

# Lesson Forest Consulting Project Report

**Prepared for:** University of Toronto

**Prepared by :**

Haley Liu

Teresa Qian

Zhengzheng Wang

Yuan Xue

Jingwen Zhang

Chenjie Zhao

# Table of Contents

<b>Project 1 - MIE1624 Course curriculum redesign</b>	<b>3</b>
1. Data Analysis and Visualization	3
2019 Kaggle Dataset	3
Linkedin	4
Indeed	5
2. Course Curriculum Design	5
Overview	5
Topics	5
Project	6
<b>Project 2: MSc Data science and artificial intelligence program (MDSAI) Curriculum Design</b>	<b>6</b>
Overview of the Master of Data science and Artificial Intelligence programs	6
Research:	7
Visualization of skills that need to be learned	7
Program structure (Timeline)	8
Description for each course :	8
Five core courses visualization:	10
<b>Project 3 - Course Recommender System</b>	<b>11</b>
<b>References:</b>	<b>13</b>
Project 1	13
Project 2	13
<b>Appendix:</b>	<b>13</b>
Project 1	13
Project 2	15
Project 3 HTML code	18

We are Lesson Forest, a specialized consultancy that is passionate about providing services in the educational industry. We are confident to help educational workers and students to find the best solutions in their careers and future studies. Every suggestion we propose would be the optimal solution generated by thorough data analysis. The team consists of experienced data analysts, data scientists and software engineers, and through the following consulting projects, we were able to demonstrate our data visualization, machine learning and software development skills.

## Project 1 - MIE1624 Course curriculum redesign

Our task was to help with redesigning the course curriculum for MIE 1624: Introduction to Data Science and Analytics, the topics selected should be based on skills required for data analysts, data scientists and data managers. We sourced our data from the 2019 Kaggle Machine Learning and Data Science Survey, LinkedIn and Indeed to conduct data analysis. Given that a job is likely to be posted on both LinkedIn and Indeed, there are two separate analyses conducted on each website to avoid any repetitive counting.

### 1. Data Analysis and Visualization

#### 2019 Kaggle Dataset

Figure1.11 Count Plot for Important Topics to Cover

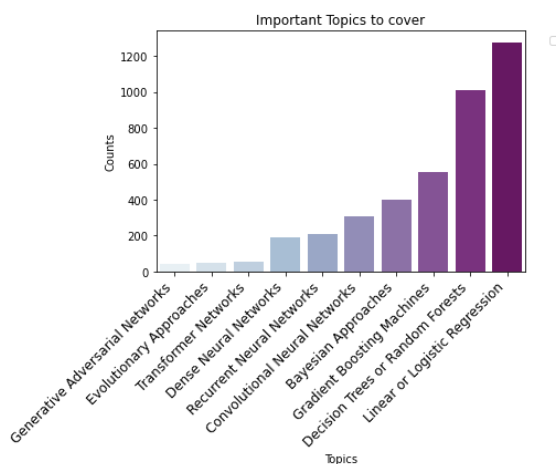


Figure1.13 Collaboration Platform Popularity

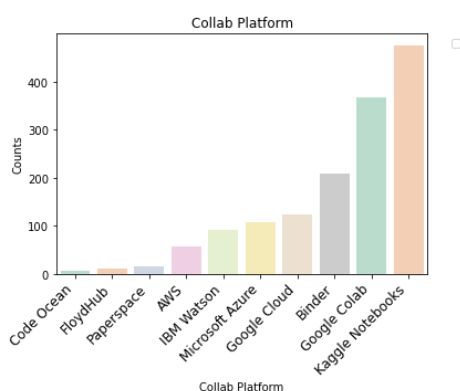


Figure1.12 Count Plot for Programming Language

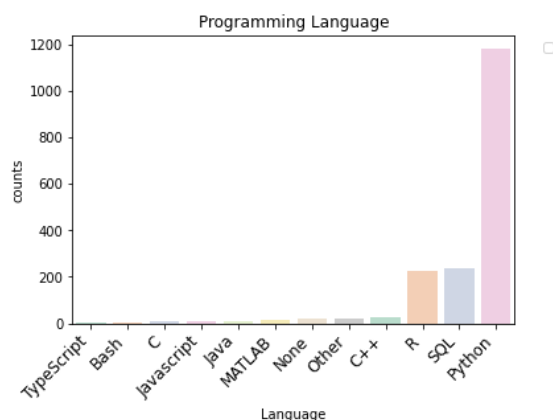
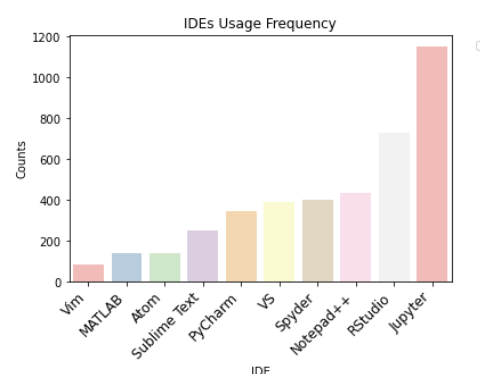


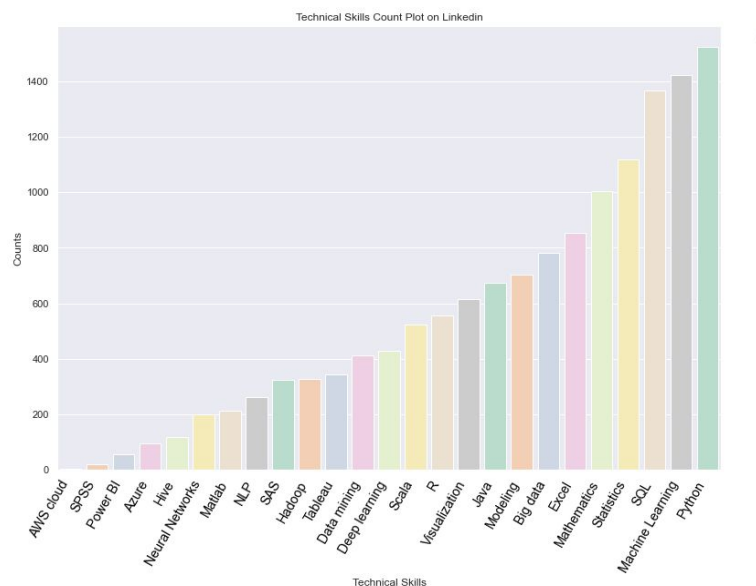
Figure1.14 IDE Usage Popularity



From the analysis, we conclude that curriculum should include topics such as: Linear/Logistic Regression; Decision Trees/Random Forests; Gradient Boosting Machines; Bayesian Approaches; Convolutional Neural Networks. The most popular language is Python and projects can be designed to collaborate on Kaggle Notebooks, or Google Collab. Lastly, the course can introduce Jupyter Notebooks/Jupyter Lab, as the primary IDE.

