Data Management, Grade 12 (MDM4U)
Course Description

Course Title: Data Management
Course Code: MDM4U
Grade: 12

Course Type: University
Credit Value: 1.0
Prerequisite: MCF3M or MCR3U

- **This course builds on** your knowledge from grade 11 University or University/College mathematics
- **It leads you** on a direct path to university.
- **This can lead you to many careers such as:** Aerospace Mechanic, Emergency Medical Technician (EMT), Group Home Worker, Solar Power Technician

Official Ontario Ministry of Education secondary curriculum available here:
http://www.edu.gov.on.ca/eng/curriculum/secondary/math.html

This course has five main strands:

Counting and Probability

Probability Distributions

Organization of Data for Analysis

Statistical Analysis

Culminating Data Management Investigation

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Counting and Probability:

Students will solve problems involving probability. For example: Determine the probability of the 5th card pulled from a deck being a heart if you have already pulled 4 cards and they were all hearts. Or: In many Aboriginal communities, it is common practice for people to shake hands when they gather. Use combinations to determine the total number of handshakes when 7 people gather. Students will also learn to verify using a different strategy. Or:
Determine the probability that one event will occur given that it is conditional on another event having already occurred. For example, in order for it to snow or rain it must be first be cloudy.

Problem: The probability that it is going to be cloudy today is 60%. The probability that it is snowing and cloudy today is 20%. Ron is running an outdoor hockey tournament. He knows that the perfect weather for that day would be snow. If he wakes up and it is cloudy, what is the probability that it will snow?

Solution:

$P(C) = 60\%$

$P(SNC) = 20\%$

Probability it snows today given it is cloudy.

$$P(SIC) = \frac{P(SNC)}{P(C)}$$

$$= \frac{20\%}{60\%}$$

$$= 33.3\%$$

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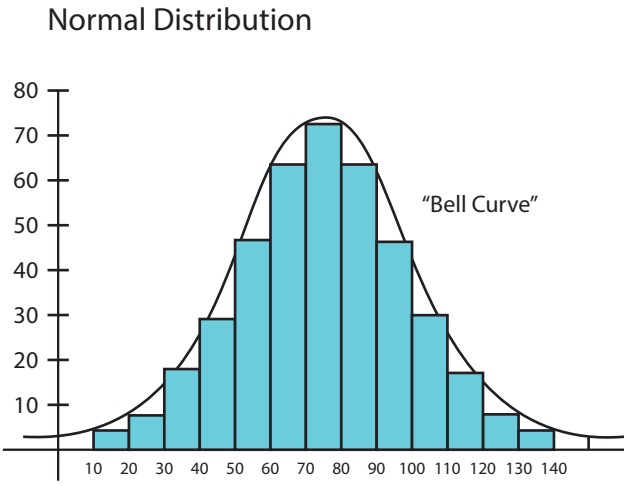
Probability distributions:

Students will solve problems involving probability distributions like this: A lightbulb manufacturer estimates that 0.5% of the bulbs manufactured are defective. Generate and graph the probability distribution for the random variable that represents the number of defective bulbs in a set of 4 bulbs. Or: The heights of 16 month-old maple seedlings are normally distributed with a mean of 32 cm and a standard deviation of 10.2 cm. What is the probability that the height of a randomly selected seedling will be between 24.0 cm and 38.0 cm? Or the probability of winning a best of 7 playoff series given the probability of winning any game?



Problem: : The Maple Leafs have a 30% of winning any playoff game. If they are in a 7 game playoff series with the Montreal Canadiens what is the probability the Leafs win in exactly 7 games.

Solution:

Multiply the probability they will win game 7 by the probability they will win 3 of the first 6.

Prob. win 3 of first 6 $\times$ Prob. win game 7

$[{}_6C_3 \times (0.3)^3 (0.7)^3] \times 0.3$

= 5.56% chance that they win in exactly 7 playoff games

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Organization of data for analysis:

Students will learn to gather data and describe characteristics of an effective survey by considering factors like ethics, privacy, the need for honest responses and possible sources of bias, including cultural bias. They will also learn to design questionnaires or experiments for gathering data, such as determining if there is a relationship between a person's age and their hours per week of Internet use, between hours of study and final course grade, between income and years of education, or assessing the growth of plants under different conditions.

Statistical analysis:

Students will analyze one and two variable data sets through the use of calculations and technology. For example: Determine the standard deviation for a sample size of six boys whose heights are 150 cm, 155 cm, 139 cm, 146 cm, 162 cm and 133 cm. Students will learn to interpret statistics presented in the media. For example: How do you interpret the UN's finding that 2% of the world's population has more than half the world's wealth, whereas half the world's population has only 1% of the world's wealth? Students will also learn to explain how the media, the advertising industry, marketers and pollsters use and misuse statistics (as represented in graphs) to promote a certain point of view. For example: They may make a general statement based on a weak correlation or an assumed cause-and-effect relationship, or start the vertical scale at a value other than zero, or make statements using general population statistics without reference to data specific to minority groups.

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Problem: The following data set is collected from all students at Briceland University taking the MCAT test in February 2016.

Organize the data and use statistical analysis to describe datum 14 and 35.

Can trends in this data be used to describe MCAT results across Canada in February 2016?

Solution:

$$\text{Mean} = \frac{\text{sum of all data}}{\text{\# of data}} = \frac{764}{26} = \boxed{29.4}$$

Median = 30 (number that is half way into set)

Mode = 30 (number that appears most frequently)

$$\text{Standard Deviation} = s = \sqrt{\frac{\sum (x-\bar{x})^2}{n-1}}$$

$\sum (x-\bar{x})^2$ = sum of all (score - mean)²

= 1586.16

n - 1 = 26 - 1 = 25

$$s = \sqrt{\frac{1586.16}{25}}$$

$$s = \sqrt{63.45}$$

$$s = 7.97$$

The standard deviation of the data is 7.97

Z score for 14

$$Z_{14} = \frac{14 - 29.4}{7.97}$$

$$= -1.93$$

Z score for 35

$$Z_{35} = \frac{35 - 29.4}{7.97}$$

$$= 0.70$$

∴ 14 is 1.93 standard deviations below the mean of the scores. 35 is 0.70 above the mean of the scores.

Total/Number samples

Briceland University MCAT Scores		
Raw scores	mean-score	deviation square
14	15.4	237.16
15	14.4	207.36
18	11.4	129.96
18	11.4	129.96
19	10.4	108.16
21	8.4	70.56
27	2.4	5.76
28	1.4	1.96
28	1.4	1.96
28	1.4	1.96
29	0.4	0.16
30	-0.6	0.36
30	-0.6	0.36
30	-0.6	0.36
30	-0.6	0.36
32	-2.6	6.76
33	-3.6	12.96
33	-3.6	12.96
33	-3.6	12.96
34	-4.6	21.16
35	-5.6	31.36
36	-6.6	43.56
37	-7.6	57.76
40	-10.6	112.36
41	-11.6	134.56
45	-15.6	243.36
Total 764		1596.16
29.4		63.4464

Trends in this data can not be used to describe MCAT results across Canada in February 2016. The sample was only taken from a single university, so it does not closely represent the population. This is known as sampling bias.

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Culminating data management investigation:

Students will apply all their skills and knowledge gained in this course to design and carry out a project involving probability and statistics, and communicate their findings.