Ontario eSecondary School
Course Outline
2022-2023

Ministry of Education Course Title: Mathematics of Data Management, University Preparation	
Ministry Course Code: MDM4U	
Course Type: University Preparation	
Grade: 12	
Credit Value: 1.0	
Prerequisite(s): Functions, Grade 11, University Preparation	
Department: Mathematics	
Course developed by: **Marieta Angjeli**	**Date: May 1st, 2017** **Revised: May 2024**
Length: **One Semester**	**Hours:** **110**
This course has been developed based on the following Ministry documents: 1. *The Ontario Curriculum, Grades 11 and 12 Mathematics, Revised 2007* 2. Growing Success: Assessment, Evaluation, and Reporting in Ontario Schools (2010) 3. *Learning for All (2013)*	

COURSE DESCRIPTION/RATIONALE

This course broadens students' understanding of mathematics as it relates to managing data. Students will apply methods for organizing and analysing large amounts of information; solve problems involving probability and statistics; and carry out a culminating investigation that integrates statistical concepts and skills. Students will also refine their use of the mathematical processes necessary for success in senior mathematics. Students planning to enter university programs in business, the social sciences, and the humanities will find this course of particular interest.

OVERALL CURRICULUM EXPECTATIONS

Unit 1

By the end of this course, students will solve problems involving the probability of an event or a combination of events for discrete sample spaces. Students will solve problems involving the application of permutations and combinations to determine the probability of an event.

Unit 2

By the end of this course, students will identify a broad range of options for present and future learning, work, and community involvement. Students will demonstrate an understanding of discrete probability distributions, represent them numerically, graphically, and algebraically, determine expected values, and solve related problems from a variety of applications. Students will demonstrate an understanding of continuous probability distributions, make connections to discrete probability distributions, determine standard deviations, describe key features of the normal distribution, and solve related problems from a variety of applications.

Unit 3

By the end of this course, students will demonstrate an understanding of the role of data in statistical studies and the variability inherent in data, and distinguish different types of data. Students will describe the characteristics of a good sample, some sampling techniques, and principles of primary data collection, and collect and organize data to solve a problem.

Unit 4

By the end of this course, students will analyse, interpret, and draw conclusions from one-variable data using numerical and graphical summaries. Students will analyse, interpret, and draw conclusions from two-variable data using numerical, graphical, and algebraic summaries; Students will demonstrate an understanding of the applications of data management used by the media and the advertising industry and in various occupations.

Unit 5

By the end of this course, students will 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. Students will communicate the findings of a culminating investigation.

COURSE CONTENT

Unit	*Length*
Unit 1: Counting and Probability	30 hours
Unit 2: Probability Distributions	25 hours
Unit 3: Organization of Data for Analysis	18 hours
Unit 4: Statistical Analysis	25 hours
Unit 5: Culminating Data Management Investigation	10 hours
Final Exam	2 hours
Total	**110 hours**

UNIT DESCRIPTIONS

Unit 1- Counting and Probability
In this unit students will solve probability problems involving discrete sample spaces and problems using counting principles.

Unit 2 - Probability Distribution
In this unit students will explore and understand probability distributions for discrete random and for continuous random variables

Unit 3 - Organization of Data for Analysis
In this unit students will explore and understand data concept and collect and organize data.

Unit 4 - Statistical Analysis
In this unit students will analyse one-variable data and two-variable data. In addition, students will evaluate the validity of the study.

Unit 5 - Culminating Data Management Investigation
In this unit students will design and carry out a culminating investigation. In addition students will be presenting and critiquing the culminating investigation.

TEACHING AND LEARNING STRATEGIES

In this course, students will experience the following activities.

Presentations with embedded videos are utilized to outline concepts, explain theory with the use of examples and practice questions, and incorporate multi-media opportunities for students to learn more (e.g. online simulations, quizzes, etc.).

