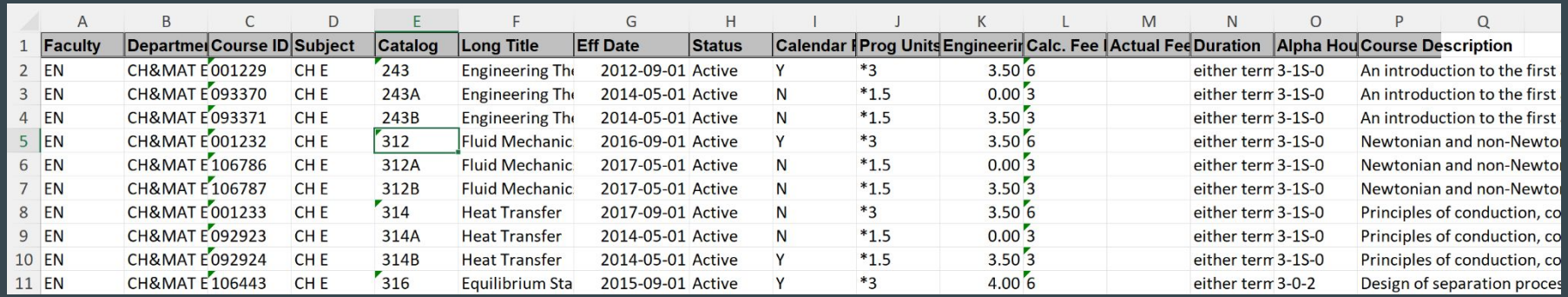
Saving an Excel spreadsheet as a .xls file

Course Excel File Formatting

- The course Excel file provides the information for each individual course on the webpage
- Row 1 of the Excel file must have 16 headers/columns. The columns from left to right should be: Faculty, Department Course ID, Subject, Catalog, Long Title, Eff Date, Status, Calendar Print, Prog Units, Engineering Units, Calc. Fee Index, Actual Fee Index, Duration, Alpha Hours, Course Description
- There should be only one sheet in this Excel file (name is irrelevant) with every course that will be placed on the webpage and any courses that are pre/corequisites for any course on the page

Course Excel File Example

Below is an example of the first few rows of the course Excel file. Not every column has to be filled in. For example, Faculty, Department, Course ID, Eff Date, Status, Calendar Print, Prog. Units, and Actual Fee index are not used and thus can be left blank if such information is unknown



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Faculty	Departmer	Course ID	Subject	Catalog	Long Title	Eff Date	Status	Calendar F	Prog Units	Engineerir	Calc. Fee I	Actual Fee	Duration	Alpha Hou	Course Description	
2	EN	CH&MAT E	001229	CH E	243	Engineering The	2012-09-01	Active	Y	*3	3.50	6		either term	3-1S-0	An introduction to the first	
3	EN	CH&MAT E	093370	CH E	243A	Engineering The	2014-05-01	Active	N	*1.5	0.00	3		either term	3-1S-0	An introduction to the first	
4	EN	CH&MAT E	093371	CH E	243B	Engineering The	2014-05-01	Active	N	*1.5	3.50	3		either term	3-1S-0	An introduction to the first	
5	EN	CH&MAT E	001232	CH E	312	Fluid Mechanic	2016-09-01	Active	Y	*3	3.50	6		either term	3-1S-0	Newtonian and non-Newto	
6	EN	CH&MAT E	106786	CH E	312A	Fluid Mechanic	2017-05-01	Active	N	*1.5	0.00	3		either term	3-1S-0	Newtonian and non-Newto	
7	EN	CH&MAT E	106787	CH E	312B	Fluid Mechanic	2017-05-01	Active	N	*1.5	3.50	3		either term	3-1S-0	Newtonian and non-Newto	
8	EN	CH&MAT E	001233	CH E	314	Heat Transfer	2017-09-01	Active	N	*3	3.50	6		either term	3-1S-0	Principles of conduction, co	
9	EN	CH&MAT E	092923	CH E	314A	Heat Transfer	2014-05-01	Active	N	*1.5	0.00	3		either term	3-1S-0	Principles of conduction, co	
10	EN	CH&MAT E	092924	CH E	314B	Heat Transfer	2014-05-01	Active	Y	*1.5	3.50	3		either term	3-1S-0	Principles of conduction, co	
11	EN	CH&MAT E	106443	CH E	316	Equilibrium Sta	2015-09-01	Active	Y	*3	4.00	6		either term	3-0-2	Design of separation proces	