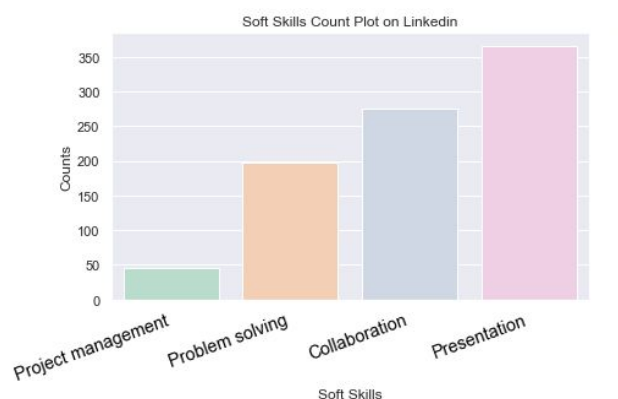
## LinkedIn

**Figure:1.21 Technical skills analysis from LinkedIn**



Through hierarchical clustering, the sourced technical skills can be divided into two categories. (see appendix Figure 1.1) The first category consists of useful tools and general techniques, including data mining, modelling, visualization, etc. The second group consists of specific skills and visualization tools. The most popular technical skills in the first group are Python, Machine Learning, SQL, Statistics, Mathematics, Big Data and Modelling. Second group's top skills include Tableau, Hadoop, NLP, and Neural Networks.

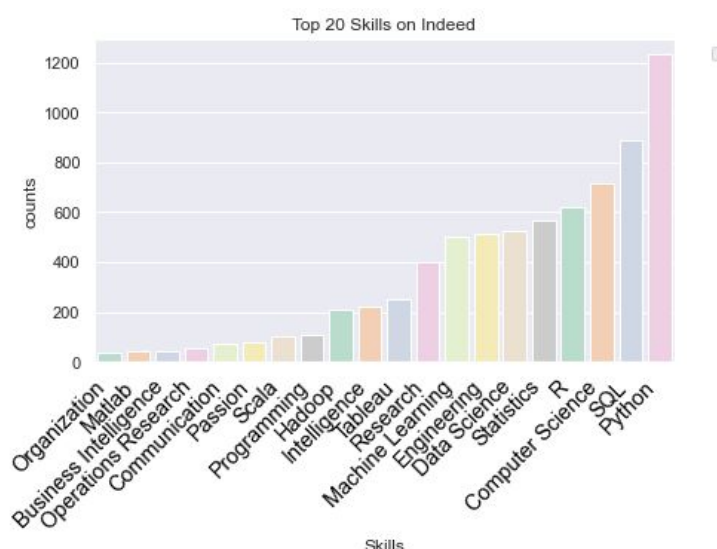
**Figure:1.22 Soft skills analysis from LinkedIn**



In terms of soft skills, presentation skills are the most important then followed by collaboration, problem solving and project management skills.

## Indeed

Figure:1.31 Skills analysis: Indeed



1500 samples of job description were scraped from the first 100 pages of Canadian Data Science job posting on Indeed. Top 20 keywords include Python, SQL, computer science, R, statistics, data science, engineering, machine learning, research, tableau, Artificial Intelligence, Hadoop, programming, communication, operations research, business intelligence, Matlab and organization.

This course means to build students' technical skills as well as necessary soft skills. Therefore the curriculum will be incorporating soft skills such as research and communication and application skills through assignments and group projects. Based on the original course structure, and the findings above, we presented the following solution.

## 2. Course Curriculum Design

### MIE1624: Introduction to Data Science and Analytics

#### Overview:

This course aims to provide students with some hands-on technical and communication skills required in the data analytics and data science field. Python will be used as the primary programming language, with a brief introduction to visualization tools such as Tableau and Power BI. Students will explore various topics in supervised learning, unsupervised learning, as well as Deep learning. Emphasis will be placed on understanding the mathematical frameworks behind each model and being able to apply them efficiently with real world datasets. Graduate students can anticipate to draw meaningful conclusions after analyzing datasets with skills learned in class. Presentation skills and collaboration skills will also be examined throughout the course.

#### Topics:

- Statistics
  - Basic Statistics Review
  - Linear Regression
  - Logistic Regression
  - Bayesian Approaches

- Machine Learning
  - Decision Trees
  - SVM
  - Ensemble methods:
    - Random Forests
    - Gradient Boosting
- Deep Learning
  - Feedforward Neural Networks
  - Convolutional Neural Networks
- Natural Language Processing
  - Introduction
  - Recurrent Neural Networks
  - Transformer (Optional)
- Introduction to Big Data (Optional)
- Introduction to Database (Optional)

**Tools:**

- Python

**Project:**

Build an English optical character recognition application that converts images of typed, handwritten or printed text into machine-encoded text. Bonus marks will be given to applications that have external features such as translation, Multi-languages conversion. Students need to select a way to store their data and storing files in local is not allowed.

- Tableau

**IDE:**

- Jupyter Notebooks/Jupyter Labs

**Collaboration Platform:**

- Kaggle Notebooks
- Google Colab

**Possible Assignment Options:**

1. Fake News Headline Detection (Naive Bayes & Logistic Regression)
2. MNIST Handwritten digits classification (CNN)

## **Project 2: MSc Data science and artificial intelligence program (MDSAI) Curriculum Design**

### **Overview of the Master of Data science and Artificial Intelligence programs**

The faculty of Engineering offers a postgraduate curriculum leading to the master of data science and AI. Data science is an interdisciplinary subject that combines knowledge from statistics, computer science, and math. It aims to manipulate data to learn and extract valuable insights from data. In this program, all courses offered are taught by experienced experts or professors with a strong academic background in data science. It can teach students knowledge systematically and equip them with a set of technical data analysis skills, methods, and experiences to offer them a wide range of opportunities to advance their careers in a data-driven world.