End of unit conversations and Poodlls are opportunities for students to express their ideas, problem solving, and thought processes with a teacher who provides timely feedback.

Reflection is an opportunity for students to look back at concepts and theories with new eyes, to relate theory to practice, and to align learning with their own values and beliefs.

Discussions with the instructor are facilitated through video conferencing, discussing the concepts and skills being studied. This enables two-way communication between the student and the instructor, to share ideas and ask questions in dialogue. This also helps to build a relationship between the student and instructor.

Instructor demonstrations (research skills, etc.) are opportunities for the instructor to lead a student through a concept or skill through video conferencing, videos, or emailing with the student.

Discussion forums are an opportunity for students to summarize and share their ideas and perspectives with their peers, which deepens understanding through expression. It also provides an opportunity for peer-to-peer feedback.

Practical extension and application of knowledge are integrated throughout the course. The goal is to help students make connections between what they learn in the classroom and how they understand and relate to the world around them and their own lives. Learning becomes a dynamic opportunity for students to be more aware that their learning is all around them and enable them to create more meaning in their lives.

Individual activities/assignments assessments are completed individually at a student's own pace and are intended to expand and consolidate the learning in each lesson. Individual activities allow the teacher to accommodate interests and needs and to assess the progress of individual students. For this reason, students are encouraged to discuss IEPs (Individual Education Plans) with their teacher and to ask to modify assessments if they have a unique interest that they feel could be pursued in the assessment. The teacher plays an important role in supporting these activities by providing ongoing feedback to students, both orally and in writing.

Research is an opportunity to apply inquiry skills to a practical problem or question. Students perform research to gather information, evaluate quality sources, analyse findings, evaluate their analysis, and synthesize their findings into conclusions. Throughout, students apply both creative thinking and critical thinking. New questions are also developed to further learning.

Writing as a learning tool helps students to think critically about course material while grasping, organizing, and integrating prior knowledge with new concepts. Good communication skills are important both in and out of the classroom.

Virtual simulations are interactive websites that provide students with an opportunity to ask questions, relate variables, and examine relationships.

Diagrams are visual representations of mathematical ideas and concepts. They provide another perspective to organize ideas. Visuals are thought to promote cognitive plasticity - meaning, they can help us change our minds or help us to remember an idea.

Graphs and charts are visual representations of math concepts and analysis. This helps us to see the relationships within and between sets of data.

Tables involve organizing information in terms of categories (rows and columns). This helps us to understand the relationships between ideas and data, as well as highlight trends.

Practice problems provide students with a scenario/problem to solve by applying concepts and skills learned in a context. This helps students to understand the relevance of their learning.

ASSESSMENT, EVALUATION, AND REPORTING

Assessment: The process of gathering information that accurately reflects how well a student is achieving the identified curriculum expectations. Teachers provide students with descriptive feedback that guides their efforts towards improved performance. These assessments are not for marks.

- In assessment for learning (AFL), teachers provide students with descriptive feedback and coaching for improvement.
- In assessment as learning (AAL), teachers help students develop their capacity to be independent, autonomous learners who are able to set individual goals, monitor their own progress, determine next steps, and reflect on their thinking and learning.

Evaluation: Assessment of Learning (AOL) focuses on evaluation which is the process of making a judgement about the quality of student work on the basis of established criteria over a limited, reasonable period of time.

Reporting: Involves communicating student achievement of the curriculum expectations and Learning Skills and Work Habits in the form of marks and comments as determined by the teacher's use of professional judgement.

STRATEGIES FOR ASSESSMENT

Assessment practices can nurture students' sense of progress and competency and information instruction. Many diagnostic tools, e.g. checklists and inventories, are used at regular intervals throughout the units to encourage students' understanding of their current status as learners and to provide frequent and timely reviews of their progress. Assessment of student acquisition of listening and talking, reading and viewing and writing skills also occurs regularly through unobtrusive teacher observation and conferencing.

