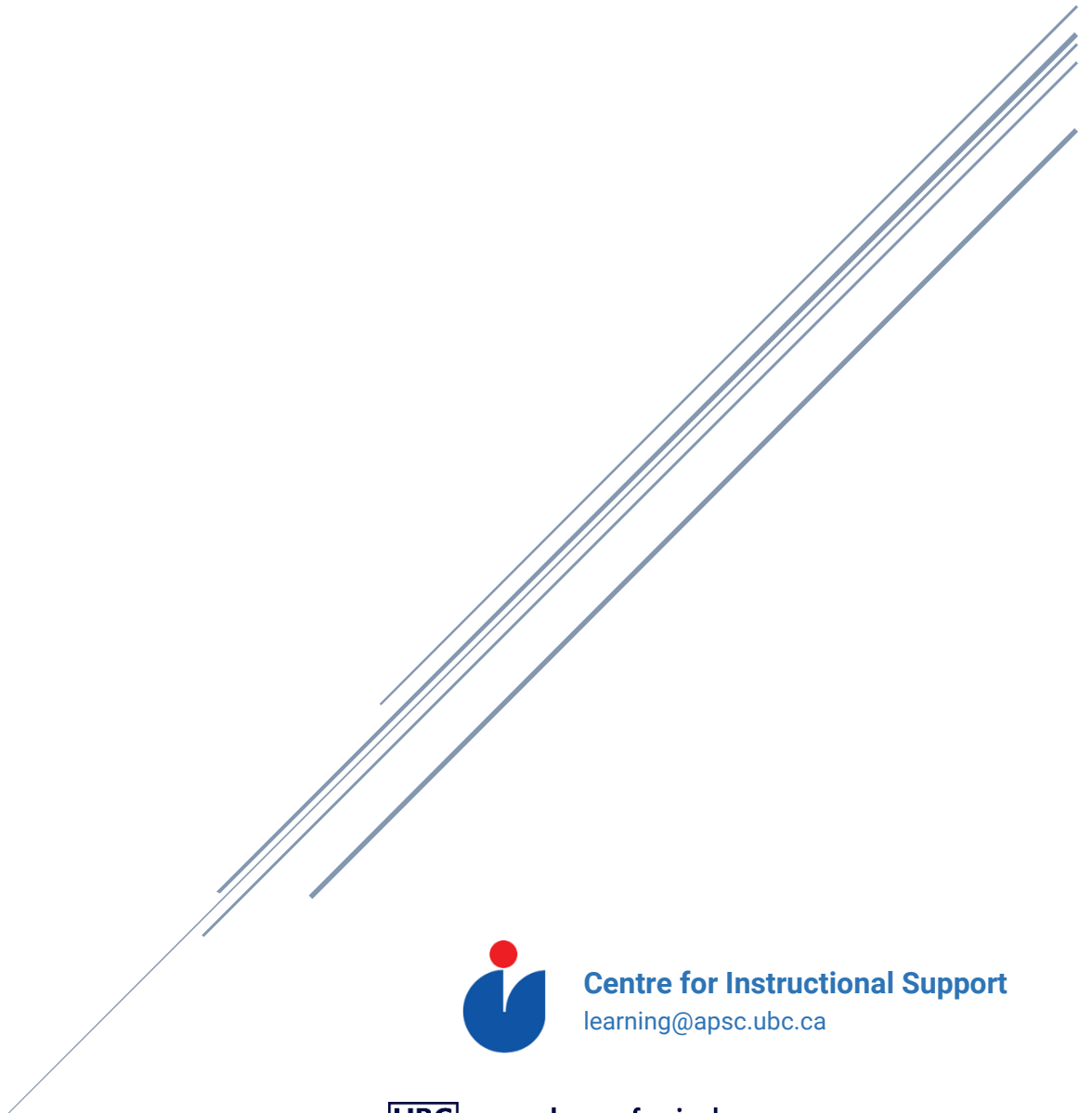


CIS CAPSTONE PROJECT GROUP MAKER

Documentation



Centre for Instructional Support
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a place of mind
THE UNIVERSITY OF BRITISH COLUMBIA

Contents

Contents	1
I. About	2
II. Installation	3
A. Java Development Kit (JDK)	3
B. Program Files	3
PC	3
Mac	3
III. Preparing to Use the Program	3
C. Creating the Project Database	3
D. Creating the Survey on Connect	4
E. Exporting the Student Preference Survey Data	7
F. Placing the Database files	9
IV. Starting the Program	10
V. Running the Program	10
VI. Uploading the Groups into Connect	11
VII. Appendix A: Frequently Asked Questions (FAQs)	12
A. Why is the Program Not Working?	12
B. How Long Should I Run For?	12
VIII. Appendix B: Troubleshooting	13
A. The Program Won't Start	13
PC	13
Mac	13
B. Error Reading the Project Database	14
C. Error Reading the Student Preferences	14
D. The Program Didn't Place All Students	14
IX. Appendix C: Editing the Source Files [CIS Staff Only]	15

I. About

The algorithm for the CIS Capstone Project Group Maker is heavily based off of an algorithm that was published in 2007 by two professors from the University of Calgary. It can be viewed in more detail by downloading it from the following link:

- <https://peer.asee.org/an-algorithm-for-project-assignment-in-capstone-design.pdf>

The program begins by assigning students in a random order to their first choice of project. If their first choice is not available, they will be placed in their second choice. If their second choice is not available, they will be placed in their third choice, etc. Students who are not able to be placed in any of their chosen projects (the projects are all full) will be placed in a group of unassigned students.

Any projects that are too small after the initial placement will be removed, unless removing that project would take the total number of available spots in projects below the total number of students.

The program then chooses a random student from the group of unassigned students and places them in their first choice of project. At the same time, a random student is removed from that same project and an attempt is made to place them in another one of their ranked projects. If this removed student is able to be placed in another one of their ranked projects, they will be placed in this project and all changes will be made permanent. If the newly removed student is not able to be placed in one of their ranked projects, they will be placed in their first choice of project and a new student will be removed from that project and undergo the same routine. This bumping routine will go up to 5 “bumps” deep at which time all the changes will be undone and the original unplaced student will remain unplaced. This bumping routine will be performed for every student in the group of temporarily unassigned students.

The program then assigns a numerical score to the groups that were created. Again, the method for calculating this numerical value can be viewed in more detail in the original document at the link above. If these groups have a higher numerical score than the highest score that was previously achieved, these groups will become the new highest score and the groups will be saved.