This program provides students with the opportunity to achieve the following goals:

1. Understand the knowledge of machine learning, deep learning and artificial intelligence; implement those algorithms to make predictions and decisions
2. Develop management skills in terms of collaboration, problem solving, and communication
3. Effectively present analysis results with the audience

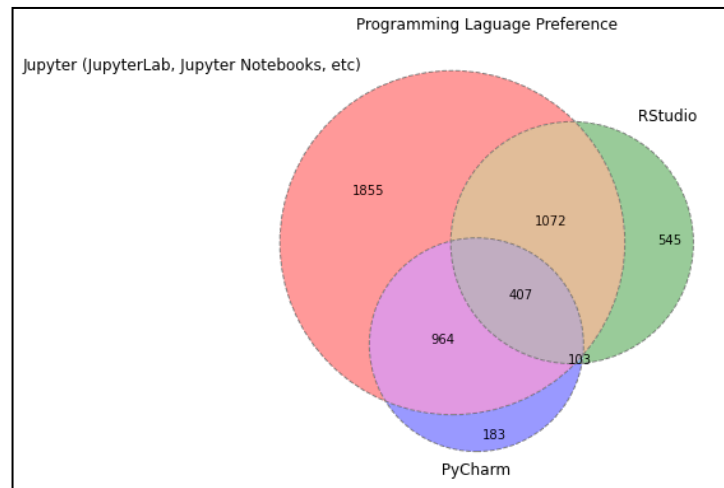
**Admission requirements:** Applicants should have a bachelor's degree in computer science, statistics, mathematics, engineering.

**Possible career path:** Data scientist, Senior data analyst, Machine learning engineer, Data architect, etc.

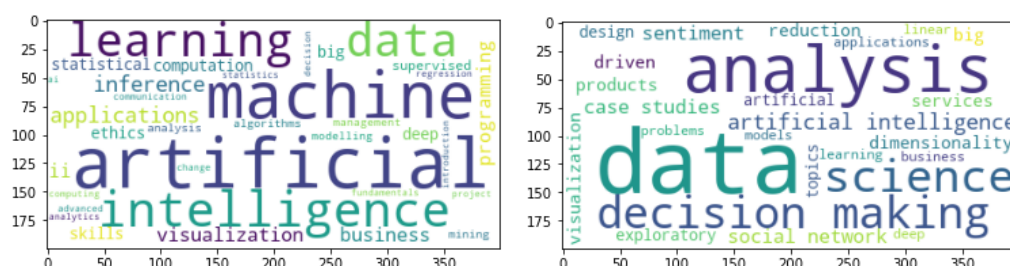
### Research:

Before designing the MDSAI program for the University of Toronto, this report first investigated the structure and courses of similar programs related to data science and business management at other Canadian universities. We select four master programs: UBC - Master of Data Science, York - Master of management in artificial intelligence, Queen - Master of Management Analytics, and Ryerson - Master of Data Science and Analytics. According to CourseCompare, the master of data science programs at UBC and Ryerson are listed as one of the best of 2020, respectively. Meanwhile, Vector institute also recommends the Queen's management analytics and York's management in artificial intelligence programs. After collecting the course information on those programs, we use natural language processing to analyze each course description. **Several keywords are highlighted: Algorithms, programming, machine learning, big data, management, artificial intelligence, data visualization, statistics, and data science.** Those keywords help us design the core and elective courses in this program regarding data science, artificial intelligence, and business skills. Also, according to the exploratory data analysis on the 2019 Kaggle survey data, Jupyter, **Python and R are the two primary languages used by data analysts and data scientists in the industry**; and so Python or R will be mainly used for most data science and statistical courses. Furthermore, to help students expand their knowledge and practice the latest theories, our team plans to provide a co-op option in this program.

**Figure 2.1: Venn diagram of Programming language preference**



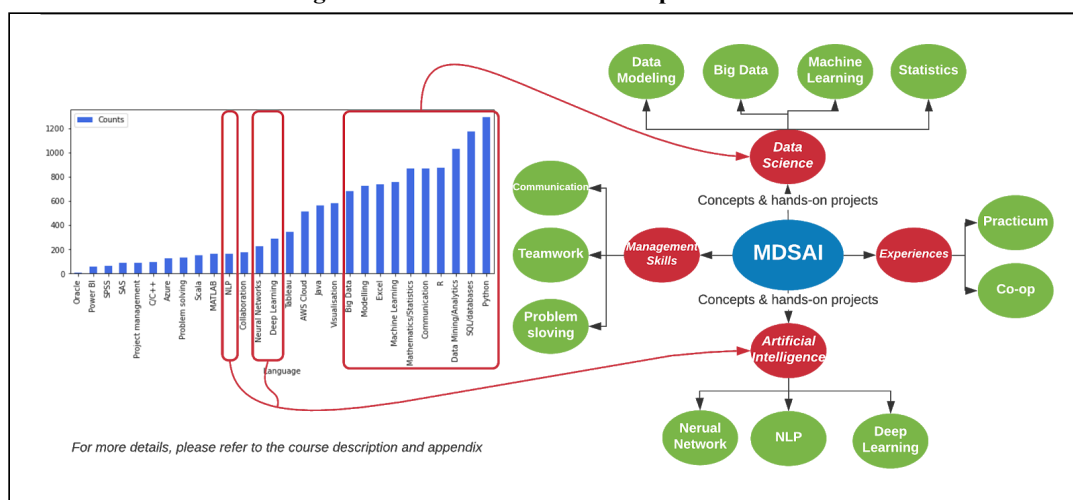
**Figure 2.2: WordCloud for course name and course description**



## Visualization of skills that need to be learned

The MDSAI program mainly focuses on four areas: Data Science, Artificial Intelligence, Management skills, and hands-on experiences. The former two areas are technical-oriented. In comparison, the latter two areas are more integrated. To be specific, students will apply their skills and knowledge through project-based learning and real-world industry exposure.

