

MA111 PROJECT
PRELIMINARY SUBMISSION DUE NOVEMBER 9
FINAL SUBMISSION DUE NOVEMBER 21

In MA 111 we have been investigating some topics in contemporary mathematics and you have been developing your mathematical and quantitative reasoning skills. For your MA 111 project, you will be choosing one of the projects listed below to better develop and exhibit these skills. Each project involves some amount of research, writing and quantitative reasoning.

Project 1: Symmetries All Around

Read the following instructions carefully.

1. **Project 1: Preliminary.** For the preliminary part of the project, you are to personally find real-world examples of 12 different symmetry types. We will be discussing symmetry types in class, but you can read ahead in Sections 11.6 and 11.7.
 - (a) Four of these should be of the Z types— Z_2 , Z_3 , Z_4 , etc. These should be of four different Z types, but do not choose Z_1 .
 - (b) Four of these should be of the D types— D_1 , D_2 , D_3 , etc. These should be of four different D types.
 - (c) The final four of these should be of four of the seven different border pattern types. Again, these should be of four different types.
 - (d) You are to personally photograph each of these 12 examples, and then insert the pictures into a document—the three acceptable document types are .docx, .doc, and .pdf. (You can insert pictures into Microsoft Word documents, for example, by using Insert→Picture.) For each photograph, identify what it is, where you found it, and what symmetry type it has, typing directly in the document. Your photographs are to be original, not downloaded from the internet, and no students should be sharing any photographs.

 2. **Project 1: Final.** For the final part of the project, you are to add information and explanation to each of your photos. Write a paragraph for each photo.
 - (a) As before, for each photograph, identify what it is and where you found it.
 - (b) Identify what symmetry type it represents, and provide your reasoning and analysis to justify your assertion.
 - (c) Use tools such as those included with Microsoft Word to add lines and figures to your photo to highlight such features as reflections, rotations, translations, and glide reflections, to accompany your analysis. For example, in Microsoft Word, once you have inserted a picture, you can use Insert→Shapes to bring up a palette of shapes to use, such as lines, arrows. You can then use Shape Styles to change color, weight, etc. (Another alternative is to carefully draw the additional lines and figures by hand and scan the result.)
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Project 2: Amazing Mazes

Finding your way through a maze can be a difficult but fun task. This project consists of two parts. Read the following instructions carefully.

1. **Project 2: Preliminary.** For the preliminary part of the project, you are to research five famous historical mazes. Clearly describe each of the five mazes you are using for this project, including diagrams and/or photos. You do not have to give its history in the preliminary assignment.
 2. **Project 2: Final.** For the final part of the project, you are to add information to each maze and analyze two of the mazes.
 - (a) For each of your five mazes, describe the maze, including diagrams and/or photos, and include a paragraph or two about its history.
 - (b) Choose two of the mazes (don't choose them too simple!). For each of the mazes, draw a graph with a vertex at each intersection, corner or deadend in the maze (as we did in the Chapter 5 section in class). For each pathway between intersections, draw two edges (we are Eulerizing the maze). Find an Euler circuit through the maze that starts at the maze's starting point. Then prune of the circuit to form a path (not an Euler path) from the starting point of the maze to the ending point. For each maze in part (2), you should show your process in finding the route. That is, you should show your Eulerization of the maze and your Euler circuit. Then you should show the path that comes from the Euler circuit on a separate graph.
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Project 3: I'm the Decider

1. **Project 3: Preliminary.** This project involves investigating the current practices in elections. For the preliminary part of the project, you are to research and clearly describe two different voting methods used to decide real elections.
 - Each can be a government election, reality television election, religious election, club election, or one not listed here.
 - The voting methods may NOT be an election decided by any of the four methods we discussed in class. (If you are unsure if we have discussed it in class, please ask.)
 - I would like you not to use the United States election for president as your example. (It is too close to the Plurality Method.)
 - Keep in mind that you should research voting methods used in one election (as opposed to a sequence of elections; e.g., one night on American Idol versus the entire American Idol series). In particular, a voter's preferences must be transitive and should not change if a choice is removed from an election.

 2. **Project 3: Final.** For the final part of the project, you are to analyze the voting methods you chose.
 - (a) Clearly describe the voting methods that you intend to use.
 - (b) For each of the voting methods you research, determine whether this voting method satisfies or violates each of the fairness criteria we have discussed (Majority, Condorcet, Monotonicity, and Independence of Irrelevant Alternatives). If your voting method satisfies the criterion, give clear evidence why it does so (this should be more than examples). If the voting method violates the criterion, give an example of a preference schedule which violates the fairness criterion using the voting method.
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You must use credible sources for your research and cite all of them appropriately. A UK resource on research can be found at <http://libguides.uky.edu/MathCore>. There is lots of good guidance here under each of the tabs 1 to 5. In particular, under the *Evaluate Information* section there is a video on internet research. Be sure you also review the *Plagiarism/Paraphrasing* section.

Your projects should also be mathematically correct. Your ability to find information, analyze it and clearly communicate your analysis is the heart of the project. If you have questions, you are welcome to solicit help—please come talk to me during my office hour.

Instructions on turning the project in:

Project: Preliminary.

1. Give the file the name: *LAST-FIRST*-MA111-003-PRELIM.docx (or .doc or .pdf), where *LAST* and *FIRST* are your own last and first names. Again, the three acceptable types of document are .docx, .doc, and .pdf.
2. Upload your file into Blackboard Assignments at the location labeled “Project: Preliminary”.
3. **THE DEADLINE FOR DOING THIS IS WEDNESDAY, NOVEMBER 9.** Five points will be deducted for every day of unexcused late work.

Project: Final.

1. Every MA 111 student should be writing on a college level. This means that you are writing in complete sentences, capitalizing correctly and using correct grammar and punctuation. I will return any project with excessive grammatical errors to you to be rewritten. Any returned project will be subject to late penalties outlined below if not resubmitted by the original due date. One source of additional assistance is the UK Writing Center, <http://wrd.as.uky.edu/writing-center>.
2. Give the file the name: *LAST-FIRST*-MA111-003-FINAL.docx (or .doc or .pdf), where *LAST* and *FIRST* are your own last and first names. Again, the three acceptable document types are .docx, .doc, and .pdf.
3. Upload your file into Blackboard Assignments at the location labeled “Project: Final”.
4. **THE DEADLINE FOR DOING THIS IS MONDAY, NOVEMBER 21.** 10 points will be deducted for every day of unexcused late work.

Your grade for the project will be determined by the following rubric:

Preliminary Assignment: 0–12 points.

Mathematical Correctness: 0–15 points.

Clarity and Completeness: 0–15 points.

Originality: 0–5 points.

Citations: 0–3 points.
