Course Outline

School Name:	KEEWAYTINOOK INTERNET HIGH SCHOOL
Department Name:	Mathematics

Ministry of Education Course Title: Mathematics of Data Management

Grade Level: 12

Ministry Course Code: MDM4U

Teacher's Name: Mary Anne F. Barrett

Developed by: Erik Tu   Date: January 2018

Revision Date: September 2022

Developed from:
Ontario Ministry of Education. (2007). *The Ontario curriculum, grades 11 and 12: Mathematics.* Toronto ON: Queen's Printer for Ontario.

Text: None

Prerequisite: MCR3U: Functions, Grade 11, University Preparation OR
                  MCF3M: Functions and Applications, Grade 11, University/College
                  Preparation

Credits: One

Length: 110 hours

Principal's Name: Angela Batsford-Mermans

Principal's Approval: *Angela Batsford-Mermans*

Approval Date: September 26, 2022

Course Description/Rationale

This course broadens students' understanding of mathematics as it relates to managing data. Students will apply methods for organizing and analyzing 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 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

Counting and Probability
• Solve problems involving the probability of an event or a combination of events for discrete sample spaces;
• Solve problems involving the application of permutations and combinations to determine the probability of an event.

Probability Distributions
• 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;
• 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.

Organization for Data Analysis
• Demonstrate an understanding of the role of data in statistical studies and the variability inherent in data, and distinguish different types of data;
• 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.

Statistical Analysis
• Analyze, interpret, and draw conclusions from one-variable data using numerical and graphical summaries;
• Analyze, interpret, and draw conclusions from two-variable data using numerical and graphical summaries;
• Demonstrate an understanding of the applications of data management used by the media and the advertising industry and in various occupations.

Culminating Data Management Investigation
• 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;
• Communicate the findings of a culminating investigation and provide constructive critiques of the investigations of others.

Course Content

Unit	Length
1. Discrete Probability Distributions	20 hours
2. Statistics of One Variable	20 hours
3. Statistics of Two Variables	20 hours
4. Combination and Permutation	20 hours
5. Continuous Probability Distribution	20 hours
6. Culminating Activities and Assessments	10 hours
Total	110 hours

Unit Descriptions

Unit 1 – Discrete Probability Distributions
In this unit students will solve problems involving the probability of an event or a combination of events for discrete sample spaces; 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. This unit provides an opportunity to begin choosing appropriate sampling methods for a study involving data collection within a First Nations community (student specific).

Unit 2 – Statistics with One Variable
This unit will focus on the analysis and presentation of one-variable data. Students will process raw data and develop the skills to summarize it in terms of central tendency, spread and distribution. Students will analyze, interpret, and draw conclusions from one-variable data using numerical and graphical summaries and explore methods of describing a single piece of data in the context of a wider data set. They develop the critical thinking skills necessary to interpret and assess the validity of secondary data and conclusions drawn from it.

Unit 3 – Statistics with Two Variables
Two-variable statistics are the basis for many decisions personally and as a society. Although most two variable statistical tests are beyond the scope of secondary school math, this unit will examine some of the basic topics in two-variable statistics. Two-variable statistics provide methods for detecting relationships between variables and for developing mathematics of these relationships. The visual pattern in a graph or plot can often reveal the nature of the relationship between two variables. In this unit students will analyse, interpret, and draw conclusions from two-variable data using numerical, graphical, and algebraic summaries.

Unit 4 – Combination and Permutation
Combination and Permutation is the branch of mathematics dealing with ideas and methods for counting, especially in complex situations. The techniques and mathematical logic for counting possible arrangements or outcomes are useful for a wide variety of applications. Students will investigate the concepts of combinations and permutations, solve problems involving the application of permutations and combinations to determine the probability of an event. They will consider situations in which each should be used, and develop the skills to be able to determine which is most appropriate. This unit provides opportunities to determine how many ways a given Chief and Council can be chosen from a given sample space.

Unit 5 – Continuous Probability Distributions
Students will gain an understanding of continuous distributions, and will investigate different shapes of distribution, considering situations that may generate them. Students will explore the normal distribution in detail, and investigate its many applications. Students will solve problems involving the probability of an event or a combination of events for continuous distribution; demonstrate an understanding of continuous probability distributions, represent them numerically, graphically, and algebraically, determine expected values, and solve related problems from a variety of applications, maintaining an awareness of the possibility of bias and misrepresentation, either deliberate or accidental. This unit provides an opportunity for students to design a quantitative data collection study that is relevant to their interests and life on a First Nations reserve and appropriate for this context.

Teaching/Learning Strategies

This course is organized into an eight-week series of lessons and activities that is presented to students in remote northern communities via the internet. The eighth week is used for course consolidation, review, and the final examination. Teacher and students communicate over the internet through timely activity feedback, emails, messages, video and audio calls. Classroom mentors assume the role of liaison between the teacher and student while also supporting a holistic approach to motivate, engage and support each individual student.

A variety of strategies will be used in the online delivery of this course. Some instructional strategies include:

- Electronic simulation activities
- Discussions boards and email
- Assessments with real-time feedback
- Interactive activities that engage both the student and the teacher in subject

Mathematical processes will form the heart of the teaching and learning strategies used:

- *Communicating*: To improve student success there will be several opportunities for students to share their understanding.
- *Problem solving*: Scaffolding of knowledge, detecting patterns, making and justifying conjectures, guiding students as they apply their chosen strategy, directing students to use multiple strategies to solve the same problem, when appropriate, recognizing, encouraging, and applauding perseverance, discussing the relative merits of different strategies for specific types of problems.
- *Reasoning and proving*: Asking questions that get students to hypothesize, providing students with one or more numerical examples that parallel these with the generalization and describing their thinking in more detail.
- *Reflecting*: Modeling the reflective process, asking students how they know.
- *Selecting Tools and Computational Strategies*: Modeling the use of tools and having students use technology to help solve problems.
- *Connecting*: Activating prior knowledge when introducing a new concept in order to make a smooth connection between previous learning and new concepts, and introducing skills in context to make connections between particular manipulations and problems that require them.
- *Representing*: Modeling various ways to demonstrate understanding, posing questions that require students to use different representations as they are working at each level of conceptual development - concrete, visual or symbolic, allowing individual students the time they need to solidify their understanding at each conceptual stage

Learning goals will be discussed at the beginning of each assignment and success criteria will be provided to students. The success criteria are used to develop the assessment tools in this course, including rubrics and checklists.