**Figure 2.3: Visualization of Concepts and Skills**



## Program structure (Timeline)

The Master of Data Science and Artificial Intelligence (MDSAI) is an intensive full-time program. Students in this program could choose two options: 1. One-year program without co-op; 2. One-and-half years with co-op. The timeline table below illustrates this information:

	SUMMER	FALL	WINTER	SUMMER	FALL
<b>Option 1 (1 year without Co-op)</b>	Bootcamp(*)	4 core courses	3 core courses + 1 elective	2 electives	
<b>Option 2 (1.5 year year with Co-op)</b>	Bootcamp(*)	4 core courses	3 core courses + 1 elective	Co-op	1 electives

**Table 2.1: Timeline table**

*Note(\*)*: The bootcamp offers basic mathematics, statistical concepts and programming knowledge to help students who do not have related backgrounds to be fully prepared.

## Description for each course :

Students in the MDSAI program have to take 7 Core courses and 3 elective courses.

### Core courses:

#### 1. Introduction to data science

This course is an introduction of data science, which will focus on three topics: Classification models, Regression models, and Unsupervised models. Students will learn the algorithms and concepts behind those machine learning methods. The basic concepts of deep learning and artificial intelligence will also be introduced. Students will also solve real-life problems, which involves data cleaning, exploratory data analysis, model



preparation, model implementation, model tuning and discussions. Python will be used in this course.

**2. *Statistical Inference***

This course will study statistics topics that play a role in developing data mining and machine learning technologies. We will introduce various statistical methods such as point estimation, interval estimation, probability theory, hypothesis testing, statistical inference, and algorithms behind statistical models. This course is for students with basic statistical knowledge and helps them expand and deepen the introduced estimation and reasoning theory. R will be used in this course.

**3. *Programming for data science***

Python is one of the main languages used by information majors and data scientists for data analysis in most industries and academia. This course covers the basics of program design and data manipulation using Python, which provides students with the skills to solve various research problems involving social science data analysis. Students will learn data collection, storage, cleaning, conversion, visualization, and various data analysis techniques; and will apply these skills to research involving the social world.

**4. *Data Modelling and Database Design***

This course will mainly introduce database systems. It will first introduce the theoretical concepts of relational databases, and students will learn how to design a database. Students will learn how to construct the ER-diagram based on data requirements and convert it into a relational database. Furthermore, topics like Object-relational models. NoSQL and performance tuning will be introduced, and the application of database systems in real life will be discussed.

**5. *Advanced Machine Learning***

This course will consider three main topics: natural language processing, neural network, and deep learning. It will first introduce technologies involving natural language and speech in applications. Students will learn the text mining techniques such as information retrieval, extraction and filtering; and spelling and grammar checking. This course will then provide an overview of the basic ideas and the latest developments of neural network algorithms. Students will explore natural language tasks, ranging from simple word level and syntactic processing to co-referencing and question answering.

**6. *Big data Analytics***

This course will firstly introduce some important Big-Data-related problems and their solutions. It will talk about the terminologies and theoretical concepts behind big data problems. Students will understand six characteristics of big data, including volume, velocity, variety, veracity, valence, and value, and know their impact on the collection, storage, processing, analysis and other aspects. Students will learn big data processing platforms/tools, such as Hadoop and Spark. This course will also cover the basics of MapReduce paradigms. In addition, students will learn how to query data in Hive. After taking this course, students will be proficient with the big data processing platforms/tools and design the project related to big data problems.

**7. *Business skills for data science***

In this course, students will learn how to use data to answer real-world questions to non-experts and learn how to be a rational data-driven decision maker. At the same time, this course can help students develop the ability of team collaboration and communication skills. In addition, students will learn the core concepts of project management. This

course will also cover the following three topics by a series of class tasks: leadership, problem-solving skills in the workplace, and presentation skills.

### ***Elective courses:***

According to the designed program structure, students have to select three courses from ten elective courses, and those courses are designed based on the four skills mentioned above. A detailed course description for each elective course could refer to the Project 2 Appendix.

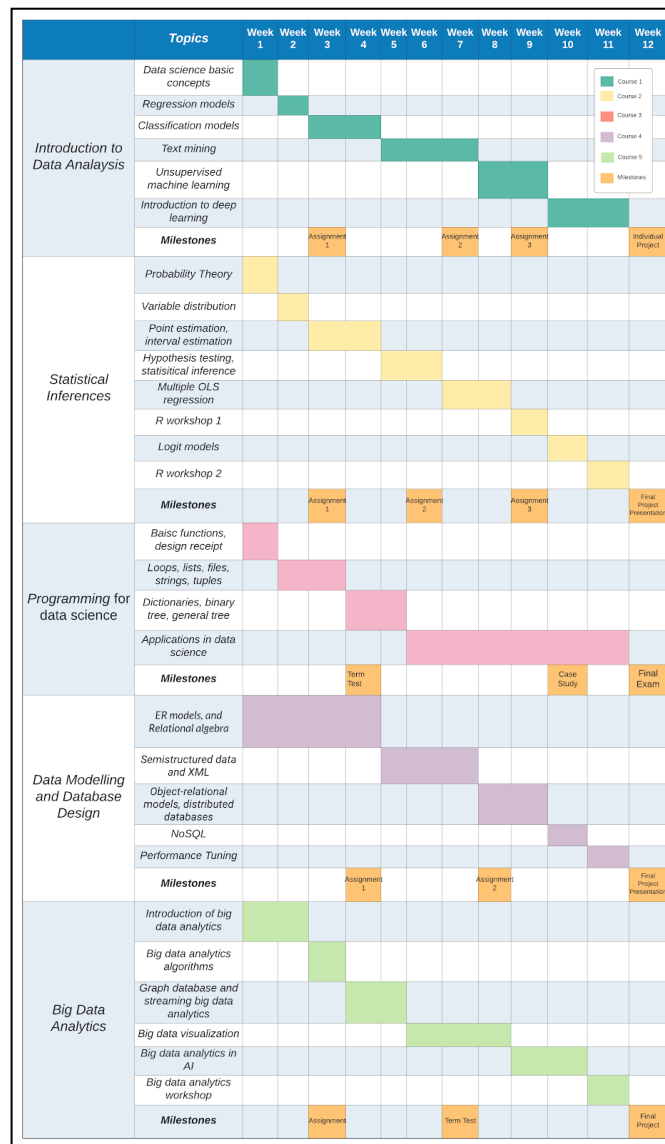
### ***Other Activities:***

#### ***Co-op***

The faculty of engineering will post jobs every winter term. After job-postings, co-op students will start submitting job applications for their interested jobs. Through co-op terms, students will gain hands-on experience in their field of study. Note: The co-op will only be graded “credit/non-credit” on students’ transcript.