Units conclude with performance tasks. Teachers are encouraged to share goals with students early in the course and to connect unit learning experiences frequently and explicitly with big ideas, overall expectations, and performance tasks, i.e. check bricks; teacher-adapted generic rubrics available in many sources, including the *Ontario Secondary School Literacy Course (OSSLC) Profile,* so that they are more task-specific. The teacher might ask: "What does the criteria look like for this particular task?" Or "What does limited effectiveness look

like?" The teacher could involve students in the discussion or creation of rubrics, and teach students to use rubrics as a learning tool that can support the writing process and practice.

ASSESSMENT ACTIVITIES

- ❑ Discussion forums
- ❑ Diagnostic tests
- ❑ Completed templates and graphic organizers
- ❑ Reflections
- ❑ Tests and quizzes
- ❑ Graphs - plotting and analyzing
- ❑ Drawings / diagrams / sketches / schematics - creating, labeling, and analyzing
- ❑ Problem solving calculations
- ❑ Lab reports
- ❑ Simulation, lab, and case study worksheets
- ❑ Research projects and reports
- ❑ End of unit conversations (Google Meets)
- ❑ Final exam

EVALUATION

The final grade will be determined as follows:

- ❑ 70% of the grade will be based on evaluation conducted throughout the course. This portion of the grade should reflect the student's most consistent level of achievement throughout the course, although special consideration will be given to more recent evidence of achievement.
- ❑ 30% of the grade will be based on a final evaluation administered at or towards the end of the course. This evaluation will be based on evidence from one or a combination of the following: an examination, a performance, an essay, and/or another method of evaluation suitable to the course content. The final evaluation allows the student an opportunity to demonstrate comprehensive achievement of the overall expectations for the course.

  (*Growing Success: Assessment, Evaluation and Reporting in Ontario Schools*. Ontario Ministry of Education Publication, 2010 p.41)

Weightings	
Course Work	**70**
Knowledge/Understanding (K)	17.5
Thinking/Inquiry (T)	17.5
Communication (C)	17.5
Application (A)	17.5
Final Evaluations	**30**
Culminating Project (2.5K, 2.5T, 2.5C, 2.5A)	10
Final Exam (6.3K, 4.3T, 5.4C, 4A)	20

TERM WORK EVALUATIONS (70%)

Evaluation Item	Description	Category	Relative Weight
Unit 1	Combination Quiz- Students will be evaluated on their knowledge of the lesson concepts thus far.	K, T, C, A	18
Unit 1	Unit 1 Culminating Project- Students will demonstrate their learning of counting and probability concepts by completing the problem sets.	K, T, C, A	
Unit 1	Unit 1 Test- Students will write a proctored test evaluating their understanding and application of counting and probability concepts.	K, T, C, A	
Unit 2	Unit 2 Quiz- Students will be assessed on their knowledge and application of Binomial Distribution in a timed, multiple choice quiz.	K, T, C, A	17
Unit 2	Culminating Project- Students will work through a project of problem sets to demonstrate their learning of the unit concepts. This will be followed by a conversation with their teacher to orally assess their growth in learning.	K, T, C, A	
Unit 2	Unit Test- Students will write a proctored test evaluating their understanding and application of Probability Distributions.	K, T, C, A	
Midpoint of the course			
Unit 3	Quiz- Students will be assessed on their knowledge and application of Bias and Surveys in a timed, multiple choice quiz.	K, T, C, A	17
Unit 3	Culminating Project- Students will work through a project of problem sets to demonstrate their learning of the unit concepts. This will assess their understanding and application of Sampling Bias. This will be followed by a conversation with their teacher to orally assess their growth in learning.	K, T, C, A	
Unit 3	Unit Test- Students will write a proctored test evaluating their understanding and application of Organization of Data for Analysis.	K, T, C, A	

