Name of school: Hanson International Academy

Department: Mathematics

Course Developer: Alex Ning, M.T.M

Development Date: July 2, 2007

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Course Title: Mathematics of Data Management

Grade: 12

Course Type: University Preparation

Course Code: MDM4U

Credit Value: 1

Curriculum Policy Document: Mathematics, The Ontario Curriculum, Grades 11 and 12, 2007 (Revised)

Prerequisite: Functions and Relations, Grade 11, University Preparation, or, Functions, Grade 11, University/College Preparation
1. Strategies and the Purposes of Assessments

1.2 The Achievement Chart

1.3 The Final Grade

Textbook

Resources

Program Planning Considerations
Course Description

This course broadens students’ understanding of mathematics as it relates to managing information and focuses on a culminating project throughout the course. Students will apply methods for organizing and analysing 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.

Successful completion of MDM4U prepares students for any undergraduate course in probability and statistics. Such courses are typically a requirement for students in their second year of most four-year undergraduate programs in both the sciences and humanities. In particular, students planning to pursue university programs in business, social sciences, or the humanities will find this course of relevance.

Learning Expectations, by strand

Organization of Data for Analysis

Overall Expectations
1.01 organized data to facilitate manipulation and retrieval;
1.02 solve problems involving complex relationships, with the aid of diagrams;
1.03 model situations and solve problems involving large amounts of information, using matrices.

Counting and Probability

Overall Expectations
2.01 solve counting problems and clearly communicate the results;
2.02 determine and interpret theoretical probabilities, using combinatorial techniques;
2.03 design and carry out simulations to estimate probabilities.
Statistics

Overall Expectations
3.01 demonstrate an understanding of standard techniques for collecting data;
3.02 analyze data involving one variable, using a variety of techniques;
3.03 solve problems involving the normal distribution;
3.04 describe the relationship between two variables by interpreting the correlation coefficient;
3.05 evaluate the validity of statistics drawn from a variety of sources.

Integration of the Techniques of Data Management

Overall Expectations
4.01 carry out a culminating project on a topic or issue of significance that requires the integration and application of the expectations of the course;
4.02 present a project to an audience and critique the projects of others.

Units: Title and Time

<table>
<thead>
<tr>
<th>Unit</th>
<th>Content</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit 1</td>
<td>Posing and Refining Questions</td>
<td>16 hours</td>
</tr>
<tr>
<td>Unit 2</td>
<td>Collecting Data and Finding Information</td>
<td>14 hours</td>
</tr>
<tr>
<td>Unit 3</td>
<td>Data Analysis</td>
<td>16 hours</td>
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<tr>
<td>Unit 4</td>
<td>An Introduction to Probability</td>
<td>18 hours</td>
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<tr>
<td>Unit 5</td>
<td>Probability Distributions and Prediction</td>
<td>20 hours</td>
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<tr>
<td>Unit 6</td>
<td>Solving Problems with Matrices, Graphs, and Diagrams</td>
<td>14 hours</td>
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<tr>
<td>Unit 7</td>
<td>Managing the Culminating Projects</td>
<td>12 hours</td>
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<tr>
<td>Total</td>
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<td>110 hours</td>
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</tbody>
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Unit Overviews

Unit 1: Posing and Refining Questions
Time: 16 hours

Unit Description

Students learn to find, retrieve, and organize credible data. They learn to pose significant questions through the use of journals and critique the work of others. Some activities are grouped to teach the expectations in an instructional activity followed by an assessment activity.

Using Fathom, students locate and retrieve large data sets from a variety of Internet sites, including Statistics Canada (E-STAT). Students answer questions using the data sets and consider and explore other factors that could influence the data. They use the analysis features of Fathom to analyse one- and two-variable data; analyses include cause-and-effect and regression. Students present their findings in small-group settings and critique the data analyses of others clearly, honestly, and with sensitivity. Students complete the unit by posing a problem, finding and analysing data, presenting their work on a poster, and critiquing the work of others.

Unit 2: Collecting Data and Finding Information
Time: 14 hours

Unit Description

Students learn how to search databases to locate data to answer significant questions. Students use the Internet effectively as a source of information. Students learn how to create database or spreadsheet templates to manipulate and retrieve data effectively. An emphasis is placed on understanding the need for a variety of sampling techniques. Students learn how to identify different types of bias, organize and summarize data from secondary sources. Pose a significant problem whose solution would require the organization and analysis of a large amount of data.