### **Five core courses visualization:**

Furthermore, our team visualizes five core courses in terms of critical concepts and milestones in the form of the Gantt Chart, which is shown as follows:



### Project 3 - Course Recommender System

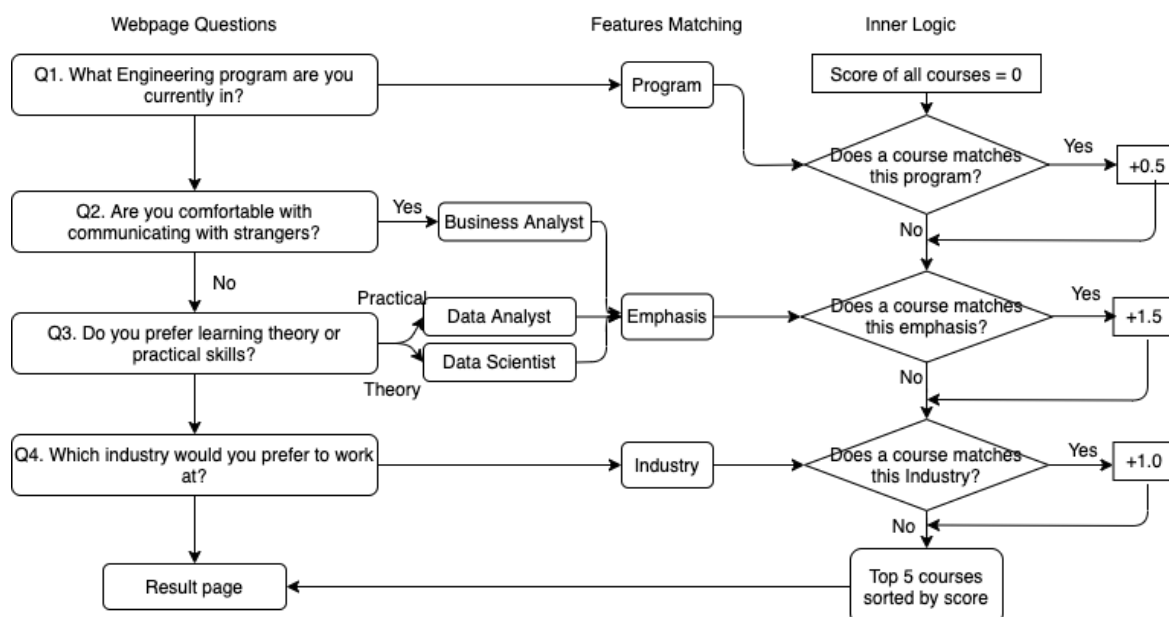
Previous projects provide our team with rich experience in Data Science education. Based on the data and insights, an online [course recommender system](#) is developed, aiming to help U of T MEng students pursuing an emphasis in analytics to find elective courses that suit them the best. Here are the three steps to implement the demo of the system.

Firstly, to describe a course with minimal features, we researched on how a student choose his elective course, and every course is assigned three features:

- Program:** the department or program that is offering the course. Seven categories are: CHE, CIV, CEM, ECE, MIE, MSE, Other. APS is not included since it is not offered by a specific department.  
 This feature is selected since a student tends to choose courses from his own department to complete their degree requirements.
- Emphasis:** the aiming job of a course. Four categories are: Data Scientist, Data Analyst, Business Analyst and Other.  
 This feature is selected since a student tends to choose a course based on if the skills provided matches his future job.
- Industry:** the aiming industry of a course. Seven categories are Finance, Management, IT, Civil, Healthcare, All and Other.  
 This feature is selected since a student tends to choose a course based on if the course matches his aiming industry.

Secondly, to classify the courses by the three features to proper categories, the data collected in program 1 and 2 are applied. We manually go over the syllabus of all 40 available courses, and find the keyword that matches the skill set of each category. The result is saved to a csv file, which is uploaded as `analytic_elective_courses.csv`.

Figure 3.1: Flowchart of Course Recommender System



Thirdly, we developed a set of survey questions, and matches student input to the three features of courses. And an algorithm is developed to sort the courses by student input. The flow chart is shown in Figure 3.1.

We compared the importance of the three features, and the most important feature is assigned the largest weight.

- Program has a weight of 0.5. Compared with other features, a student is more likely to take courses from other programs to learn the skills he needs for further development.
- Feature Emphasis has a weight of 1.5. The skills of different emphasis is of more importance than the skills of different industries. No matter which industry a student is in, his central skill set is the professional skills regarding data.
- Feature Industry has a weight of 1. This feature is more important than Program, but less important than Emphasis. However, if a course matches both the program and industry, then it will have the same weight as a course that matches only the emphasis.

Link to the deployed web page is: <https://maybe8240.github.io/>. It is a single page web application written in HTML and JavaScript. Source code is attached to Appendix.

### An example of a use case

**Figure 3.2: Elective Course Recommender System**

**Figure 3.3: Result of the use case**

The above use case describes a student who is a MIE student, enjoys learning theory and wants to enter the IT Industry after graduation. And the recommended courses for him are given. Four MIE courses and a ECE course that provide skills for data scientists and the IT industry are listed. By training a Natural Language Process model instead of manually going through all course syllabus, this system can be widely applied to other universities or programs regarding data analytics, and provide an opportunity for Engineering students to find most suitable elective courses.