Unit 4	Quiz- Students will be assessed on their knowledge and application of Normal Distribution in a timed, multiple choice quiz.	K, T, C, A	18
Unit 4	Culminating Project- Students will work through a project of problem sets to demonstrate their learning of the unit concepts. This will assess their understanding and application of Regression and Statistics of Two Variables. This will be followed by a conversation with their teacher to orally assess their growth in learning.	K, T, C, A	
Unit 4	Unit Test- Students will write a proctored test evaluating their understanding and application of Statistical Analysis.	K, T, C, A	

FINAL EVALUATIONS (30%)

Evaluation Item	Description	Category	Weight
Final Project	Students will perform a research-based project, incorporating what they have learned from units 1 through 4 with a focus on application of knowledge to read-world situations and financial literacy.	K, T, C, A	10
Final Exam	The final exam will be a proctored and written examination and assessment of all course concepts and curriculum expectations.	K, T, C, A	20

AFL/AAL/AOL Tracking Sheet

Unit 1: Counting and Probability (30 hours)

AAL	**AFL**	**AOL**
● Lesson 1.2 Notes and Fundamental Counting Techniques Problem Set Assignment ● Lesson 1.6 Notes and Dependent, Independent, and Mutually Exclusive Events Problem Set Assignment ● Unit 1 Discussion Forum ● Unit 1 Discussion Forum 2 (Peer Reflection)	● Gizmos: Theoretical and Experimental Probability ● Lesson 1.1 Notes and Intro to Probability Problem Set Assignment ● 1.1 Probability Quiz ● FCP and ACP Quiz ● Gizmos: Permutations ● Lesson 1.3 Notes and Permutations Problem Set Assignment ● 1.3 Permutations Quiz ● Gizmos: Combination - order not important ● Lesson 1.4 Notes and Combinations Problem Set Assignment ● Lesson 1.5 Notes and Pascal's Triangle Problem Set Assignment ● 1.5 Pascal's Triangle Quiz ● Gizmos: Independent or dependent event ● 1.6 Dependent and Independent Quiz ● 1.6 Mutually Exclusive Quiz ● Unit 1 End of Unit 1 Feedback	● 1.4 Combinations Quiz ● Unit 1 Culminating Assignment ● Unit 1 Question Response Interactive Content (Interview) ● Unit 1 Test

Unit 2: Probability Distributions (25 hours)

AAL	AFL	AOL
● Unit 2 Discussion Forum ● Note-taking template ● Lesson 2.2 Notes and Binomial Distribution Problem Set Assignment ● Unit 2 Discussion Forum 2 (Peer Reflection) ● Unit 2 Review	● Lesson 2.1 Notes and Random Discrete Probability Distribution and Expected Value Problem Set Assignment ● 2.1 Probability Distributions and Expected Value Quiz ● Gizmos: Binomial distribution ● Lesson 2.3 Notes and Hypergeometric Distribution Problem Set Assignment ● 2.3 Hypergeometric Distribution Quiz ● Unit 2 End of Unit Feedback	● 2.2 Binomial Distribution Quiz ● Unit 2 Culminating Assignment ● Unit 2 Question Response Interactive Content (Interview) ● Unit 2 Test

Unit 3: Organization of Data for Analysis (18 hours)

AAL	AFL	AOL
● Unit 3 Discussion Forum ● Lesson 3.3 Notes and Histograms and Displaying and Organizing Data Problem Set Assignment ● Unit 3 Discussion Forum 2 (Peer Reflection)	● Gizmos: Population vs Sample ● Lesson 3.1 Notes and Types of Data and Sampling Problem Set Assignment ● 3.1 Types of Data and Sampling Quiz ● Lesson 3.2 Notes and Bias and Surveys Problem Set Assignment ● Gizmos: Histogram ● Histograms Assignment ● Unit 3 End of Unit Feedback	● 3.2 Bias and Surveys Quiz ● Unit 3 Sampling Bias Project ● Unit 3 Question Response Interactive Content (Interview) ● Unit 3 Test