Sequencing Excel File Formatting (1/4)

- The sequencing Excel file provides the order in which courses are to be taken in each plan
- Each sheet on the spreadsheet should represent a plan. The name of the sheet will be shown as the radio button for that plan
- On every sheet, the very top row (row 1) should contain the respective names of the terms, and the cells below that should be the abbreviated course name for the courses taken in that term
    - For electives use:
        - PROG for a program/technical elective
        - ITS for an ITS elective
        - COMP for a complementary studies elective

Sequencing Excel File Formatting (2/4)

- Certain plans have the option for different “course groups”, which is essentially the option to interchange which term you take a certain two grouping of courses
  - The grouping of courses are labelled names in the form <digit><letter>
  - For example, a plan may have it so you can either take a set of courses called 2A in Term 3 and a set of courses called 2B in Term 4, or take the courses in Group 2B in Term 3 and the courses in 2A in Term 4.
  - A plan can have multiple of these course groups. For example, a plan called Plan A can have the option to either take Group 2A in Term 3 and Group 2B in Term 4, or take Group 2B in Term 3 and Group 2A in Term 4, and the option take Group 3A in Term 5 and Group 3B in Term 6, or Group 3B in Term 5 and Group 3A in Term 6
  - These options are independent of each other, so the above example has four possible variants of the plan’s sequence. 2A 2B 3A 3B, 2A 2B 3B 3A, 2B 2A 3A 3B, and 2B 2A 3B 3A.

Sequencing Excel File Formatting (3/4)

- To implement these “course groups”, treat each variant as its own “plan” by forming a new sheet for it
  - In these new sheet, ensure the ordering of courses in the sheet matches the ordering of course in the variant
- Name the sheet <plan name> {<name of course groups>}
  - The plan name should not contain { or }, as those are special characters used in the processing of course groups
  - Ensure that the plan name between the variants is EXACTLY the same, take into account capitalization, whitespace and special characters!
  - The course groups names should be the names of the groups taken first in each of the possible choices, and each possible choice should be space separated from each other
  - Following the example mentioned in the previous slide, you should name the sheets Plan A {2A 3A}, Plan A {2A 3B}, Plan A {2B 3A}, Plan A {2B 3B}.
- The sheets of the variants of a certain plan must be adjacent to each other

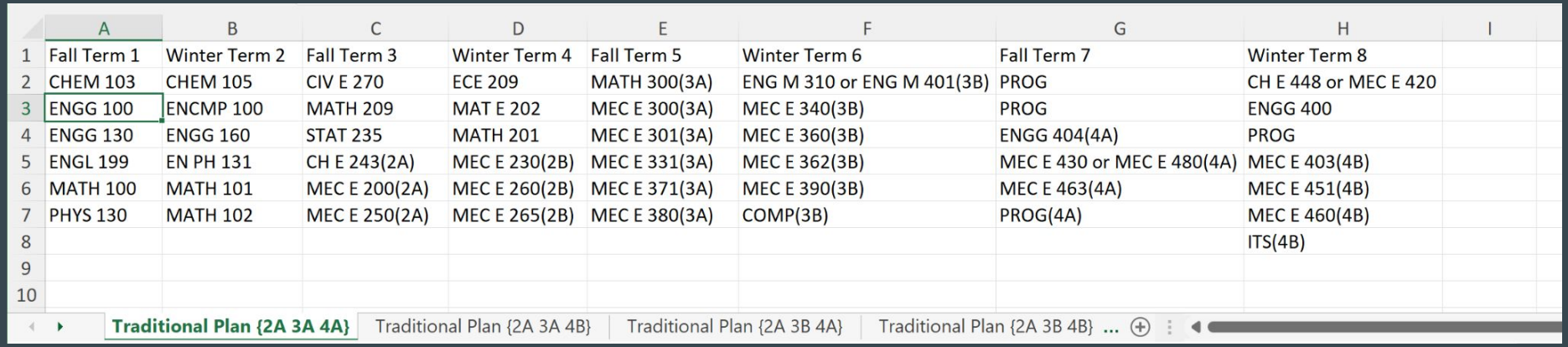
Sequencing Excel File Formatting (4/4)

