# Markville Secondary School <br> Grade 12 Mathematics of Data Management <br> (MDM4U) 

## Course Description:

This course broadens students' understanding of mathematics as it relates to managing information. Students will apply methods for organizing large amounts of information; apply counting techniques, probability, and statistics in modelling and solving problems; and carry out a culminating project that integrates the expectations of the course and encourages perseverance and independence. Students planning to pursue university programs in business, the social sciences, or the humanities will find this course of particular interest.

## Prerequisite:

Functions and Relations, Grade 11, University Preparation, or Functions, Grade 11, University/College Preparation

## Text:

McGraw Hill Ryerson Mathematics of Data Management

Evaluation: Throughout the course students will be given many opportunities to demonstrate the extent of their achievement. All work submitted in this course will be assessed and evaluated using the standards set by the Ontario Ministry of Education. The final mark will be calculated as follows:

| Term Mark | $70 \%$ |
| :---: | :---: |
| Final Exam | $20 \%$ |
| Culminating Project <br> (written/presentation) | $10 \%$ |

The evaluation of all achievement demonstrated in this course is based on the following Ministry categories listed below. The term mark ( $70 \%$ of course grade) will be based on summative evaluations of the course expectations which may include unit tests, quizzes, performance tasks and/or journals. These evaluations will be assessed according to the achievement chart categories more or less as follows:

| Knowledge and <br> Understanding | Subject-specific content acquired in each course (knowledge), and the <br> comprehension of its meaning and significance (understanding). | $35 \%$ |
| :---: | :--- | :--- |
| Application | The use of knowledge and skills to make connections within <br> and between various contexts. | $30 \%$ |
| Communication | The conveying of meaning through various oral, written, and visual forms (e.g., <br> providing explanations of reasoning or justification of results orally or in writing; <br> communicating mathematical ideas and solutions in writing, using numbers and <br> algebraic symbols, and visually, using pictures, diagrams, charts, tables, graphs, <br> and concrete materials). | $15 \%$ |
| Thinking | The use of critical and creative thinking skills and/or processes, as follows: <br> - planning skills (e.g., understanding the problem, making a plan for solving <br> the problem) <br> - processing skills (e.g., carrying out a plan, looking back at the solution) <br> - critical/creative thinking processes (e.g., inquiry, problem solving) | $20 \%$ |

Throughout the course, formative assessments will be implemented to provide students with direct feedback on their progress and learning. These assessments and the resulting feedback are designed to improve student learning but will not be used in the calculation of the final mark.

## Unit 1: Counting Techniques

## Part A: Permutations \& Organized Counting

| Day | Lesson | Expectations | Homefun |
| :---: | :---: | :---: | :---: |
| 1 | Introduction to Course <br> - Course outline <br> - Student info sheet <br> - An Unusual Incident <br> - Let's Start Counting Activity |  |  |
| 2 | Organized Counting 4.1 <br> - Fundamental Counting Principle <br> - Additive Counting Principle | A2.3 | $\begin{aligned} & \text { p.229 \#1, 5, 6, 7, 9, 10, } \\ & 12,13,14,15,18 a b, \\ & 20 a, 23 \end{aligned}$ |
| 3 | Factorial Notation <br> - Basic Factorials |  | Handout |
| 4 | Permutations 4.2 | A2.2 | p. 239 \#1-15 (not \#5, 12) |
| 5 | Permutations with some Identical Elements 4.3 |  | $\begin{aligned} & \text { p. } 245 \text { \#1-7, 8a, 10-13, } \\ & 16 \end{aligned}$ |
| 6 | Review |  | $\begin{aligned} & \hline \text { p. } 260 \# 1-10 \\ & \text { p. } 261 \text { \#1-6 } \end{aligned}$ |
| 7 | Summative Quiz |  |  |

## Part B: Combinations

| Day | Lesson | Expectations | Homefun |
| :---: | :--- | :--- | :--- |
| 1 | Venn Diagrams 5.1 <br> $\bullet \quad$ Principal of inclusion and Exclusion 2 sets |  | p.271 \#1-5, 7, 9 |
| 2 | Venn Diagrams 5.1 <br> $\bullet \quad$ Principal of inclusion and Exclusion 3 sets |  | p.271 \#6 back of <br> handout |
| 3 | Combinations 5.2 | A2.2 | p.279 \#1ace, 2ab, 3-7, <br> $8 \mathrm{la}, 9,11-13, ~ 16-18, ~$ <br> 20 bc |
| 4 | Combinations 5.2 |  | p.286 \#1-13, 16 |
| 5,6 | Culminating Project Part 1 - An EXCELIent Exercise |  | Handout |
| 7 | Combinations \& Venn Diagrams Quiz (half period) <br> Culminating Project Part 2 - Evaluating Internet <br> Resources |  | 4 letter words <br> EINSTEIN (354) <br> MATHEMATICS(2454) <br> MISSISSIPPI (176) |
|  |  |  | 5 letter word <br> COCOON (60) |


| 9/10 | Pascal's Triangle 4.4 \& 4.5 <br> •Do investigation (top of p.248) <br> $\bullet$ <br> Do investigation (bottom of p.254) <br> 11 Review | A2.4 | p.251 \#1-5, 7a (Ans.33) <br> p.256 \#1-7a |
| :---: | :--- | :--- | :--- |
| 12 | Summative Quiz - Combinations |  | Combinations \& Venn <br> diagrams (Moodle) |
| 13 | Review |  |  |
| 14 | Cullminating Project Part 3 - Census at School: <br> Getting Ready/Collecting the Data |  |  |
| 15 | Perms \& Combs Test (Chapter 4 and 5) |  |  |