The program will then shuffle the students in a random order and attempt this procedure again. The program will end when the desired number of minutes is reached or the maximum number of iterations is reached (1 billion). The groups that had the highest overall numerical score assigned to them will be written by the program into two Excel files: one for general viewing and another for uploading the groups to Connect.

II. Installation

A. Java Development Kit (JDK)

In order to run the program, you need to download the **Java Development Kit (JDK)**:

- <http://www.oracle.com/technetwork/java/javase/downloads/index.html>

B. Program Files

You will download the program files from the Centre for Instructional Support's website (<http://cis.apsc.ubc.ca/capstone-project-groups/>). This will provide you with a zipped folder.

PC

To obtain the folder containing the files, right-click on the zipped folder and click "Extract All." Then, "Browse..." for the location that you want the folder placed and click "Extract." The title of the new folder containing the program's file will be the same as that of the zipped folder.

Mac

To obtain the folder containing the files, double-click on the zipped folder. The folder containing the files should be automatically extracted and placed in the same location as the zipped folder. The title of the new folder will be the same as that of the zipped folder.

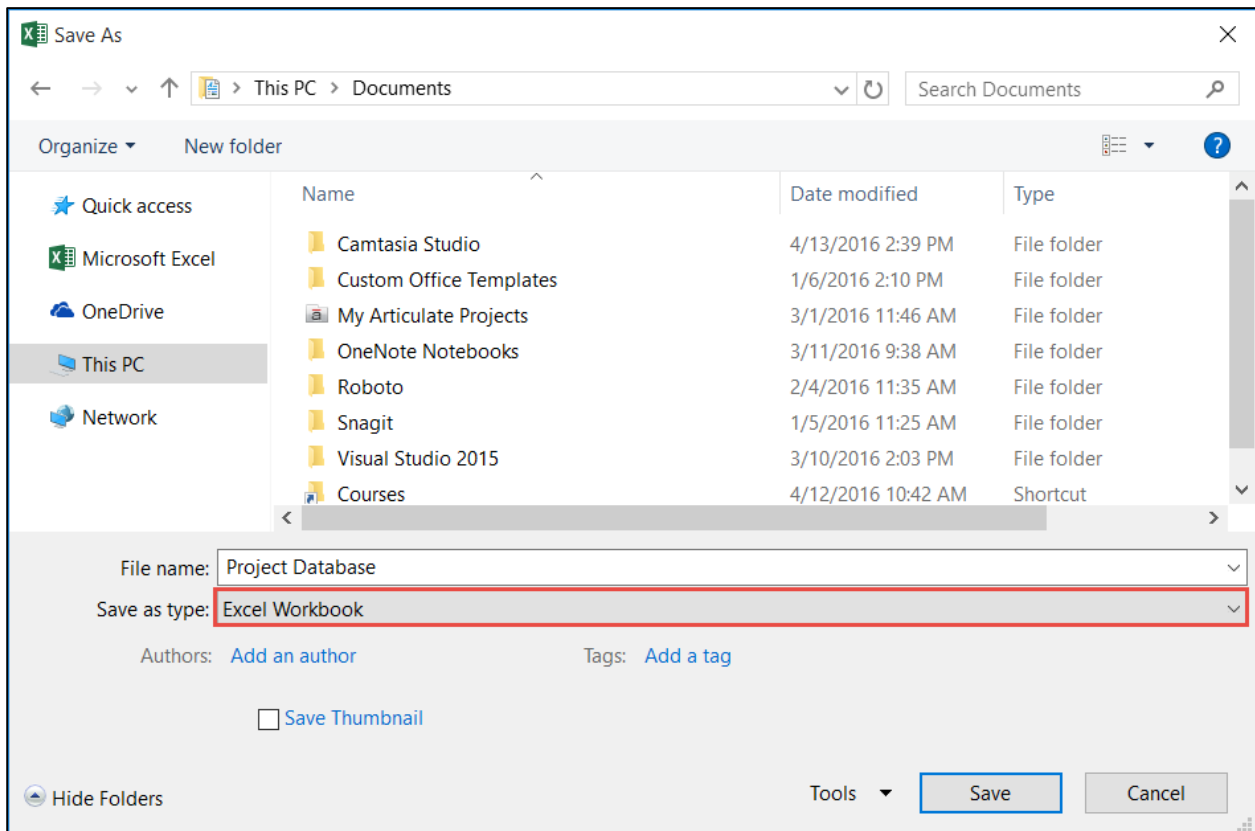
III. Preparing to Use the Program

A. Creating the Project Database

1. Create a new Excel spreadsheet.
2. In the first row, add the titles "Project Number", "Minimum Group Size", "Maximum Group Size", "Title", and "Description", from left to right, respectively.
3. Enter the information for the projects into the spreadsheet. **Make sure that none of the five cells are empty for any given project.**
 - Project Number, "Minimum Group Size," and "Maximum Group Size" must have numerical cells (correct: "4"; incorrect: "four", "project4", etc.).
 - "Title" and "Description" must have string cells (correct: "four", "project4", etc.; incorrect: "4").