- If there are two or more options for a certain course, enter the abbreviated course name with the word “or” between them (eg: “ENG M 310 or ENG M 401”)

- If a course belongs to a course group, write the regular abbreviated course name but then end the entry with the course group closed in parentheses.
  eg: “MATH 300(2A)”, “MEC E 250(4B)”, “ENG M 310 or ENG M 401(3A)”

- The courses in a course group must be the last entries in that column (i.e. there shouldn’t be any courses below a course group)

Sequencing Excel File Example



	A	B	C	D	E	F	G	H	I
1	Fall Term 1	Winter Term 2	Fall Term 3	Winter Term 4	Fall Term 5	Winter Term 6	Fall Term 7	Winter Term 8	
2	CHEM 103	CHEM 105	CIV E 270	ECE 209	MATH 300(3A)	ENG M 310 or ENG M 401(3B)	PROG	CH E 448 or MEC E 420	
3	ENGG 100	ENCMP 100	MATH 209	MAT E 202	MEC E 300(3A)	MEC E 340(3B)	PROG	ENGG 400	
4	ENGG 130	ENGG 160	STAT 235	MATH 201	MEC E 301(3A)	MEC E 360(3B)	ENGG 404(4A)	PROG	
5	ENGL 199	EN PH 131	CH E 243(2A)	MEC E 230(2B)	MEC E 331(3A)	MEC E 362(3B)	MEC E 430 or MEC E 480(4A)	MEC E 403(4B)	
6	MATH 100	MATH 101	MEC E 200(2A)	MEC E 260(2B)	MEC E 371(3A)	MEC E 390(3B)	MEC E 463(4A)	MEC E 451(4B)	
7	PHYS 130	MATH 102	MEC E 250(2A)	MEC E 265(2B)	MEC E 380(3A)	COMP(3B)	PROG(4A)	MEC E 460(4B)	
8								ITS(4B)	
9									
10									

Traditional Plan {2A 3A 4A} | Traditional Plan {2A 3A 4B} | Traditional Plan {2A 3B 4A} | Traditional Plan {2A 3B 4B} ...

An example of the sequencing Excel file. Notice how the different permutations for course groups are arranged and formatted as the sheet names. Notice how if there are two options for a course (MEC E 430 or MEC E 480(4A)) there is simply the word “or” between the course names. Notice that course groups are the last entries in that column and that courses in a course group end with the course group label in parentheses.

Course Categories Excel File Formatting

- The cells along the first row (row 1) of this Excel file will act as the category names. Therefore, in the first row, enter the category names (Math, Natural Sciences, Engineering Design, etc.)
- The cells along the second row are reserved for color coding of categories. In the second row, enter the HEXADECIMAL color code you wish for this category. This is the color that highlighted course boxes appear as. You can find a hex color picker at: https://htmlcolorcodes.com/color-picker/
- In the proceeding cells under each category enter the courses that are part of this category. Ensure that the course name is identical to the Course Excel file (eg: “MATH 100”, “ENG M 310”, etc.)
- Only one sheet is required. The name of this sheet is irrelevant
- Each cell should be the name of one course. Do not include “A” or “B” for course groups
- For Electives, simply enter the category name as:
    - PROG for a program/technical elective
    - ITS for an ITS elective
    - COMP for a complementary studies elective

Course Categories Excel File Example

	A	B	C	D	E	F	G	H	I	J
1	Math	Natural Sciences	Engineering Sciences	Engineering Design	Engineering Profession	COMP	PROG	ITS	Other	Mechatronics
2	ff5050	a2fab0	66ccff	ff9900	ff78c0	f5f569	cc33ff	996633	5ce0c4	ff9696
3	MATH 100	CHEM 103	CH E 243	ENGG 160	ENGG 100				ENG M 310	MCTR 202
4	MATH 102	CHEM 105	CIV E 270	MEC E 260	ENGG 299				ENG M 401	MCTR 200
5	MATH 101	PHYS 130	MEC E 250	MEC E 265	ENGG 400				ENGL 199	MCTR 274
6	MATH 209	ENGG 130	MAT E 202	MEC E 360	ENGG 404				PHIL 386	MCTR 374
7	MATH 201	EN PH 131	ECE 209	MEC E 362	MEC E 200					MCTR 300
8	MATH 300	ENCMP 100	MEC E 370	MEC E 460	WKEXP 901					MCTR 332
9	MATH 390	BME 320	MEC E 330	MEC E 461	WKEXP 902					MCTR 365
10	STAT 235	BME 321	MEC E 301		WKEXP 903					MCTR 370
11	MEC E 390	MAT E 201	MEC E 380		WKEXP 904					MCTR 460
12	STAT 337	MEC E 230	MEC E 340		WKEXP 905					MCTR 461
13	ECE 342		MEC E 430		WKEXP 906					MCTR 465
14			MEC E 480							
15			CH E 448							