## Unit 2: Statistics

Organization of Data for Analysis \& Statistical Analysis

## Part A: One Variable Statistics

| Day | Lesson | Expectations | Homefun |
| :---: | :---: | :---: | :---: |
| 1 | Data Analysis with Graphs 2.1 |  | p. 101 \#1-5, 7, 8, 11, 12 |
| 2-3 | Culminating Project Part 3-Continue Census at School: Bar Graphs \& Circle Graphs |  |  |
| 4 | Sampling Techniques 2.3 <br> Simple Random Sample, Systematic Sample, Stratified <br> Sample, Cluster Sample, Multi-Stage Sample, Voluntary <br> Response Sample, Convenience Sample | C2.1, C2.2 | p. 117 \#1-4, 8, 9 |
| 5 | Data Collection Methods | C2.1 | Ptask - Designing a Questionnaire |
| 6 | Bias in surveys 2.4 <br> Sampling Bias, Non-Response Bias, Measurement <br> Bias, Response Bias | C2.3 | p.123 \#1-6, 8 |
| 7 | Culminating Project: Selecting a Topic Lesson |  |  |
| 8 | Measures of central tendency 2.5 <br> - Mean, median, mode <br> - Grouped data | D1.1 | p. 133 \#1-7, 9, 11, 12 |
| 9 | Measures of Spread 2.6 <br> - Range, Calculate and interpret interquartile ranges, <br> - Box and whisker Plots | D1.1 | p. 148 \#1-3, 6ab, 9a, 1013 |
| 10 | Measures of Spread 2.6 <br> - Standard deviation and variance with or without using the technologies | D1.1 | p. 148 \#4, 5, 6cd, 7,8, 9bcd, 14 |
| 11 | Summative Quiz - One Variable Statistics |  |  |
| 12 | Culminating Project - Selecting a Topic: Project Proposal Sheet |  |  |
| 13 | Review |  |  |
| 14 | ONE VARIABLE STATS TEST |  |  |

## Part B: Two Variable Statistics

| Day | Lesson | Expectations | Homefun |
| :---: | :---: | :---: | :---: |
| 1 | Scatter Plots and Linear Correlation 3.1 <br> - Define Correlation coefficient | D2.1 | p. 168 \#1bcd, 2ade, 4-6, 10, 11 |
| 2 | Linear Regression 3.2 (time series) <br> - Investigation on p. 171 | D2.3, D2.4 | p. 180 \#1,2,5,6,8,9 |
| 3 | Culminating Project Part 4 Census at School: Scatterplots \& Linear Regression |  |  |
| 4 | Non-Linear Regression | D2.3 | $\begin{array}{\|l\|} \hline \text { p. } 191 \text { \#1, 2-5, } 7 \text { (use } \\ \text { EXCEL for all but \#1) } \\ \hline \end{array}$ |
| 5 | Cause and Effect 3.4 | D2. 2 | p. 199 \#1-8, 10, 11 |
| 6 | Critical Analysis 3.5 |  | p.209-11 \#1-6, 8 |
| 7 | Misuses of Statistics in Advertising \& the Media |  | PTask - Poster |
| 8 | Summative Quiz - Two Variable Statistics |  |  |
| 9-11 | Culminating Project Part 5 |  |  |
| 12 | Review |  | $\begin{aligned} & \text { p. } 212 \# 1-4,5 a, 6 a, \\ & 7-13 \end{aligned}$ |
| 13 | Culminating Project Part 5 - Peer Critique Day |  |  |
| 14 | TWO VARIABLE STATS TEST |  |  |