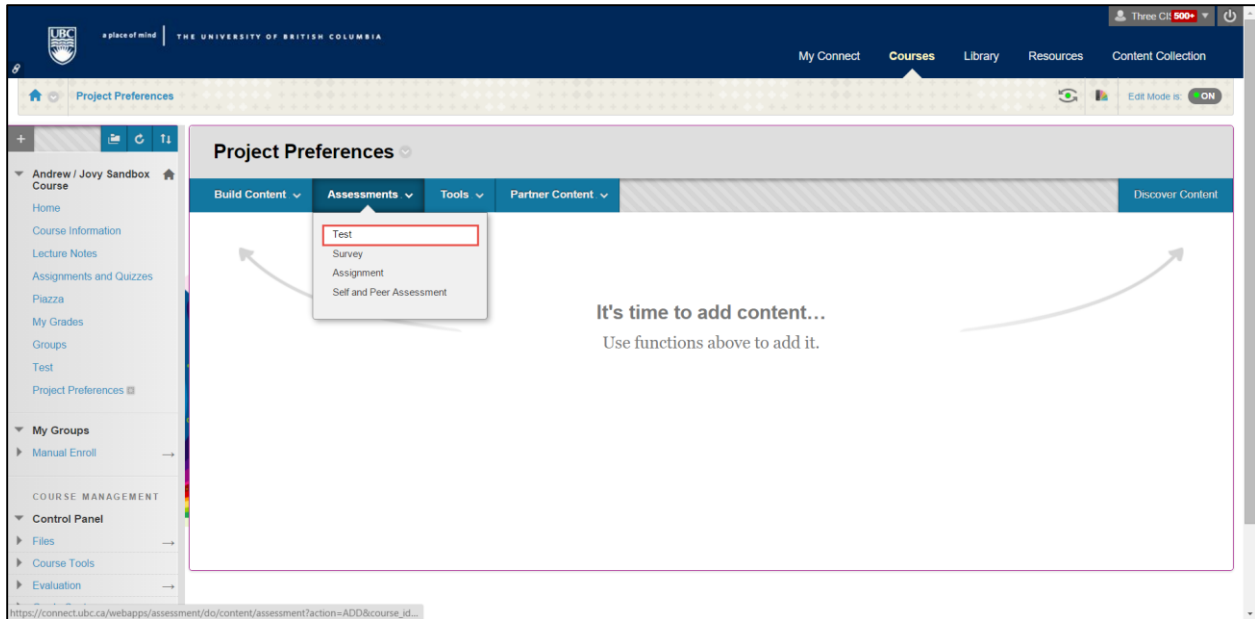
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Project Number	Minimum Group Size	Maximum Group Size	Title	Description								
2	1	3	7	Project 1	ND								
3	2	3	7	Project 2	ND								
4	3	3	7	Project 3	ND								
5	4	3	7	Project 4	ND								
6	5	3	7	Project 5	ND								
7	6	3	7	Project 6	ND								
8	7	3	7	Project 7	ND								
9	8	3	7	Project 8	ND								
10	9	3	7	Project 9	ND								
11	10	3	7	Project 10	ND								
12	11	3	7	Project 11	ND								
13	12	3	7	Project 12	ND								
14	13	3	7	Project 13	ND								
15	14	3	7	Project 14	ND								
16	15	3	7	Project 15	ND								
17	16	3	7	Project 16	ND								
18	17	3	7	Project 17	ND								
19	18	3	7	Project 18	ND								
20	19	3	7	Project 19	ND								
21	20	3	7	Project 20	ND								

4. Save the spreadsheet as an “Excel Workbook.” This file will be your Project Database.

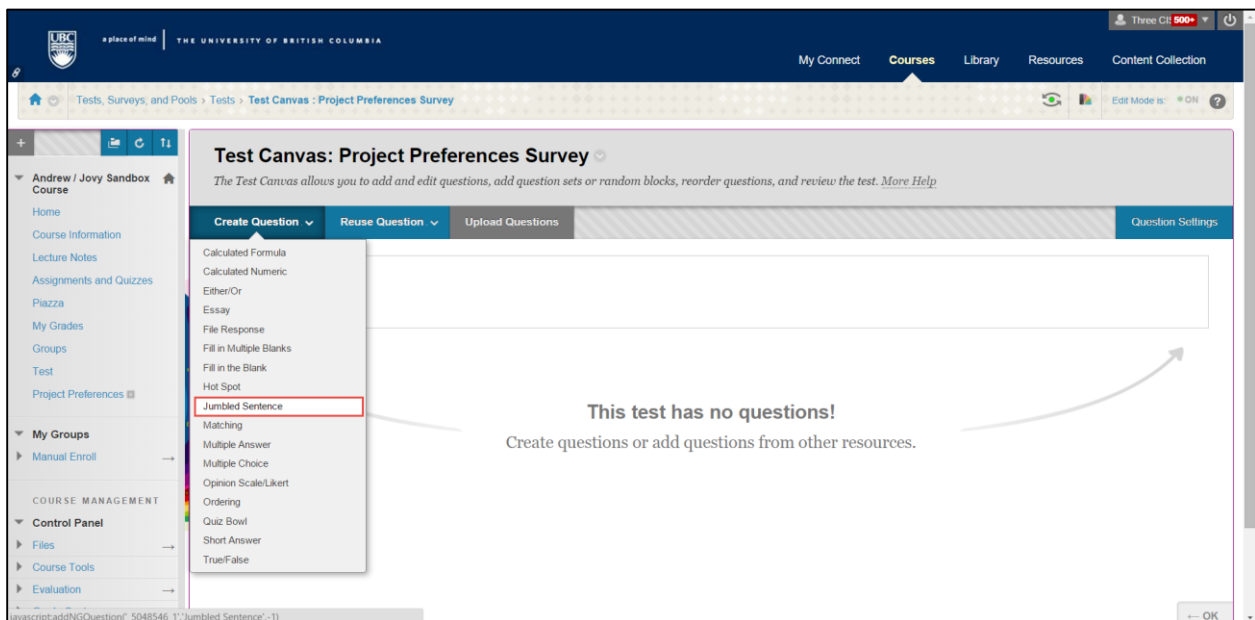


B. Creating the Survey on Connect

1. Go to the Content Area where you wish to place the Survey.
2. Hover your mouse over the “Assessments” tab on the top of the Content Area. When the drop-down list appears, select “Test.”



3. Click “Create” to create a new Test. Enter your desired information and click “Submit.” The Test Canvas will open.
4. Hover your mouse over the “Create Question” tab at the top of the Test Canvas. When the drop-down list appears, select “Jumbled Sentence.”