An example of the Course Categories spreadsheet. The cells along the first row are the category names. The cells along the second row are the hexadecimal color codes for each category. Under each category are listed all of the courses in that category.

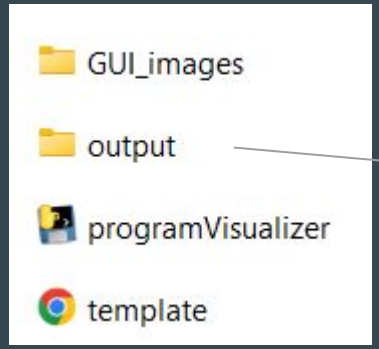
Template HTML File

- The webpage generator requires a template HTML file as input that provides some basic layout information.
- This file is called *template.html*. Without this file in the proper location, the program will fail to generate the webpage.
- *template.html* must be in the same folder as *programVisualizer.exe* when *programVisualizer.exe* is run.
- Do NOT make any modifications to this file (edits or renaming), as this will break the layout of the final webpage OR prevent the program from locating it

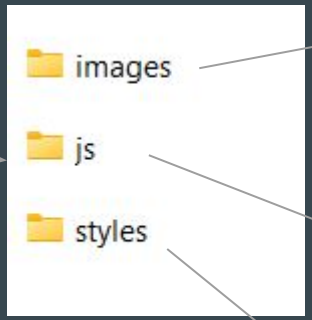
Output Folder - Before Execution

- In the same folder as *programVisualizer.exe*, there must be a sub-folder called *output*. The *output* folder is where the final webpage will be generated.
- Also in the same folder as *programVisualizer.exe*, there must be a sub-folder called *GUI-images*, which contains image files used by the GUI.
- Before *programVisualizer.exe* is run, there must be a sub-folder in the *output* folder called *images*. This folder should contain three image files that are displayed on the webpage. The images should be named *favicon.ico*, *requisite_legend.png*, and *uofalogo.png*
- There should also be a folder called *styles* which contains formatting information for the webpage. In this folder, there should be a file called *styles.css*
- There should also be a folder called *js*, which contains the Javascript which controls the frontend logic of the webpage. There should be a singular JS file called *line.js*
- As with the template HTML, do NOT modify or rename any of these files.

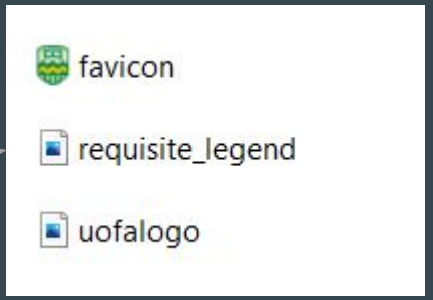
File Structure - Before Execution



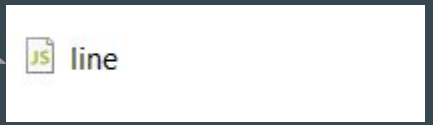
The required contents of the directory with *programVisualizer.exe* before execution



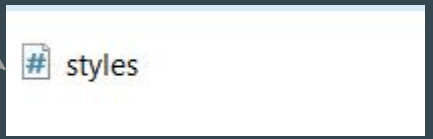
The required contents of the *output* subdirectory before execution