## Unit 3: Probability

| Day | Lesson | Expectations | Homefun |
| :---: | :--- | :--- | :--- |
| $1-4$ | Culminating Project Part 6 - Background \& Argument |  |  |
| 5 | Introduction to Probability <br> $\bullet$ Vocabulary (sample space, outcomes, trials, events, <br> $\bullet$ <br> Types of probabilities (theoretical, experimental, <br> subjective) | A1.1, A1.2, A1.3, A1.4 | Handout <br> p.312 \#1, 2, 4-7, 10, <br> $11,12 \mathrm{~b}$ |
| 6 | Odds 6.2 | A2.5 | p.318 \#1-10 (not 7), <br> 11 ab |
| 7 | Probability using counting techniques 6.3 | A1.6 | Handout <br> p. 324 \# 1-9 (not 7) |
| 8 | Dependent and Independent events 6.4 | Handout <br> p.334 \#1-7, 9, 10, 16 |  |


| 9 | Mutually Exclusive/Non Mutually Exclusive Events 6.5 | A1.5 | Handout <br> P. 340 \#1-3, 5-7, 13, 15 |
| :---: | :--- | :--- | :--- |
| 10 | Summative Quiz - Probability |  |  |
| 10 | Culminating Project Part 6 - last day to hand in for <br> feedback |  |  |
| 11 | Review |  |  |
| 12 | Probability Test |  |  |

## Culminating Project Part 7 - Final Report \& Presentation Preparation [5-6 days]

It is expected that students will continue to work on Part 7 on their own time after this point. Part 7 will be due BEFORE the end of the Probability Distribution Unit.

## Unit 4 Probability Distributions and the Normal Distribution

| Day | Lesson | Expectations | Homefun |
| :---: | :---: | :---: | :---: |
| 1 | Introduction to Probability Distribution 7.1 <br> - Define Random Variables <br> - Create a probability distribution table. <br> - Expected Value <br> - Discrete, continuous, uniform | B1.1, B1.2, B1.3 | $\begin{aligned} & \text { Handout } \\ & \text { p. } 374 \text { \#1, 2, 3c, } 4 \text {, } \\ & 7-9,12,15 \end{aligned}$ |
| 2 | Binomial Distribution 7.2 <br> - Define Bernoulli trials (with replacement) <br> - Probability area graph (histogram) | B1.4 | Handout <br> p. 385 \#1, 2, 3ab, 5, 7, <br> 8, 10, 13adef |
| 3 | Geometric Distribution 7.3 |  | $\begin{aligned} & \text { p. } 394 \text { \#1, 2a, 3, 4, 7, } \\ & 11,12 \end{aligned}$ |
| 4 | Hyper-geometric Distribution 7.4 <br> - Repeated Trials without replacement | B1.5 | Handout p. 404 \#1-3, 8-12, 15 |
| 5 | Intro to Normal Distributions (Nelson Resource section 3.4) | B2.1-2.8 | \#1, 2, 3a, 4, 6, 8, 9 |
| 6 | Applying z-scores to Normal Distributions (Nelson Resource section 3.5) | B2.1-2.8 | \#1ac, 2-8, 10, 11, 13 |
| 7 | Normal Approximations to the Binomial Distribution (Nelson Resource section 5.4) | B2.1-2.8 | $\begin{aligned} & \text { \#1ace, 2ef, 3b, 5b, 6, } \\ & 7-10,12 \end{aligned}$ |
| $\because$ | $\text { PART } 7 \text { DUE }$ |  |  |
| 10 | Review |  |  |
| 11 | Summative Quiz - Probability Distributions |  | $\begin{aligned} & 8.2 \text { p. } 430 \# 1-10 \\ & 8.4 \text { p. } 449 \# 1-10 \\ & \hline \end{aligned}$ |
| 12-14 | GAME FAIR PREP DAYS |  |  |
| 15 | Probability Distributions Test |  |  |

## Unit 5 Culminating Investigation/Presentations

| Day | Lesson | Expectations |
| :---: | :--- | :--- |
| 1 | Game Fair Prep Day/Try your game today in class | E1.1-1.5, E2.1 |
| 2 | Game Fair Day/Invite other classes to play |  |
| $3-4$ | Presentation Prep Day | E2.2 - 2.4 |
| $5-8$ <br> (approx) | Presentations |  |

## SPECIFIC EXPECTATIONS

1. Designing and Carrying Out a Culminating Investigation

By the end of this course, students will:
1.1 pose a significant problem of interest that requires the organization and analysis of a suitable set of primary or secondary quantitative data (e.g., primary data collected from a student-designed game of chance, secondary data from a reliable source such as E-STAT), and conduct appropriate background research related to the topic being studied
1.2 design a plan to study the problem
1.3 gather data related to the study of the problem and organize the data with or without technology
1.4 interpret, analyse, and summarize data related to the study of the problem with or without technology
1.5 draw conclusions from the analysis of the data, evaluate the strength of the evidence, specify any limitations of the conclusions, and suggest follow-up problems or investigations
2. Presenting and Critiquing the Culminating Investigation

By the end of this course, students will:
2.1 compile a clear, well-organized, and detailed report of the investigation
2.2 present a summary of the culminating investigation to an audience of their peers within a specified length of time, with technology (e.g. presentation software) or without technology
2.3 answer questions about the culminating investigation and respond to critiques
2.4 critique the mathematical work of others in a constructive manner
*This culminating investigation allows students to demonstrate their knowledge and skills from this course by addressing a single problem on probability and statistics or by addressing two smaller problems, one on probability and the other on statistics.

## 2-3 days (minimum) for final exam preparation