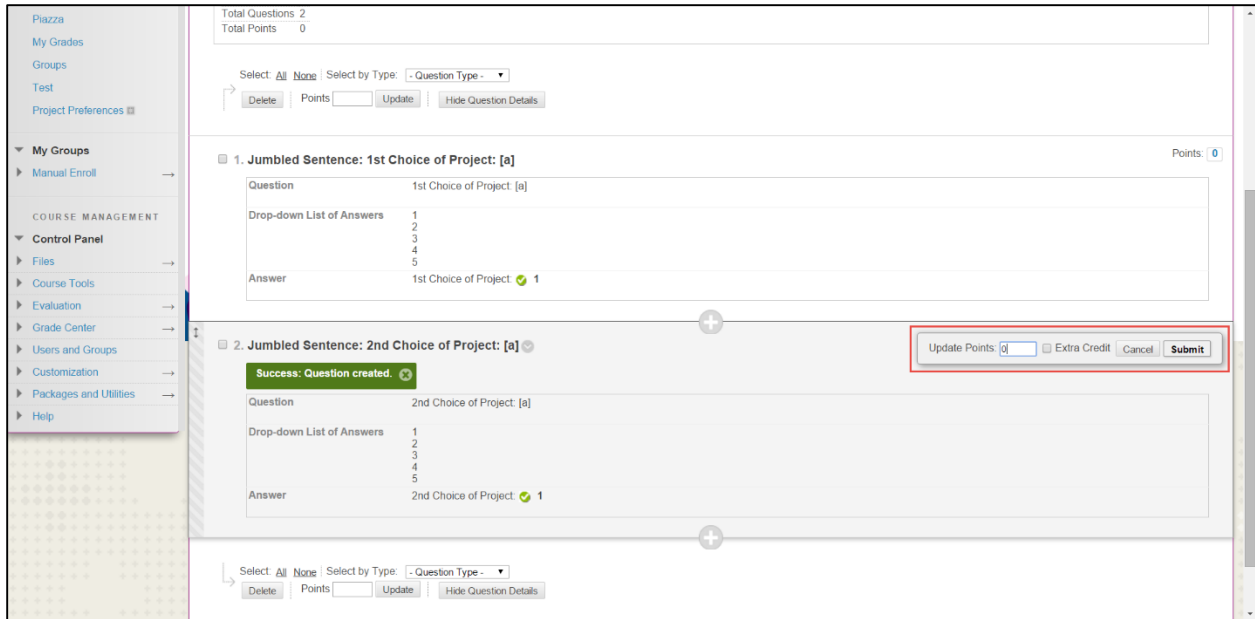


5. In the “Question Text” box, enter a prompt for the student’s first choice of project followed by “[a]” (e.g., “1st choice of Project: [a]”). The “[a]” will become a drop down list consisting of the possible responses when the question is given to the students. Therefore, let’s create those responses.

6. Scroll down to the “Answers” section. Set the “Number of Answers” equal to the number of projects that the students will choose from. Then, in the box next to “Answer 1” enter the number of the first project and so forth until all the answer boxes are filled.
7. Click “Next” and then “Submit and Create Another” to create a question for the students’ second choices, third choices, etc. such that you create n questions so that the students can rank their top n projects.

The screenshot shows a question editor interface. On the left is a sidebar with navigation options like 'My Groups', 'Manual Enroll', and 'Control Panel'. The main area is titled 'Question Text' and contains a rich text editor with the text '1st Choice of Project: [a]'. Below the editor is the 'OPTIONS' section with a checkbox for 'Allow Partial Credit'. The 'ANSWERS' section is at the bottom, featuring a 'Number of Answers' dropdown set to 5 and five rows of answer boxes labeled 'Answer 1' through 'Answer 5', each with a 'Remove' button.

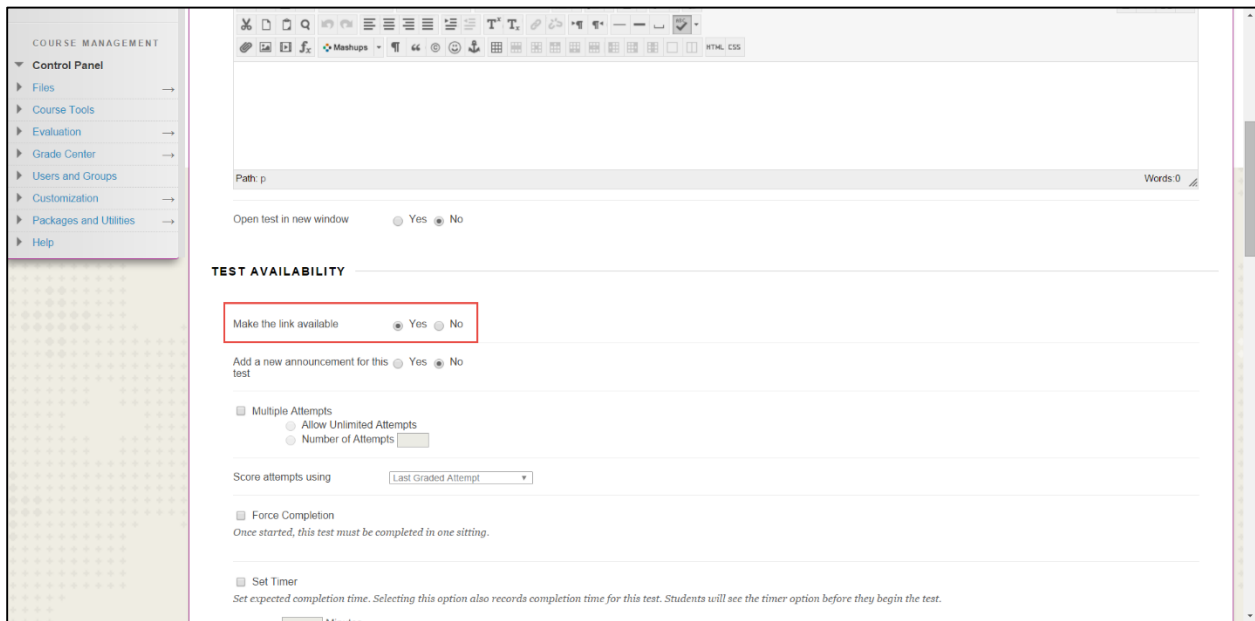
8. After you have finished the last question, click “Submit” rather than “Submit and Create Another.”
9. Change the points for each question to 0 as found at the top right of each of the questions in the Test Canvas.