## References:

### Project 1:

- Sen, P. (2019, March 09). Top Data Scientist Resume Keywords for Your New Resume. Retrieved from <https://www.rezrunner.com/blog/data-scientist-resume-keywords-skills/>

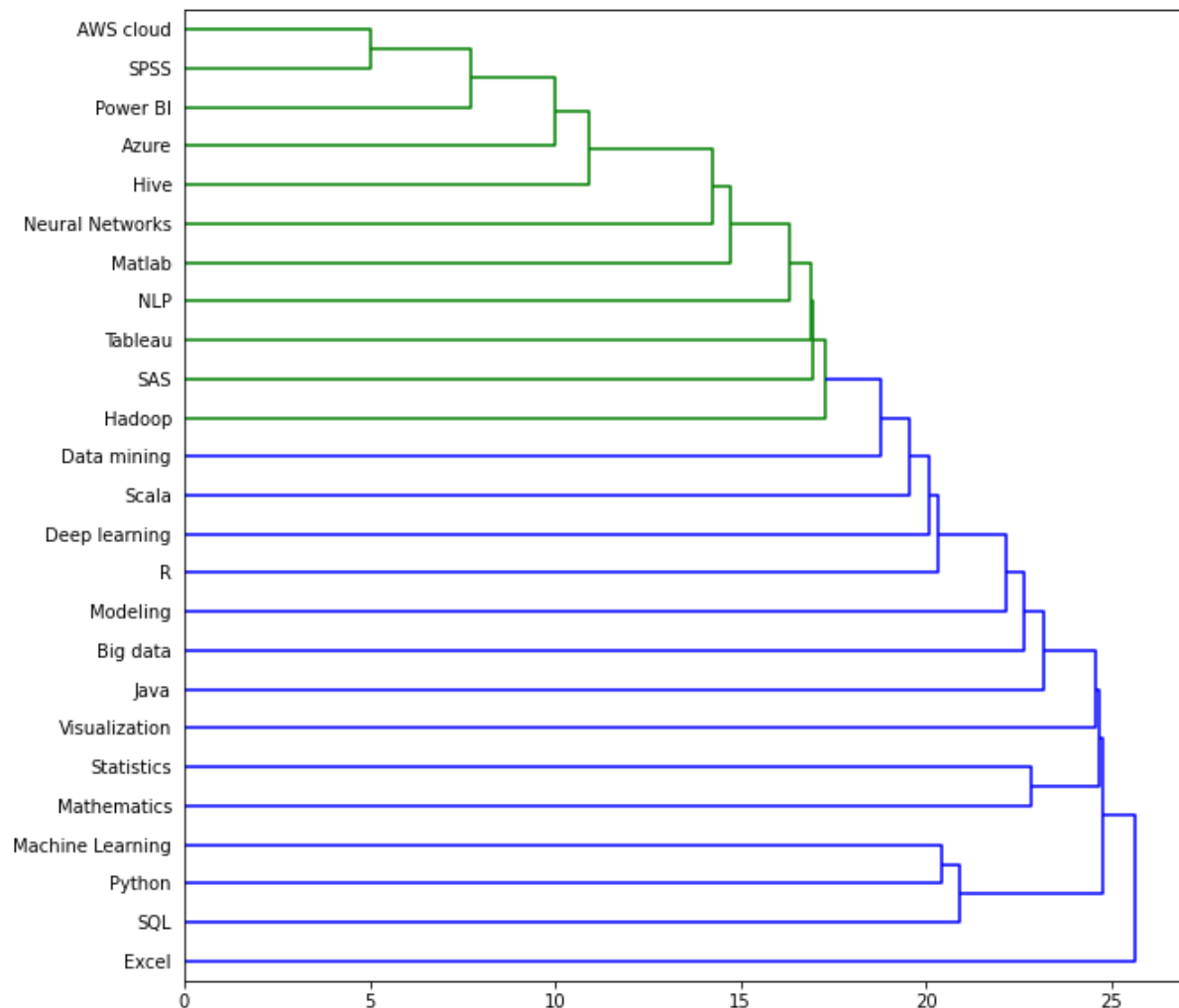
### Project 2:

- CourseCompare. (2020, May 27). Best Master's in Data Science Degrees of 2020. Retrieved from <https://www.coursecompare.ca/masters-in-data-science/>
- Vectorinstitute. (2020, August 27). List of Recognized AI-Related Programs. Retrieved from <https://vectorinstitute.ai/list-of-recognized-ai-related-programs/>

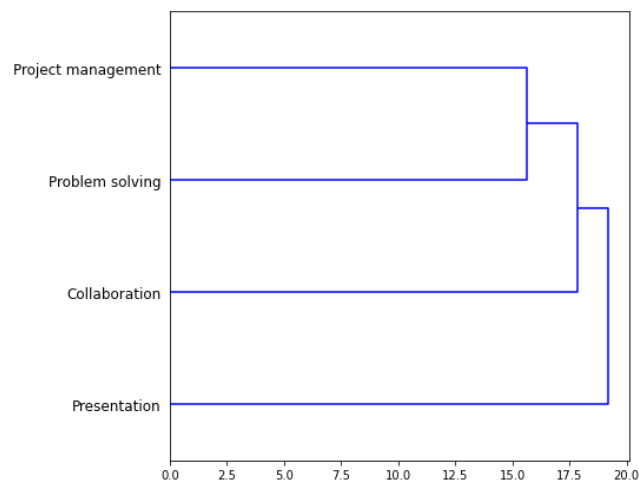
## Appendix:

### Project 1:

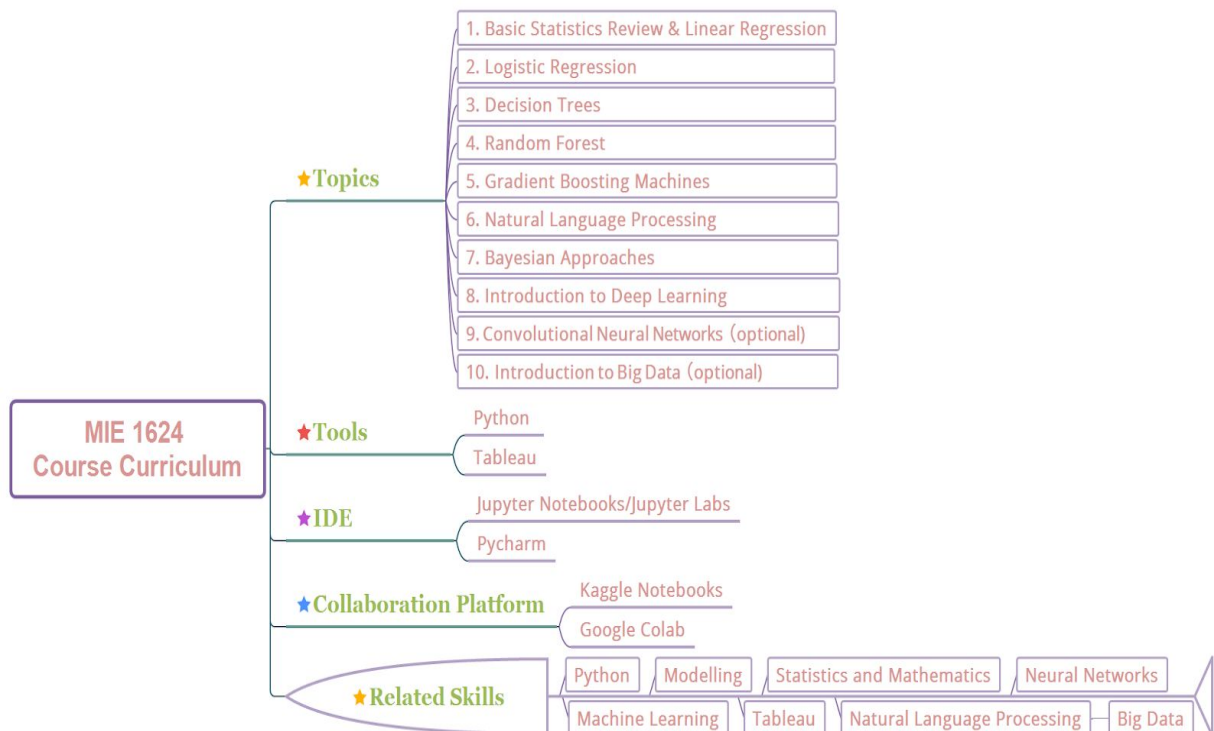
**Figure 1.1 Hierarchical clustering on Technical Skills**



