MDM4U Culminating Project

The main focus of this project is for you to gather, organize, and analyze secondary and/or primary data. Your study will include relevant descriptive statistics that you have learned about in this course. Complete each of the following tasks independently or with a partner:

Task 1: Creating a Thesis

This thesis question must aim to solve a significant problem using large amounts of real data. This thesis question will be the foundation for the research you complete. Make sure to review section *2.1 – Developing a Thesis* to help you understand the criteria of a good thesis question.

Task 2: Designing your Study

- **Hypothesis** – What do you expect to find?
- Define the **population** and describe the **characteristics** of the population (e.g. all players in the NBA that played at least 70 games during the 2006-07 regular season).
- Define the **sample** you will be using (e.g. all players from Raptors and Warriors that played at least 70 games in 2006-07) and describe the sampling method used (even if it is non-random, mention that and explain why you did that).
- Define the **independent variables** (e.g. points per game in 2006-07 NBA regular season, rebounds per game in 2006-07 NBA regular season)
- Define the **dependent variables** (e.g. player salary).
- Make a plan for what graphs and numerical calculations you could use to answer your thesis question

Task 2.5: Design your Survey (only if you are collecting primary data)

- Create a useful survey that uses at least 3 different question types
  - Use either a paper survey or www.surveymonkey.com to do an online survey
- Make sure the survey looks professional and have me approve it
- Have a plan for what summary tables you are going to make from the data and what graphs you will make with the tables

Task 3: Collecting and Organizing Data

You must collect a sufficient amount of secondary and/or primary data to help you answer your thesis question. One table of data is not enough. It may be helpful to break your thesis in to sub-questions and then collect data to help answer each sub-question. Read through the rest of the project requirements to help determine how much data will be necessary. Some places that students often obtain secondary data from are as follows:

   a. Professional sports websites (www.nhl.com)
   b. Statistics Canada: www.statcan.ca
   c. Nation Master www.nationmaster.com

You then need to organize your data in to tables using some type of spreadsheet software (excel, numbers, libre, google sheets). **All organized tables of raw data need to be included in your final report.**

If you used a survey to collect primary data, you need to record the results from EVERY completed survey in an organized table.

Task 4: Analyzing the Data

For **each sub-question** identified, use the statistics we learned in class to **describe the data** or find **trends/relationships**. Only use those that are **relevant**. You are required to make a minimum of three graphical displays of data and calculate a minimum of three numerical statistics.

(a) Graphical Representations (you must include at least 3)

- Scatter plots (this should be included in every project as you will be finding many relationships)
- Bar graph / relative frequency polygon (freq. as a %)
- Histogram
- Boxplot
- Pie graph

(b) Numerical Statistics (you must include at least 3)

- Find measures of central tendency
- Find measures of spread
- Use linear regression and find the correlation coefficient, equation of a line of best fit
- Use non-linear regression and find the coefficient of determination, equation of a curve of best fit
- Relate your data to the Normal Distribution
- Use z-scores and z-tables to find some useful information.
- Predict the probability of certain events using your knowledge of counting techniques

Make sure it is clear which data table was used to create each graph and do each calculation.

Task 5: Analyzing your Graphs and Calculations

With each graph AND calculation, you must include **descriptive sentences**. This part is **very important** and often overlooked by students. Don't just provide numbers and statistics. Be sure to interpret them for the reader. What do the graphs and numbers tell you about your thesis question?

Task 6: Conclusion

- Draw **conclusions** that directly relate to your thesis.
- Note any **biases** that you believe occurred in your study.
- Make **suggestions for further/follow-up studies** or any **modifications** that would make to the current study.

Task 7: Bibliography

Web sites cited using APA format. General format/sequence:
Author. (Date published if available; n.d. (no date) if not). Title of article. Title of web site . Retrieved date. From URL.

You must hand in a final report as **one** organized file that includes evidence of all tasks being complete.