10. Click “OK” at the bottom right of the page.

11. Click “Submit.”

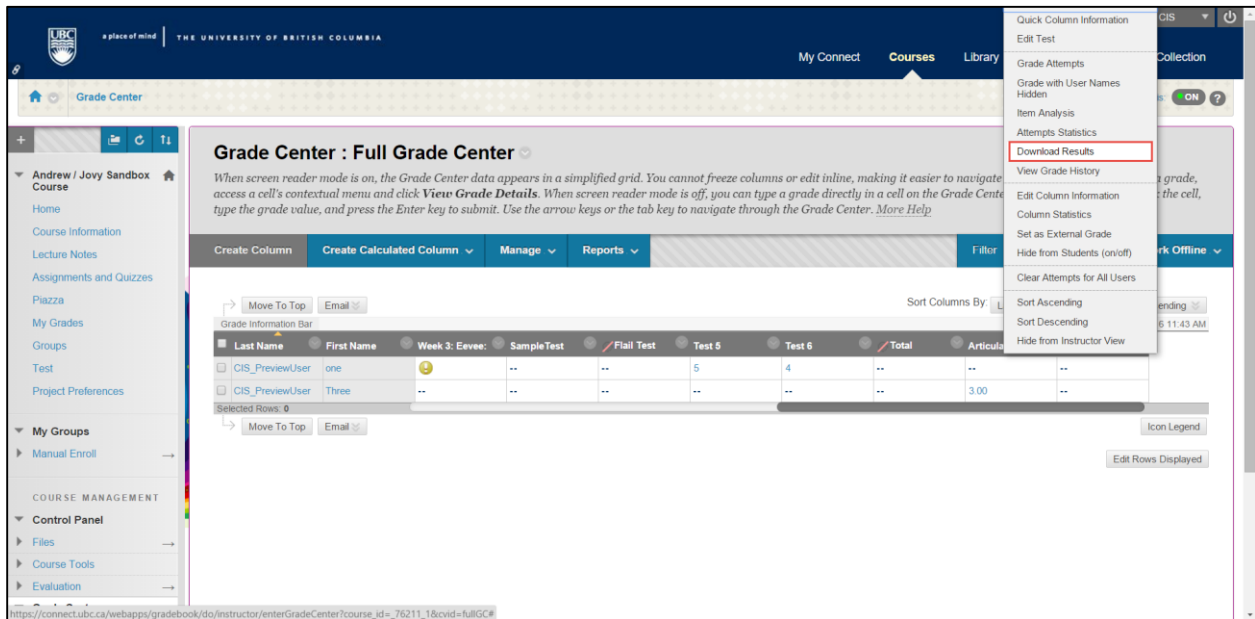
12. Enter preferred settings (make sure you “Make the link available”) and click “Submit.”



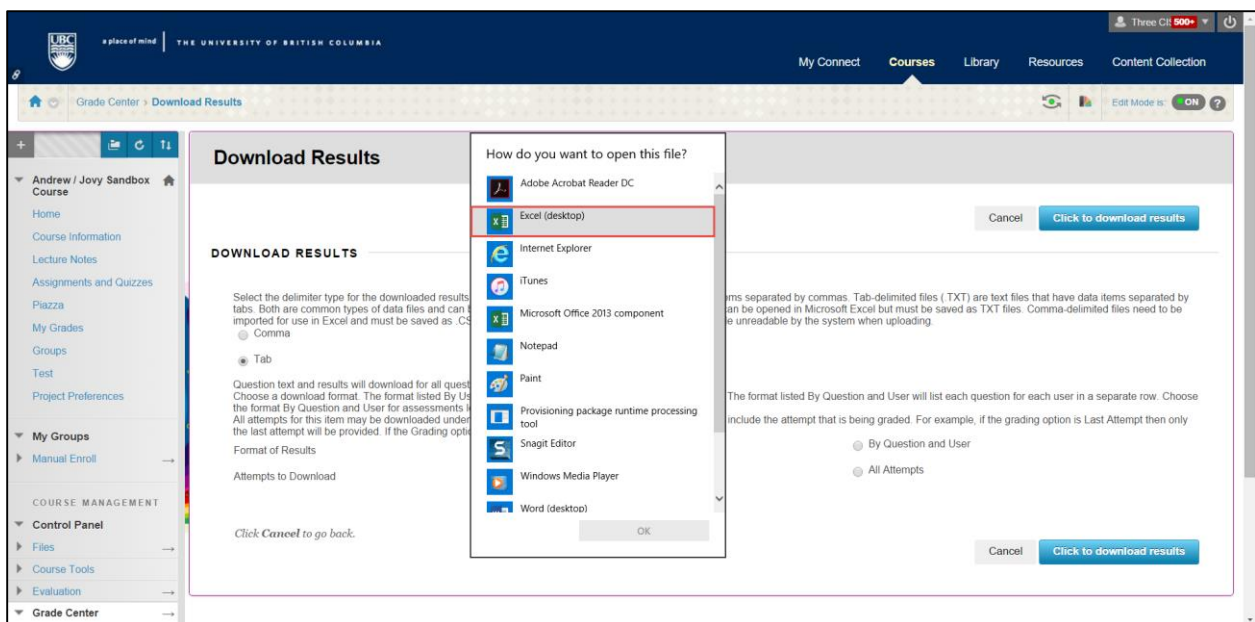
C. Exporting the Student Preference Survey Data

1. After the students have completed the survey (though it is technically a test), navigate to the “Full Grade Center” under “Grade Center” on the left Course Menu.

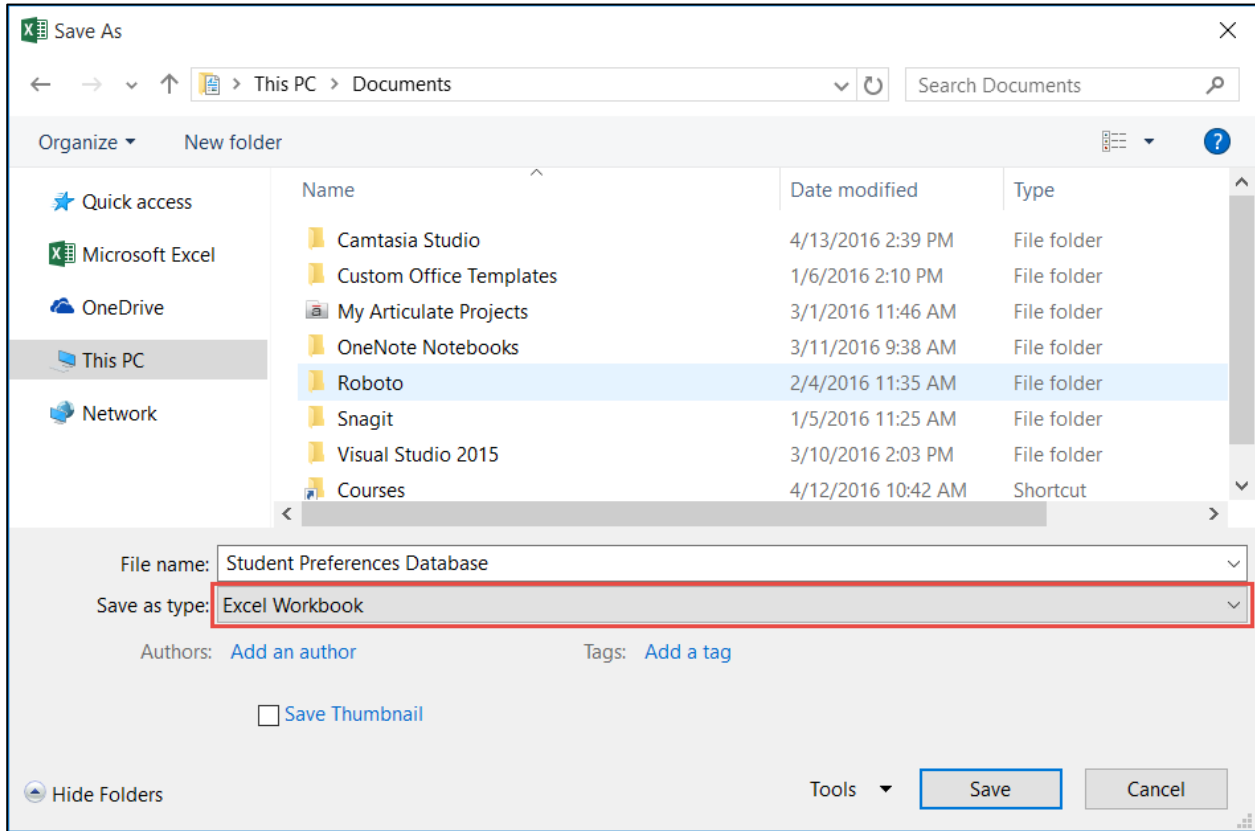
2. Find the column which represents the survey (it will have the same name).
3. Select the grey chevron to the right of the column title to open the contextual menu for the column.
4. Select "Download Results."



