MDM4U Culminating Research Project

This investigation allows you to demonstrate your knowledge and skills from this course by addressing a single problem on statistics and probability.

Overall Expectations
1. Design and carry out a culminating investigation that requires the integration and application of the knowledge and skills related to the expectations of this course.
2. Communicate the findings of your culminating investigation and provide constructive critiques of the investigations of others.

Specific Expectations
1.1 Pose a significant problem of interest that requires the organization and analysis of a suitable set of primary or secondary data, and conduct appropriate background research related to the topic.
1.2 Design a plan to study the problem.
1.3 Gather data related to the study of the problem and organize the data.
1.4 Interpret, analyze, and summarize data related to the study of the problem.
1.5 Draw conclusions from the analysis of data, evaluate the strength of the evidence, specify any limitations of the conclusions, and suggest follow-up problems or investigations.

2.1 Compile a clear, well-organized, and detailed report of the investigation.
2.2 Present a summary of the investigation to the class within a specified length of time, using technology.
2.3 Answer questions about the investigation and respond to critiques.
2.4 Critique the mathematical work of others in a constructive manner.
What to Do:

Define the Problem (p482)
- Choose a topic (e.g., a social issue, a sport or hobby, etc.)
- Narrow down your topic to a specific problem (a research question)
- Pose the problem. It must:
  - Be of significant interest to you
  - Involve collecting and organizing data
  - Involve analyzing the data
  - Allow the use of technology, diagrams, etc.
  - Allow the use of one-variable statistics (central tendency, spread, etc.)
  - Allow the use of two-variable statistics (regression, correlation, etc.)
  - Allow you to include some of the following:
    - Probability Distributions
    - Permutations and Combinations
    - Probability
    - Simulations

Define your Task (p486)
- Develop a hypothesis or thesis statement; this must be something that can (and will) be tested.

Develop and Implement an Action Plan (p488)
- See the textbook for suggestions, and later in this handout for a calendar.

Evaluate Your Own Project (p491)
- Reflect on your Conclusion
- Reflect on your Investigation Methodology
- Reflect on your Learning

Report, Present, and Critique
- Compile a clear, well-organized, and fully justified report of your investigation and its results.
- Present your project in a clear and coherent manner, within a restricted length of time, using communications technology effectively.
- Critique the mathematical work of others by identifying the strengths and weaknesses of their work, and making suggestions to improve in the future.
Report Requirements

1. **Title Page**
   - Title indicating the purpose of your project.
   - Your name, your teacher’s name, the course name, and the due date.

2. **Research question / problem definition**
   - Statement of your hypothesis.
   - Background information to us to understand your problem.
   - Why you chose your topic, and what you were hoping to learn.

3. **Raw Data**
   - Charts, graphs, and tables, clearly indicating the source.

4. **Data Organization and Analysis** – Using the Tools of the Course
   - Summarize data in tables, graphs, and using one-variable statistics (e.g., central tendency, spread, etc.).
   - Analysis of your data, including calculations, and graphs (one- and two-variable).
   - Two-variable statistics (regression, correlation, etc.)
   - Application of other ideas from the course (probability, counting, distributions, etc.)

5. **Results and Conclusions**
   - Based on your data and analysis and addresses your problem statement.

6. **Reflection**
   - Evaluation of your conclusions and of your investigation.
   - The requirements for this section are outlined on pages 491-492.

7. **References**
   - May also include a section of endnotes, or use footnotes throughout.
   - Include all your sources, using a consistent style (e.g., APA, MLA, etc.)
Presentation Requirements

- You will have 15 minutes to share your findings with the class. Allocate 10 to 12 minutes for the presentation and 3 to 5 minutes for questions.
- There won’t be enough time to cover all of your findings so identify the key ideas and the data that supports them as a basis for your presentation.
- Use communications technology in a manner that supports your presentation. The tools used should enhance your presentation but should not overshadow your findings.
- During the presentation:
  - Identify your problem and hypothesis.
  - Preview the key ideas.
  - Present two or three key ideas in a logical order.
  - Support the ideas with data.
  - Summarize your points and make a conclusion.
  - Be prepared to answer questions to demonstrate that you are an expert on your topic. *(It is helpful to have material ready to address the questions)*
- Know your audience. Your classmates won’t be as familiar with the topic as you are but will have experience with data analysis.
- Your presentation will be critiqued by your classmates. Those who will critique your presentation will be chosen randomly on the day of your presentation. They will also ask at least one question about your presentation.