The required contents of the *images* subdirectory before execution



The required contents of the *js* subdirectory before execution



The required contents of the *styles* subdirectory before execution

File Structure - Before Execution

- The Program Visualizer is distributed in a .zip file that wraps the executable *programVisualizer.exe* and the required file structure mentioned before, including the required directories and contents.
- The user only needs to download and extract this .zip file, run the executable, and select the three required Excel files that were created in the previous steps.
- It is essential that the user does not modify any of the files provided in the .zip file, nor move the executable to a different location without moving the provided files along with it.
- Note that when downloading the .zip file, your computer may block the download due to safety concerns. Ensure you override these security measures. The same will occur when running the executable

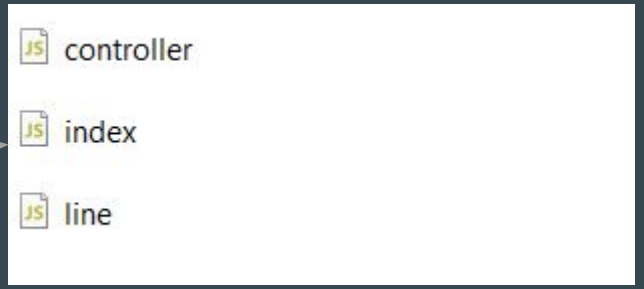
Output Folder - After Execution

- After the execution of *programVisualizer.exe* there should be a new HTML file called *index.html* located in the *output* directory mentioned before. This is the HTML file that is the webpage generated from the program
- Within the *js* directory, there should be two new JS files, *index.js* and *controller.js.*, alongside *line.js*. These are the JS files that drive the logic of the webpage, including line generation, highlighting and plan switching.
- Within the *styles* directory, there should be one new CSS file, *category.css*, alongside *styles.css*. This defines the styling and colouring of the user defined categories
- The contents of the *output* directory is what should be uploaded to the web server hosting the webpage (note you MUST keep the same file structure within *output* when uploading)

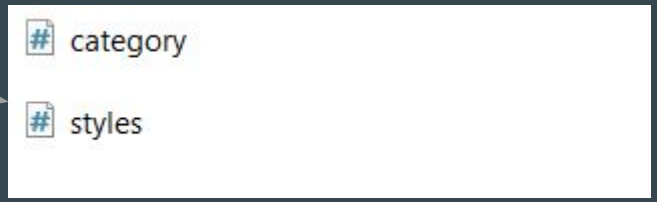
File Structure - After Execution

Note that the contents of the *images* directory does not change during execution!

The contents of the *output* subdirectory after execution. Upload this full structure to the web server.



The contents of the *js* subdirectory after execution.



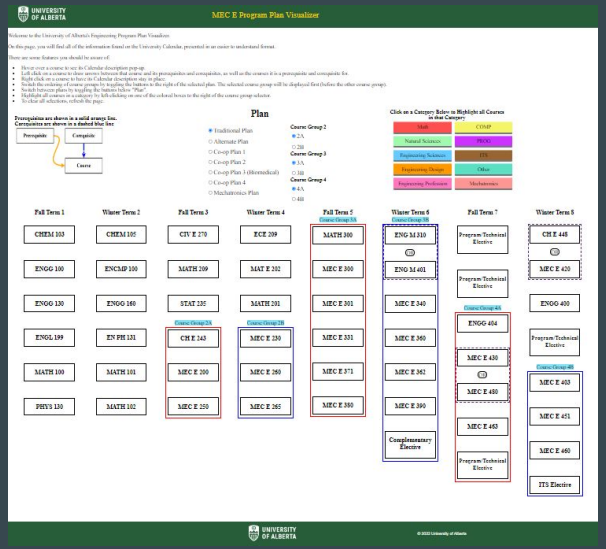
The contents of the *styles* subdirectory after execution.

Troubleshooting

- If any errors come up or the webpage is not working properly, check that you have all of the required files in their proper locations first
- If issues still persist, the most likely cause is improper formatting of the Excel spreadsheets. Check the following:
  - The three Excel files are all .xls files and not .xlsx files
  - Every course that is in the sequencing and category Excel file is present in the course information Excel file (no course is missing)
  - The sequencing Excel file has its sheets named appropriately. Curly braces are used appropriately for course groups
  - In the sequencing Excel file, course groups should come last in their term (there shouldn't be courses that are below course groups)
  - There are no typos in any course names

Conclusion

After following all of the previous steps, you should have a complete webpage that can be uploaded to a web server.



Complete Mechanical Engineering Program Plan Visualizer