Unit 3: Data Analysis
Time: 16 hours

Unit Description
Students learn how to create histograms and bar graphs for quantitative information. They apply the common techniques used for analysing one- and two-variable data and they learn how to determine and interpret the measures of central tendency, deviation, and indices based on a data set. They learn how to use normal distribution to describe a population and to make comparisons between one value and the rest of the normal distribution.

**Unit 4: An Introduction to Probability**  
*Time: 18 hours*  

**Unit Description**  
Students develop skills for counting and determining probabilities using Venn diagrams, simulations, counting principles, factorial notation, permutations, and combinations. They consider experimental and theoretical probability.

**Unit 5: Probability Distributions and Prediction**  
*Time: 20 hours*  

**Unit Description**  
Students learn how to create theoretical probability distributions for events. They apply simulation to create probability distributions when it is not possible to find the theoretical probability distributions. Students learn how to analyze simulations that can be modeled using a binomial probability distribution. Students also learn how to determine the likelihood that a particular simulation is representative of a whole population.

**Unit 6: Solving Problems with Matrices, Graphs, and Diagrams**  
*Time: 14 hours*  

**Unit Description**  
Students learn how to represent simple and complex processes using diagrams. They learn how to solve network problems associated with scheduling events or with efficiently planning routes using simple graph theory. Students use matrices to organize and analyse data. Concepts and skills, understood and practised using small data sets, can be applied to large data sets with the use of technology.

**Unit 7: Managing the Culminating Projects**  
*Time: 12 hours*
Unit Description

Students prepare to successfully complete the culminating project outlined in the Integration of the Techniques of Data Management strand. Students engage in activities in which they apply several of the techniques/tools of the course to answer significant questions. Each activity could be viewed as a mini-project, providing the teacher with a vehicle for giving each student an opportunity to make a presentation to the class and have it critiqued by other students. The student gains valuable experience with these two expectations, which form part of the culminating project.

Teaching/Learning strategies

Teachers play a variety of roles, which are included as a facilitator, consultant, and instructor and employ a variety of strategies, including:

• a balance of whole-class, small-group, mixed-ability structured group, and individual instruction through student-centred and teacher-directed activities;

• the use of learning/performance tasks that are designed to link several expectations and give students occasion to demonstrate their optimal levels of achievement through the demonstration of skill acquisition, the communication of results, the ability to pose extending questions following an inquiry, and the determination of a solution to unfamiliar problems;

• the use of rich contextual problems, which provide students with opportunities to demonstrate learning and appreciate the need for new skills;

• the prompting, supporting, and challenging of individual students as well as the class as a whole;

• the use of technological tools and software, for example, graphing software, dynamic geometry software, and the use of the Internet in activities, demonstrations, and investigations to facilitate the exploration and understanding of mathematical concepts; approaches that accommodate multiple learning styles, for example, provision of verbal and written instructions, inclusion of hands-on activities to address the needs of verbal vs. non-verbal learners;

• accommodations and extension activities to meet the needs of exceptional students;
Strategies for Assessment and Evaluation of Student Performance

The main objective of assessment and evaluation is to improve student learning. Information gathered through assessment helps teachers to determine students’ strengths and weakness in their achievement of curriculum expectation in this course. In order to ensure that assessment and evaluation are valid and reliable, and that they lead to the improvement of student learning, the teacher will use assessment and evaluation strategies that:

• address both what the students learn and how well they learn;
• are based both on the categories of knowledge and skills;
• are varied in nature, administered over a period of time, and designed to provide opportunities for students to demonstrate the full range of their learning;
• are fair to all students;
• accommodate the needs of exceptional students;
• ensure that each student is given clear directions for improvement;
• promote students’ ability to assess their own learning and to set specific goals;

1. Strategies and the Purposes of Assessments

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Tool</th>
<th>Purpose</th>
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</thead>
<tbody>
<tr>
<td>Research project:</td>
<td>Rubric</td>
<td>To evaluate the following: Knowledge, Thinking and Inquiry, Communication and Application</td>
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<tr>
<td>Topics are selected as following:</td>
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<tr>
<td>i. Conducting a survey on the development of statistical software such as Splus, SAS, SPSS.</td>
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<tr>
<td>ii. Conducting a research on the development of data mining, data warehouse.</td>
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<tr>
<td>Assignments/Tests/Quizzes/ Examination</td>
<td>Marking scheme</td>
<td>To evaluate the following: Knowledge Thinking and Inquiry, Communication and Application</td>
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</table>
1.2 The Achievement Chart