5. Select "Click to download results."
6. Open the download.
7. If prompted for which program you want to open this file with, select "Excel" or "Excel (desktop)."



- Save this file as an “Excel Workbook.” This will be your Student Preferences Database.



D. Placing the Database files

- Copy your Project Database and Student Preference Database Excel files.
- Open the “CIS Capstone Project Group Maker” folder.
- Open the “Files” folder. This is the location to paste your Project Database and Student Preference Database Excel files.

Name	Date modified	Type	Size
icons	4/27/2016 8:33 AM	File folder	
GroupMaker	4/27/2016 8:33 AM	Windows Batch File	1 KB
GroupMaker	4/27/2016 8:33 AM	Executable Jar File	14,610 KB
Project Database	4/27/2016 8:33 AM	Microsoft Excel Worksheet	9 KB
Student Preferences	4/27/2016 8:33 AM	Microsoft Excel Worksheet	12 KB

IV. Starting the Program

1. Open the “CIS Capstone Project Group Maker” folder.
2. Click on “Make Groups!” to start the program. The program should open in the Command Prompt (PC) or Terminal (Mac).

Note for Mac Users: If you receive a message that the program cannot open because it is from an “Unrecognized Developer”, simply right-click on “Make Groups!” and click “Open” and then “Open” again to start the program.

V. Running the Program

The program will ask you three questions when you start it and one question at the end:

1. What is the name of your Project Database?
2. What is the name of your Student Preferences Database?
3. How many minutes do you want the program to run?
4. Do you want to run the program again?

The first two questions are straightforward, simply type the name of your corresponding Excel files which you placed in the “Files” folder. The third question is a little trickier; typically 1–5 minutes should be more than enough time (see [How Long Should I Run For?](#)). After answering these questions, as long as there were no errors (if so, see [Appendix B: Troubleshooting](#)), the program will begin making groups for as many minutes as were specified.

The program will immediately print out on the console any students who placed at least one project multiple times in their rankings. Since these students were likely trying to beat the system, they will not be included in the groups and can be manually placed into groups afterwards.

After the program has run for the specified time, it will print out a message informing the user of the results of the program’s efforts. The user will be informed if the program was able to place every student in a group. If it wasn’t, the unplaced students will be put into a project with the number “N/A.” If you don’t know why some students are not placed in a group, see [The Program Didn’t Place All Students](#).

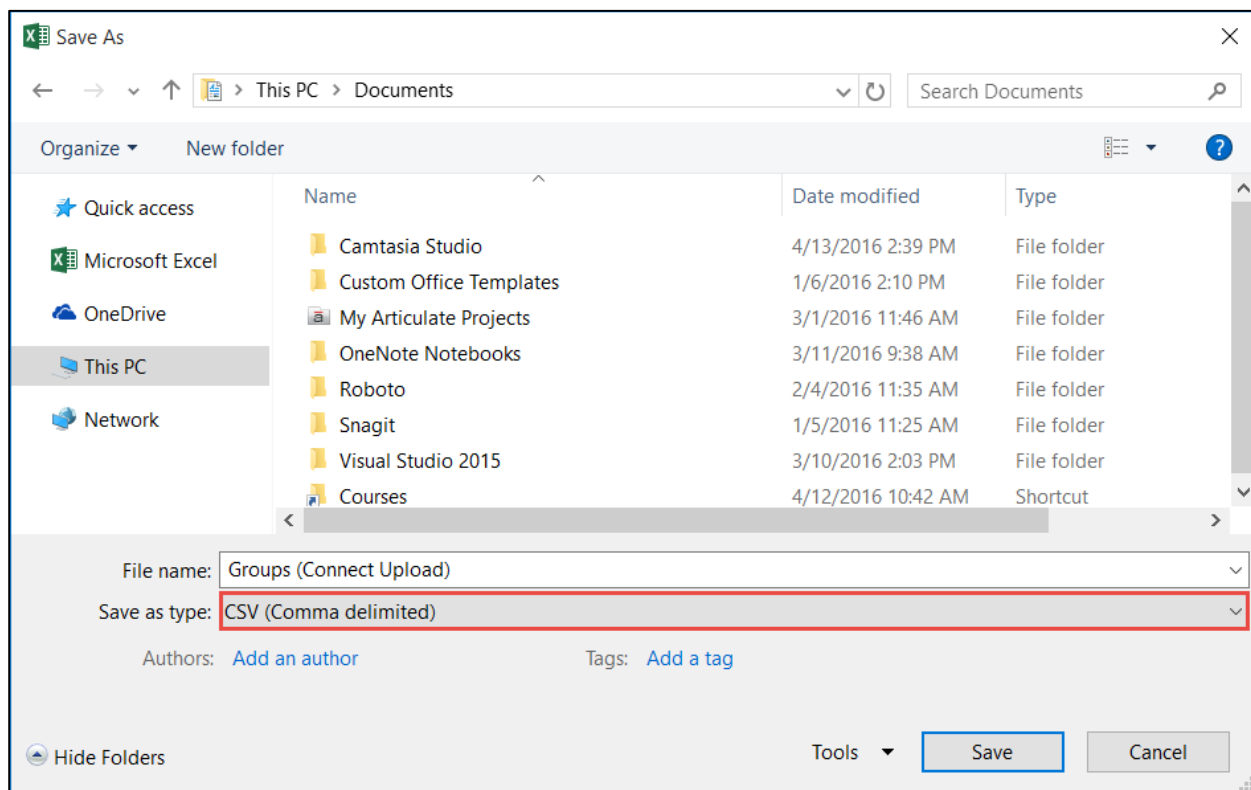
The program will then prompt the user for a file name which will be given to the two Excel spreadsheets containing the group information. These will be written by the program and placed in the “Files” folder. The first Excel spreadsheet (titled “YourSpecifiedFileName”) is for general viewing purposes and will have the exact name