Formative Steps

These formative steps are designed to help you organize your time. It is **not possible** to complete this project the night or the week before! **Don’t delay, start today!**

1. **Three ideas** – submit to your teacher three topic ideas. For each topic, include a
   - mind map,
   - possible questions and hypotheses, and
   - data that you have found.
   See section 9.1 questions #1a, 2, 7-9 for practice.
2. **Proposal** – Decide on a topic (probably one of your three ideas) and write a proposal that includes your
   - research question/hypothesis/thesis statement,
   - background information,
   - raw data (with sources), and
   - a detailed action plan
   with personal due dates for each step. See sections 9.2 and 9.3 for help with the action plan. **Keep a copy for yourself so you can keep working!**
3. **Mini-Report** – This is like a rough draft. You will get a separate assignment sheet.
4. **Project Days** – You will be given *some* class time to work, brainstorm with other students, and ask questions. Expect to show your teacher the progress you have made on your action plan.
### Planning Calendar

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<tr>
<td>NOV</td>
<td>3 Three Ideas Due</td>
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<td></td>
<td>10 P.A.Day</td>
<td>11 Remembrance Day</td>
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<td>14 Proposal Due</td>
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<td>21 Mini-Report Due</td>
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<td>28 P.A. Day</td>
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<tr>
<td>DEC</td>
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<td>5</td>
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<td></td>
<td>8</td>
<td>9</td>
<td>(Faith Day)</td>
<td>10 Project Peer Review Day (your report should be complete)</td>
<td>11</td>
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<td></td>
<td></td>
<td>15 You can start handing in your final report now</td>
<td>16 THERE WILL BE A TEST THIS WEEK! BE ORGANIZED.</td>
<td>17</td>
<td>18 Report FINAL DEADLINE</td>
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<td>Winter Break</td>
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<tr>
<td>JAN</td>
<td>5 Presentations</td>
<td>6 Presentations</td>
<td>7 (Faith Day) Presentations</td>
<td>8 Presentations</td>
<td>9 Presentations</td>
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<td>12 Presentations</td>
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<td>19 Review</td>
<td>20 Review</td>
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<td></td>
<td>26 Faith Day</td>
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<td>29 Exam Review Day</td>
<td>30 P.A. Day</td>
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### Due Dates

- Your printed report is due at the beginning of class on the due date.
- All students **must** also **e-mail** their report to their teacher by the end of the day.
- Since this project is part of the final 30% of your evaluation in this course, like an exam, the due date for the report and your presentation are fixed. **You will not be granted an extension.** Absence, suspension, and technology failures are examples of things that will **not** excuse you from passing in your project on time.
- The date of your **presentation** will be decided in advance by random draw. You must be prepared to present at the beginning of that class. Bring a back-up of your presentation (e.g., a copy on a CD and a USB drive). Your presentation must open in PowerPoint Version 2002 (*.ppt).
Places to Look for Help:

- Refer to Chapter 9 (starting at p482) for help in getting started.
- Appendix C (p593) is on Research Skills.
- Appendix D (p598) is on Oral Presentation Skills.
- Online (or a search for something like “MDM4U project”):
  - [http://www.ocdsb.edu.on.ca/Secondary_Websites/Teacher_Res/secondary/tecint/mdm4u.htm](http://www.ocdsb.edu.on.ca/Secondary_Websites/Teacher_Res/secondary/tecint/mdm4u.htm)
  - [http://www.brocku.ca/cmt/mdm4u/cproject/cproj1.html](http://www.brocku.ca/cmt/mdm4u/cproject/cproj1.html)
  - [http://www.statcan.ca/english/edu/power/toc/contents.htm](http://www.statcan.ca/english/edu/power/toc/contents.htm)
  - [http://www.statcan.ca/english/kits/courses/smath.htm#data](http://www.statcan.ca/english/kits/courses/smath.htm#data)
  - [www.mcgrawhill.ca/links/MDM12](http://www.mcgrawhill.ca/links/MDM12)