**Figure 1.2 Hierarchical clustering on Soft Skills**



**Figure 1.3 MIE 1624 Course Curriculum Visualization**

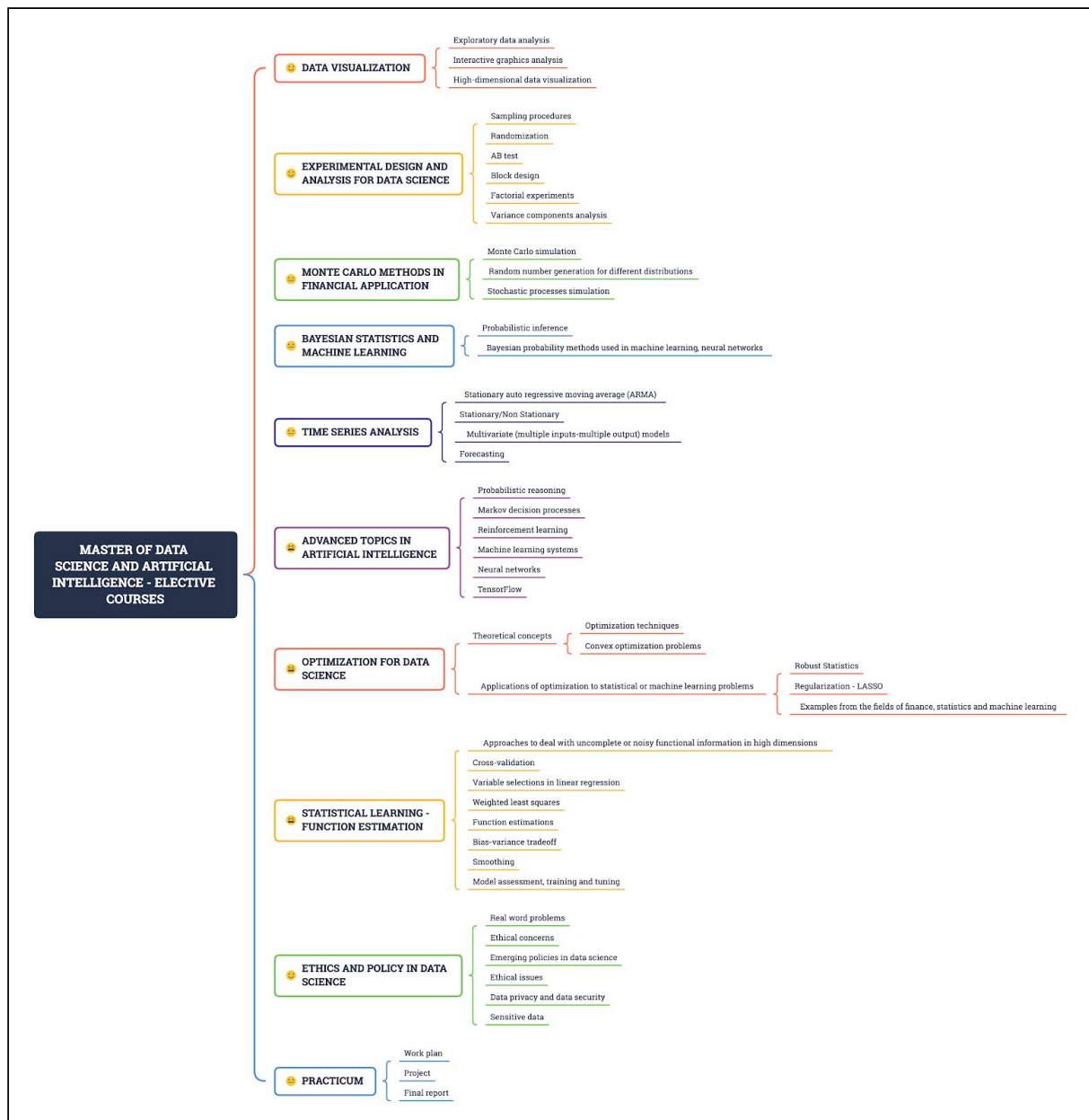


## Project 2:

Structure visualization 1:



## Structure visualization 2:



### Elective courses (10 chosen 3):

#### 1. Data visualization

This course will teach practical analytical methods using Python and provide hands-on experience on the data visualization techniques. Many important Python-based visualization tools will combine case studies with a practical introduction, providing students with opportunities to develop technical skills through application work, thereby enhancing their professional knowledge. The course topics include exploratory data analysis, effective static visualization design, interactive graphics analysis, design and implementation, and high-dimensional data visualization. No prerequisites required.

#### 2. Experimental design and analysis for data science

This course is designed for students interested in experimental design and analysis, and it covers many topics used in experimental design and analysis. The topics include



sampling procedures, randomization, block design, factorial experiments, and variance components analysis. When time permits, other topics will be introduced based on students' interests.