that is entered. The second Excel spreadsheet (titled “YourSpecifiedFileName (Connect Upload)”) is for uploading the groups into Connect.

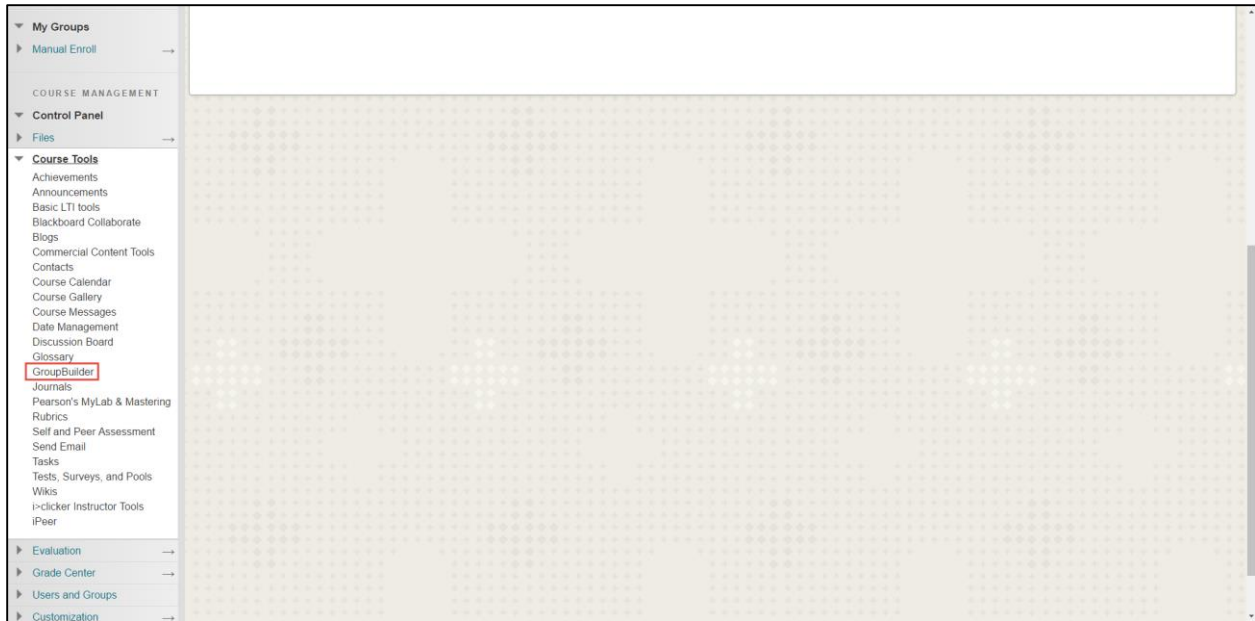
Finally, the program will ask the user if they want to run the program again. If so, it will prompt the user for the third question again (it assumes the same Project Database and Student Preference files). If not, the program prints a goodbye message and terminates.

VI. Uploading the Groups into Connect

1. Open the created Excel file for uploading to Connect (appended with “(Connect Upload)”) and save it again as a “CSV (Comma delimited)” file. If you encounter any error messages, click “Yes.”



2. Once the file is saved in the CSV format, go to the Connect page of the course. Navigate to “GroupBuilder” under “Course Tools.” If “GroupBuilder” is not available under course tools click below on “Customization” and then “Tool Availability.” Find “GroupBuilder” and click the farthest leftward box possible. Click “Submit” and navigate to “GroupBuilder” under “Course Tools.”



3. Select “CSV Import.”
4. Select “Browse My Computer,” and then find and select the CSV file that you just saved.
5. Click “Submit.” Your groups should be created in Connect.

VII. Appendix A: Frequently Asked Questions (FAQs)

A. Why is the Program Not Working?

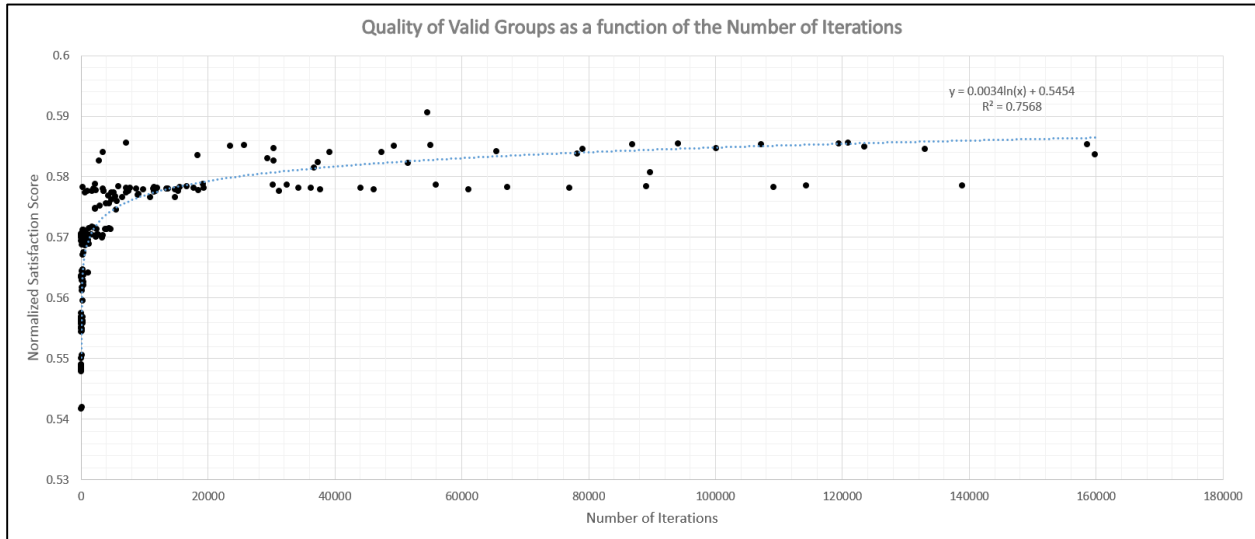
See [Troubleshooting](#).