Plagiarism and Academic Dishonesty

The Oxford English Dictionary defines plagiarism as “the wrongful appropriation or purloining, and publication as one's own, of the ideas, or the expression of the ideas (literary, artistic, musical, mechanical, etc.) of another.” This can mean several things, including (but not limited to):

- Using someone else’s paper as your own, or getting someone else to do a paper for you;
- Passing the same paper in to more than one class;
- Downloading or purchasing a paper.
- Paraphrasing someone else’s words without acknowledging the source.

**Plagiarism is essentially stealing.** There is no room in the timelines of this project for resubmission or an alternate project. Therefore, your report will not be accepted if it contains plagiarised work, and you will receive no credit. You **will** still have the opportunity to do your **presentation**. Students have been caught in previous years, and they have received a mark of **zero**. **Consider this to be your warning!**

If you are not sure if something is plagiarism, **ask your teacher!** Some places to go for help with this issue are:

- [http://library.acadiau.ca/guides/plagiarism/student/](http://library.acadiau.ca/guides/plagiarism/student/)
- [http://library.acadiau.ca/tutorials/plagiarism/](http://library.acadiau.ca/tutorials/plagiarism/)
- [http://www.utoronto.ca/writing/plagsep.html](http://www.utoronto.ca/writing/plagsep.html)
- Your textbook, p597.
- Your agenda, p10-11.
Assessment: 70 marks total (15% of your final mark)

Project Assessment: 40 marks

<table>
<thead>
<tr>
<th>Category</th>
<th>Level 1 (50-59%)</th>
<th>Level 2 (60-69%)</th>
<th>Level 3 (70-79%)</th>
<th>Level 4 (80-100%)</th>
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</thead>
<tbody>
<tr>
<td>Knowledge:</td>
<td>Demonstrates understanding of <strong>very few</strong> topics covered in the course related to data analysis.</td>
<td>Demonstrates understanding of <strong>a few</strong> topics covered in the course related to data analysis.</td>
<td>Demonstrates understanding of <strong>several</strong> topics covered in the course related to data analysis.</td>
<td>Demonstrates understanding of <strong>almost all</strong> topics covered in the course related to data analysis.</td>
</tr>
<tr>
<td>Application:</td>
<td>A <strong>basic</strong> problem and hypothesis are appropriately investigated with the tools of the course</td>
<td>A <strong>significant</strong> problem and hypothesis are investigated with the tools of the course</td>
<td>A <strong>significant</strong> problem and hypothesis are <strong>appropriately</strong> investigated with the tools of the course</td>
<td>A <strong>significant</strong> problem and hypothesis are <strong>cleverly</strong> investigated with the tools of the course</td>
</tr>
<tr>
<td>Communication:</td>
<td>Report and data are <strong>poorly</strong> organized to facilitate an understanding of the topic.</td>
<td>Report and data are <strong>roughly</strong> organized to facilitate an understanding of the topic.</td>
<td>Report and data are <strong>clear and well</strong> organized to facilitate an understanding of the topic.</td>
<td>Report and data are <strong>very clear and cleverly</strong> organized to facilitate an understanding of the topic.</td>
</tr>
<tr>
<td>Thinking:</td>
<td>Displays <strong>limited</strong> competence in ability to make valid conclusions and reflections</td>
<td>Displays <strong>some</strong> competence in ability to make valid conclusions and reflections</td>
<td>Displays competence in ability to make valid conclusions and reflections</td>
<td>Displays <strong>insight</strong> in ability to make valid conclusions and reflections</td>
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Peer Evaluation Assessment: 10 marks

Your mark in this section is the average of your project critique and presentation critique.