Evaluation

The final grade will be determined as follows (Ontario Ministry of Education, 2010):
- Seventy per cent 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 should be given to more recent evidence of achievement.
- Thirty percent 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 (p. 47).

Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation and reporting in Ontario schools*. Toronto ON: Queen's Printer for Ontario.

Type of Assessment	Category	Details	Weighting (%)

Term Work (70%)	Knowledge/ Understanding	Solve problems involving the probability of an event. Determine expected values, standard deviations, and describe key features of the normal distribution.		13
	Thinking	Solve problems involving the application of permutations and combinations. Distinguish different types of data and analyze data using numerical and graphical summaries;		19
	Communication	Represent probability numerically, graphically, and algebraically. Interpret, and draw conclusions using numerical and graphical summaries, and communicate findings.		19
	Application	Solve problems from a variety of applications. Demonstrate an understanding of the applications of data management used by the media and the advertising industry and in various occupations.		19
Final Evaluation (30%)	Culminating Activity (15%)	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; communicate the findings of a culminating investigation.	K/U	3
			T	4
			C	4
			A	4
	Exam (15%)	Written examination designed to cover all of the overall expectations of the course	K/U	3
			T	4
			C	4
			A	4
			TOTAL	**100**

Assessment/Evaluation Strategies

A variety of assessment and evaluation methods, strategies and tools are required as appropriate to the expectation being assessed. These include diagnostic, formative, and summative within the course and within each unit.

Assessment *for* learning and assessment *as* learning is obtained through a variety of means, including the following:
- Ongoing descriptive feedback;
- Self-assessment;
- Mentor observations;
- Conversations with student on a regular basis to verbalize observations, ask questions, and clarify understanding.

Evidence of student achievement (assessment *of* learning) is collected from various sources, including the following:
- Ongoing observations of most consistent work, with consideration given to most recent work;
- Conversations with students;
- Culminating activity;
- Exam.

The Ministry of Education's 2010 document, *Growing Success*, outlines the seven fundamental principles that guide best practice in the assessment and evaluation of students. KiHS teachers use practices that:

- are fair, transparent, and equitable for all students;
- support all students, including those with special education needs, those who are learning the language of instruction (English or French), and those who are First Nation, Métis, or Inuit;

- are carefully planned to relate to the curriculum expectations and learning goals and, as much as possible, to the interests, learning styles and preferences, needs, and experiences of all students;
- are communicated clearly to students and parents at the beginning of the course and at other points throughout the school year or course;
- are ongoing, varied in nature, and administered over a period of time to provide multiple opportunities for students to demonstrate the full range of their learning;
- provide ongoing descriptive feedback that is clear, specific, meaningful, and timely to support improved learning and achievement;
- develop students' self-assessment skills to enable them to assess their own learning, set specific goals, and plan next steps for their learning (p.6).

Resources

Ontario Ministry of Education. (n.d.). *Indigenous education strategy.*
http://www.edu.gov.on.ca/eng/aboriginal/

Ontario Ministry of Education. (2010). *Growing success: Assessment, evaluation and reporting in Ontario schools.* http://www.edu.gov.on.ca/eng/policyfunding/growSuccess.pdf

Ontario Ministry of Education. (2007). *The Ontario curriculum, grades 11 and 12: Mathematics.*
http://www.edu.gov.on.ca/eng/curriculum/secondary/math1112currb.pdf

Ontario Ministry of Education. (2016). *Ontario schools, kindergarten to grade 12: Policy and program requirements.* http://edu.gov.on.ca/eng/document/policy/os/index.html

Toulouse, P.R. (2016). What matters in Indigenous education: Implementing a vision committed to holism, diversity and engagement. https://peopleforeducation.ca/wp-content/uploads/2017/07/MWM-What-Matters-in-Indigenous-Education.pdf

Program Planning

This course is offered to Indigenous students living in isolated, northern Ontario communities. It is offered by qualified teachers in a blended classroom with a balance of academic, wellness, land-based learning, local language and culture to support the success of the whole student. This course uses the internet for instruction, demonstration and research. It utilizes a student-centered semi-virtual classroom which capitalizes on the strengths of internet program delivery to minimize the disadvantages of geographic remoteness.

Students are presented with 1320 minutes of instruction/activity via the internet over the period of one week. All lessons, assignments, questions and course material is presented in this manner, with approved print materials available as a student resource in each classroom. The student and instructor communicate via the internet, while a classroom mentor (a fully qualified teacher) assists students in completing tasks in a timely manner and provides support as required.

Indigenous and local content is used throughout the course to meet students' learning needs. Opportunities for outdoor activities and land-based learning are also incorporated and students are encouraged to use local knowledge in their products. Considerations are made to the learning preferences of the student population and lessons can be adjusted for individual students as required. Opportunities have been provided for students to apply ideas and concepts encountered in this course to their lives as an individual and as a member of a First Nations community. Teachers consult the Ontario Ministry of Education policies, guidelines and important initiatives when planning a comprehensive program in this area.