B. How Long Should I Run For?

In reality, 30 seconds would be a fine amount of time to get groups for almost all scenarios. Obviously, the larger the size of the class, the more variables that are present and so a longer time is preferable to give the program more opportunity. Also, we will want to stay on the safe side and make sure we aren't providing too little time. You can experiment with different time frames to see how much improvement you get for an additional period of time.

The following data shows the quality of the groups as a function of the number of iterations for a class of ≈ 200 students with *one minute* of runtime on a standard laptop. As we can calculate, by the end of the first minute, the slope of the function decreases to $+0.0000002125/\text{iteration}$. Therefore, it would take around 470,000 iterations (≈ 5 min.) to increase the Normalized Satisfaction Score by 0.01. It should, therefore, be more than

enough to **limit the search time to 1–5 min. to obtain groups which are very close to ideal.**



VIII. Appendix B: Troubleshooting

A. The Program Won't Start

If, after clicking on "Make Groups!" the program does not start or encounters an error the first thing you should do is make sure that you have downloaded the latest version of [Java](#). If you have installed the latest JDK, you can attempt to start the program via the Command Prompt (PC) or Terminal (Mac). If the instructions below don't work, double-check that you have java downloaded properly.

PC

1. Open "Command Prompt."
2. Navigate to the location of the "CIS Capstone Project Group Maker (PC)" folder. Basic navigation commands can be found at this link:
 - a. <http://www.digitalcitizen.life/command-prompt-how-use-basic-commands>
3. Type "cd CIS Capstone Project Group Maker (PC)" and hit enter.
4. Type "cd Files" and hit enter.
5. Type "java -jar GroupMaker.jar" and hit enter. The program should start.

Mac

1. Open "Terminal."

2. Navigate to the location of the “CIS Capstone Project Group Maker (Mac)” folder. Basic Navigation commands can be found at this link:
 - a. [https://github.com/Onn0/terminal-mac-cheatsheet/wiki/Terminal-Cheatsheet-for-Mac-\(basics-\)](https://github.com/Onn0/terminal-mac-cheatsheet/wiki/Terminal-Cheatsheet-for-Mac-(basics-))
3. Type “ cd “CIS Capstone Project Group Maker (Mac)” ” and hit enter.
4. Type “cd Files” and hit enter.
5. Type “java -jar GroupMaker.jar” and hit enter. The program should start.

B. Error Reading the Project Database

If an error is encountered while reading the Project Database Excel file, double-check the following:

- The name of the file was entered correctly.
- Every cell of every project in the Project Database is not empty.
- Project Database contains the correct cell-types. First three columns should be numeric and last two columns should be string-type cells.
- View the “Project Database” in the “Example Files” folder and compare it to yours.

C. Error Reading the Student Preferences

If an error is encountered while reading the Student Preferences Excel file, double-check the following:

- The name of the file was entered correctly.
- Check that your Student Preferences Excel file is identical in format to an Example Student Preferences Excel file located in the “Example Files” folder (within the “CIS Capstone Project Group Maker”).
 - If it does not match, check that the test on Connect was created correctly.
- View a Student Preferences file in the “Example Files” folder and compare it to yours.

D. The Program Didn't Place All Students

If the program does not make groups with 100% student placement (i.e. no students without a group) and you gave it sufficient time to run (1–5 mins.), then your parameters in the Project Database Excel file are too restrictive. Try lowering the minimum group sizes and raising the maximum group sizes in the Project Database Excel file to attempt to provide the program with more flexibility in making the groups. Ensure that you alter

not only the original Project Database file in your documents but also the copy of it that the program is reading.

IX. Appendix C: Editing the Source Files [CIS Staff Only]

****PLEASE ONLY EDIT THE SOURCE CODE IF YOU ARE CONFIDENT IN YOUR ABILITIES****

If there is a serious error in the program which needs a solution, the source files are included in the “Source Files” folder. I used Eclipse as my IDE while writing the program; Eclipse can be downloaded at the following link:

- <https://eclipse.org/downloads/>

The files for the program are contained within the “CIS Capstone Project Group Maker” on the shared drive (00_COOP-Student Projects -> Andrew (Jan. 2016 – Apr. 2016) -> Group Maker Program.

To open the source files in Eclipse, move the folder titled “CIS Capstone Project Group Maker” from inside the “Source Files” folder into your “workspace” folder. Then, in Eclipse, click File -> Import -> General -> Existing Projects into Workspace -> Next. Then select “Browse...” to the right of the “Select root directory:” box. Navigate to your “workspace” and select the “CIS Capstone Project Group Maker” folder and click “OK.” Then, click “Finish” and the files should be editable via. Eclipse.

If a lot of error messages appear, you probably need to add the Apache POI library to the build path. To do this click Project -> Properties -> Java Build Path -> Libraries -> Add External JARs.... Then, open all the executable JAR files within the “poi-3.13” folder. Click “OK.” Any error messages should now disappear.

Once you are finished making the relevant changes to the source code, click File -> Export -> Java -> Runnable JAR file -> Next. First, change “Launch configuration” to the Main which contains “CIS Capstone Project Group Maker.” Then, click “Browse...,” choose an easy to find location, and choose “GroupMaker” as the “File name;” click “Save.” Ensure that “Extract required libraries into generated JAR” is selected under “Library handling.” You can then click “Finish.”

Find the created executable JAR file and replace the file with the same name in both the PC and Mac versions of the program files. Ensure that the new JAR file has the same name as the old JAR files. Next, copy the new source files into the “Source Files” folder. Then, update the documentation with the relevant changes and replace the old documentation in both the PC and Mac versions of the program. Finally, compress the folders and update the program files on Dropbox (see the Credentials.txt file for login information).