Checklist for final report

Section 1: Design of Study

What needs to be included:	✓
Title Page	
Thesis question	
Hypothesis	
Detailed description of population, sample, and sampling method	
Description of independent and dependent variables	

Section 2: Collection of Data

What needs to be included:	✓
Full organized tables of all data that was collected	
Blank survey (if you collected primary data)	

Section 3: Analysis of Data

What needs to be included:	✓
Minimum 3 graphs included; with each graph is the data table used and the sub-question it is analyzing	
Minimum 3 statistical calculations included; with each calculation is the data table used and the sub-question it is analyzing	
All graphs and calculations include descriptive sentences that relate them back to the thesis question	

Section 4: Conclusion

What needs to be included:	✓
Summarize how your graphs and numerical calculations provide an answer to your thesis question.	
Biases that were present in your study	
Modifications to current study and ideas for further studies on topic	
Bibliography in APA format (if secondary data was used)	

Report Rubric

Criteria	Level 0-1	Level 2	Level 3	Level 4	Total
Title Page	Title is not representative of the topic and/or missing 3 or more key components of a title page.	Title is lacking insight and/or missing 2 of the key components of a title page.	Title is okay or missing one of the key components of a title page.	Interesting title, includes name, course code, date and teacher's name. Includes a relevant picture or graphic	2
Problem Formulate appropriate thesis question	Demonstrates limited ability to formulate a clearly stated, measurable, and manageable research report problem	Demonstrates some ability to formulate a clearly stated, measurable, and manageable research report problem	Demonstrates considerable ability to formulate a clearly stated, measurable, and manageable research report problem	Demonstrates superior ability to formulate a clearly stated, measurable, and manageable research report problem	4
Design of Study Hypothesis Population vs. Sample Variables defined	Limited effectiveness	Some effectiveness	Considerable effectiveness	Highly effective	8
Data Collection Collected sufficient data to answer thesis question. Includes full table of collected data and organized summary tables of useful and relevant data in report. Survey used meets criteria of a good survey.	Limited effectiveness	Some effectiveness	Considerable effectiveness	Highly effective	12
Show knowledge of using graphs as a data analysis tool (at least 3 graphical summaries)	Shows limited ability to identify course data analysis tools relevant to project problem	Shows some ability to identify course data analysis tools relevant to project problem	Shows considerable ability to identify course data analysis tools relevant to project problem	Shows excellent ability to identify course data analysis tools relevant to project problem	10
Show knowledge of using numerical summaries as a data analysis tool (at least 3 numerical summaries)	Shows limited ability to identify course data analysis tools relevant to project problem	Shows some ability to identify course data analysis tools relevant to project problem	Shows considerable ability to identify course data analysis tools relevant to project problem	Shows excellent ability to identify course data analysis tools relevant to project problem	10
Analysis of graphs and calculations Comments thoroughly on the results. Results are presented in a logical and sequential manner. Descriptive sentences clearly link to the thesis question and help to answer it.	Limited effectiveness	Some effectiveness	Considerable effectiveness	Highly effective.	8
Use of mathematical terminology and notation	Uses terminology or notation inconsistently or incorrectly; makes major errors	Usually uses correct terminology and notation; may make minor errors	Consistently uses correct terminology and notation	Consistently uses correct terminology and notation which enhances the presentation	4
Mathematical content	Presents material with mathematical content that is incorrect or incomplete; major errors or omissions	Presents material with mathematical content that is generally correct and complete; may have minor errors or omissions	Presents material with mathematical content that is completely correct and complete	Presents material with mathematical content that is completely correct, complete and always pertinent to the report.	4
Conclusion Student restates and summarizes in a clear manner what the overall results of the work. Also notes biases and possible further studies.	Limited effectiveness	Some effectiveness	Considerable effectiveness	Highly effective.	4
Bibliography and Appendix Bibliography is accurate and uses APA formatting. Full data tables and blank survey included as an appendix at end of report.	Limited effectiveness	Some effectiveness	Considerable effectiveness	Highly effective.	2