Unit 4: Statistical Analysis (25 hours)

AAL	AFL	AOL
● Unit 4 Discussion Forum ● 4.1 Measures of Central Tendency Quiz ● Lesson 4.2 Notes and Measures of Spread, Standard Deviation and Variance Problem Set Assignment ● Lesson 4.3 Notes and Normal Distribution Problem Set Assignment ● Lesson 4.5 Notes and Two Variable Statistics Problem Set Assignment ● Unit 4 Discussion Forum 2 (Peer Reflection)	● Gizmos:Mean, Median, and Mode ● Lesson 4.1 Notes and Measures of Central Tendency Problem Set Assignment ● Lesson 4.4 Notes and Quartiles and Percentiles Problem Set Assignment ● 4.4 Quartiles and Percentiles Quiz ● Gizmos: Correlation and Regression ● 4.5 Two Variable Data Quiz	● 4.3 Normal Distribution Quiz ● Unit 4 Culminating Assignment ● Unit 4 Test

Culminating Assessments (12 hours)

AOL
Culminating Project
Final Exam

CONSIDERATION FOR PROGRAM PLANNING

PLANNING PROGRAMS FOR STUDENTS WITH SPECIAL EDUCATION NEEDS

Classroom teachers are the key educators of students who have special education needs. They have a responsibility to help all students learn, and they work collaboratively with special education teachers, where appropriate, to achieve this goal. Special Education Transformation: The Report of the Co-Chairs with the Recommendations of the Working Table on Special Education, 2006 endorses a set of beliefs that should guide program planning for students with special education needs in all disciplines. Those beliefs are as follows: All students can succeed. Universal design and differentiated instruction are effective and interconnected means of meeting the learning or productivity needs of any group of students. Successful instructional practices are founded on evidence-based research, tempered by experience.

PROGRAM CONSIDERATIONS FOR ENGLISH LANGUAGE LEARNERS

Ontario schools have some of the most multilingual student populations in the world. The first language of approximately 20 percent of the students in Ontario's English language schools is a language other than English. Ontario's linguistic heritage includes several Aboriginal languages; many African, Asian, and European languages; and some varieties of English, such as Jamaican Creole. Many English language learners were born in Canada and raised in families and communities in which languages other than English were spoken, or in which the variety of English spoken differed significantly from the English of Ontario classrooms. Other English language learners arrive in Ontario as newcomers from other countries; they may have experience of highly sophisticated educational systems, or they may have come from regions where access to formal schooling was limited. When they start school in Ontario, many of these students are entering a new linguistic and cultural environment.

THE ROLE OF TECHNOLOGY IN THE PROGRAM

Information and communications technologies (ICT) provide a range of tools that can significantly extend and enrich teachers' instructional strategies and support students' language learning. ICT tools include multimedia resources, databases, Internet websites, digital cameras, and word-processing programs. Tools such as these can help students to collect, organize, and sort the data they gather and to write, edit, and present reports on their findings. Information and communications technologies can also be used to connect students to other schools, at home and abroad, and to bring the global community into the local classroom. Whenever appropriate, therefore, students should be encouraged to use ICT to support and communicate their learning.

ACCOMMODATIONS

Accommodations will be based on meeting with parents, teachers, administration and external educational assessment reports. The following three types of accommodations may be provided:

- ***Instructional accommodations:*** such as changes in teaching strategies, including styles of presentation, methods of organization, or use of technology and multimedia.
- ***Assessment accommodations:*** such as allowing additional time to complete tests or assignments or permitting oral responses to test questions.

Other examples of modifications and aids, which may be used in this course, are:

- Provide step-by-step instructions.
- Help students create organizers for planning writing tasks.
- Allow students to report verbally to a scribe (teacher/ student) who can help in note taking.
- Permit students a range of options for reading and writing tasks.
- Where an activity requires reading, provide it in advance.

- ❑ Provide opportunities for enrichment.