<table>
<thead>
<tr>
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<th>Level 1 (50-59%)</th>
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<th>Level 3 (70-79%)</th>
<th>Level 4 (80-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge: Critiques peer projects effectively</td>
<td>Comments are sparse and unhelpful</td>
<td>Comments are made on a few areas of the report</td>
<td>Comments are made on each area of the report</td>
<td>Constructive and detailed comments are made on each area of the report</td>
</tr>
<tr>
<td>Knowledge: Critiques peer presentations effectively</td>
<td>one critique form contains comments of some kind</td>
<td>few critique forms contain meaningful comments</td>
<td>most critique forms contain some constructive and meaningful comments</td>
<td>all critique forms contain many constructive and meaningful comments</td>
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</table>

Presentation Assessment: 20 marks

<table>
<thead>
<tr>
<th>Category</th>
<th>Level 1 (50-59%)</th>
<th>Level 2 (60-69%)</th>
<th>Level 3 (70-79%)</th>
<th>Level 4 (80-100%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge: Presentation and question period show understanding of topic and data analysis</td>
<td>Demonstrates limited understanding of topic and/or data analysis.</td>
<td>Demonstrates some understanding of topic and/or data analysis.</td>
<td>Demonstrates understanding of topic and/or data analysis.</td>
<td>Demonstrates depth in understanding of topic and/or data analysis.</td>
</tr>
<tr>
<td>Communication: Oral presentation and use of technology convey ideas and findings</td>
<td>Presentation and use of technology convey ideas and findings to a limited degree</td>
<td>Presentation and use of technology convey ideas and findings to some degree</td>
<td>Presentation and use of technology convey ideas and findings</td>
<td>Presentation and use of technology convey ideas and findings to a great degree</td>
</tr>
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</table>
Helpful Data Websites

**Data for data's sake**

**QUANTITATIVE ENVIRONMENTAL LEARNING PROJECT**
QELP – Function related data (Mauna Loa CO₂) [http://www.seattlecentral.org/qelp/Data.html](http://www.seattlecentral.org/qelp/Data.html)

DASL – Story related data (Smoking & Cancer)
[http://lib.stat.cmu.edu/DASL/](http://lib.stat.cmu.edu/DASL/)
Actual Cancer Story

.KeyPress – Fathom Data links
[http://www.keypress.com/x4138.xml](http://www.keypress.com/x4138.xml)
Actual Data from the book: [http://www.keycollege.com/ws/](http://www.keycollege.com/ws/)

Environment Canada: [www.ec.gc.ca](http://www.ec.gc.ca)
Transport Canada: [www.tc.gc.ca](http://www.tc.gc.ca)
Website Credibility: [http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html](http://www.lib.berkeley.edu/TeachingLib/Guides/Internet/Evaluate.html)
Fedstats: [www.fedstats.gov](http://www.fedstats.gov)
Baseball Stats: [http://toronto.bluejays.mlb.com](http://toronto.bluejays.mlb.com)
Science Data Files: [http://www.statsci.org/datasets.html](http://www.statsci.org/datasets.html)
Online Data Sets: [http://mathforum.org/library/topics/data_sets/](http://mathforum.org/library/topics/data_sets/)

**Data that is Live (or close to it)**

The Landmark Project – Earthquake data

Nationmaster (auto exports)
Passenger car exports:
[http://www.nationmaster.com/graph/eco_wor_tra_exp_pas_car_etc-trade-exports-passenger-cars-etc](http://www.nationmaster.com/graph/eco_wor_tra_exp_pas_car_etc-trade-exports-passenger-cars-etc)
Data that is Different

10x10 – an interesting website that arranges the most popular news stories by image. http://www.tenbyten.org/10x10.html

Word Count – These are the 86,800 most popular words based on a 100 million word sampling of words in print and speech. http://www.wordcount.org/main.php

Indexed - interesting use of Venn diagrams and other graphs http://thisisindexed.com/

Data that shows a point

Strong correlation does not always mean linear http://hven.swarthmore.edu/observing/anscombe.html

Data that is Offline

Magazine adds – No link here, just the idea that you can collect information on how many adds are in each magazine along with price, total number of pages, and type.

Wired – This magazine about technology has a monthly section that usually highlights some sort of technology data in a unique way.

Data from Entertainment


Big Champagne – This site tracks music downloads. It’s good for summary stats, not for raw data. http://www.bigchampagne.com/

Movie attendance http://www.showbizdata.com/
Box office Adjuster http://boxofficemojo.com/about/adjuster.htm