<table>
<thead>
<tr>
<th></th>
<th>Knowledge/Understanding</th>
<th>Thinking/Inquiry/Problem Solving</th>
<th>Communication</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignments</td>
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<tr>
<td>Examinations</td>
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<tr>
<td>Oral presentations</td>
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<tr>
<td>Research Project</td>
<td>-</td>
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<tr>
<td>Quizzes</td>
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<tr>
<td>Term tests</td>
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</tbody>
</table>

Assessment tools will allow students to demonstrate the full extent of their learning across the four Achievement Chart categories. Tools will be developed with the learning expectations as the criteria for this standard. Rubrics will be used to assess Thinking/Inquiry/Problem Solving, and Communication skills and analytic scales will be used to assess Knowledge/Understanding, and Application skills.

Students’ effective demonstration of communication skills is an essential component when evaluating achievement. Students are required to display and convey knowledge and understanding of concepts, share their process of thought and inquiry, and justify

1.3 The Final Grade
Assessment is the collection of information about student performance; evaluation is the determination of a quantitative value describing the student’s overall level of achievement.

The evaluation for MDM4U is based on the student’s achievement of curriculum expectations and the demonstrated skills required for effective learning.
Seventy per cent of the grade will be based on assessments and evaluations conducted throughout the course. This portion of grade will reflect the student’s most consistent level of achievement throughout the course with special consideration given to the most recent level of achievement. As part of the 70%, the student is required to conduct a research project. He/she presents the project plan in writing, and the project is carried out under the guidance of the teacher. The student must submit the completed project in the form of a report and make an oral presentation of the report to the class.

Thirty per cent of the grade will be based on a final evaluation in the form of an examination that will occur near the end of the course.

Students who receive a final performance evaluation of Level 3 or better are well prepared for study at the university level. Accordingly, to prepare students for the academic reality of most mathematically rich postsecondary programs, proper attention should be placed on effective preparation for a comprehensive final examination.

Work that is evaluated throughout the year:

- Assignments 10%
- Oral Presentation 5%
- Research Project 10%
- Quizzes 10%
- Term Test # 1 15%
- Term Test # 2 20%

Work that is evaluated at the end, which is based on the material, covered throughout the year:

- Final Examination 30%

Textbook

Nelson Mathematics of Data Management (University Preparation)

Written by: David Zimmer, Gordon Cooke, Stewart Craven, Beverly Farahani, Thomas Steinke, Chris Kirkpatrick

Thomson Canada Limited, 2003

ISBN: 0-17-615779
Resources

• McGraw-Hill Ryerson Mathematics of Data Management (University Preparation)
  Written by: Barbara J. Canton, Wayne Erdman, Jeff Irvine, Louis Lim, Fran McCarran, David Tallach Miller, Jacob Speijer, Roland W. Meisel.
  ISBN: 0-07-091714-0

• Statistical Analysis for Business and Economics
  Written by: Donald L. Harnett, James L. Murray
  Addison Wesley, 1986.
  ISBN: 0-201-10683-3

Program Planning Considerations

When planning a program in mathematics, the following will be taken into considerations:

• **The Role of Technology in the Curriculum.** Technology helps to make students more powerful learners by giving them the means to explore mathematical concepts more effectively. By using technology, students can explore fundamental ideas in greater depth, develop higher skill levels and explore more application. Various forms of technology have application in many different areas of mathematics learning. Calculators save students time in performing complex arithmetic calculations. Graphing utilities enable students to explore properties of graphs of function. The use of technology in learning and doing mathematics also gives students opportunities to develop their abilities in algorithmic thinking, for example, by writing sequences of instructions in application programs as part of a problem-solving process.

• **Career Education.** Students’ understanding of the role of mathematics in daily life and its relation to career opportunities will be promoted by exploring applications of concepts, by providing opportunities for career-related project work, and by promoting independent investigations. Such activities allow students the opportunity to investigate mathematics-related careers compatible with their interests, aspirations and abilities.

• **Mathematics Anxiety.** Mathematics anxiety is a state of mind relating to a student’s perception of his or her ability to do mathematics. To alleviate this anxiety, teachers should be accepting, patient and understanding; defuse tense situation if they arise; make mathematics relevant by connecting...
the students’ life experience; comment positively on material that is assessed, be aware of cultural biases and set up programs for peer tutoring.