**3. *Monte Carlo methods in Financial applications***

This graduate-level course is designed for students interested in business and financial areas and provides them with fundamental knowledge related to simulation modeling. The topics include an introduction to Monte Carlo simulation, random number generation for different distributions, stochastic processes simulation, and other topics such as perfect sampling, and variance reduction. This course will also emphasize the use of simulation in financial applications, including asset and derivatives pricing. Matlab will be used as the primary tool in this course.

**8. *Bayesian statistics and machine learning***

This course will introduce modern machine learning techniques from the perspective of Bayesian probability. It covers from defining a probability model to how to make predictions based on it. To be specific, it will teach the basic Bayesian probability methods used in machine learning, neural networks, pattern recognition, and graphical probabilistic modeling of uncertainty, calculated probability, and statistical reasoning.

**9. *Time series analysis***

Time-series statistical analysis deals with time-related data. This course provides an overview of methods and problems in time series data analysis, aiming to balance the introduction of statistical theory and applications with empirical data. Course topics include Stationary autoregressive moving average (ARMA), Stationary/Non-Stationary, Multivariate (multiple inputs-multiple outputs) models, Forecasting. Both Python and R are allowed to be used in this course.

**10. *Advanced topics in Artificial intelligence***

This elective course on artificial intelligence focuses on models and methods in modern AI. Specific topics include probabilistic reasoning (Bayesian networks and graphical models), Markov decision processes and reinforcement learning, machine learning systems, and neural networks. This course is both programming- and research-oriented. Applications may cover topics in finance, medicine, manufacturing, the Semantic Web, healthcare, fraud detection, autonomous driving, opinion mining, and sentiment analysis. *Note: This course is subject to approval by the graduate office.*

**11. *Optimization for Data Science***

This course consists of two parts. In the first part, this course will introduce the theoretical concepts of optimization problems. Students will learn the optimization techniques. After studying the first part, students will be able to solve convex optimization problems. In the second part, students will also learn the application of optimization to statistical or machine learning problems, such as elements of Robust Statistics, Regularization - LASSO etc. Furthermore, students will study some examples from the fields of finance, statistics and machine learning.

**12. *Statistical Learning - Function Estimation***

This course will introduce many different types of approaches to deal with uncomplete or noisy functional information in high dimensions. Students will learn the core concepts of cross-validation, variable selections in linear regression, weighted least squares, function estimations, bias-variance tradeoff, and smoothing. Students will also learn model assessment, training and tuning. Furthermore, students will study some real-life problems

in this course. This course is especially suitable for students with a strong interest in statistics.

### **13. Ethics and policy in Data science**

This course will introduce some real word problems related to data science. It will explore the concerns in data science, emerging policies in data science, ethical issues in data science, data privacy and data security. Students will also understand the roles of stakeholders involved in data science issues. In addition, students will know how to deal with sensitive data. This course will assign a series of readings for students each week. Students will need to submit their reflections through the discussion board. After taking this course, students will be able to articulate trends and issues in data science.

### **14. Practicum**

All practicum courses will be only opened in students' second year of studies. Students will choose their interested projects. Students will need to write a work plan for their instructors and supervisors. Students will work on the project during the summer term. By the end of course, students will submit a final report to the instructor. Through the practicum courses, students will improve their management skills and their professional competence. Note: The practicum courses will only be graded "credit/non-credit" on students' transcript.

### **Project 3 HTML code:**

```
1 <!DOCTYPE html>
2 <html lang="en">
3 <head>
4   <meta charset="utf-8">
5   <meta name="viewport" content="width=device-width, initial-scale=1">
6
7   <title>Course Recommender</title>
8
9   <link href="https://surveyjs.azureedge.net/1.8.17/modern.css" type="text/css"
rel="stylesheet" />
10  <script src="https://ajax.googleapis.com/ajax/libs/jquery/3.5.1/jquery.min.js"></script>
11  <script src="https://surveyjs.azureedge.net/1.8.17/survey.jquery.min.js"></script>
12
13  <style>
14      h1 {text-align: center;}
15
16      #completeMessage {
17          text-align: center
18      }
19  </style>
20 </head>
21
22 <body>
23   <h1>Elective Course Recommender System for Emphasis in Analytics</h1>
24   <div id="surveyContainer"></div>
```

```

25     <div id="completeMessage" style="display: none">
26         <h2>Thank you for using our recommender system!</h2>
27         <h2>This is a list of top 5 recommended courses:</h2>
28         <br>
29     </div>
30 </body>
31 <script type="text/javascript">
32     Survey.StylesManager.applyTheme("modern");
33
34     var surveyJSON =
    {"pages":[{"name":"page1","elements":[{"type":"radiogroup","name":"question1","title":"What
Engineering program are you currently
in?","choices":[{"value":"ECE","text":"ECE"}, {"value":"MIE","text":"MIE"}, {"value":"CHE","t
ext":"CHE"}, {"value":"CIV","text":"CIV"}, {"value":"useless","text":"Other"}], "otherText":"Oth
er"}, {"type":"radiogroup","name":"question3","title":"Are you comfortable with communicating
with
strangers?","choices":[{"value":"BA","text":"Yes"}, {"value":"item2","text":"No"}]}, {"type":"ra
diogroup","name":"question2","title":"Do you prefer learning theory or practical
skills?","choices":[{"value":"DS","text":"Theory"}, {"value":"DA","text":"Practical
skills"}]}, {"type":"checkbox","name":"question4","title":"Which industry would you prefer to
work
at?","choices":[{"value":"Healthcare","text":"Healthcare"}, {"value":"Finance","text":"Finance"},
{"value":"Civil","text":"Civil"}, {"value":"IT","text":"Information
Technology"}, {"value":"Management","text":"Management"}, {"value":"useless","text":"Other"}
]}]}, "showCompletedPage":false}
35
36     const courses = [{ "Title": "APS 502H: Financial Engineering", "Program": "na", "Area":
"BA", "Industry": "Finance" }, { "Title": "APS 1005H: Operations Research for Engineering
Management", "Program": "na", "Area": "DS", "Industry": "Management" }, { "Title": "APS
1017H: Supply Chain Management and Logistics", "Program": "na", "Area": "BA, DA",
"Industry": "Management" }, { "Title": "APS 1022H: Financial Engineering II", "Program": "na",
"Area": "BA", "Industry": "Finance" }, { "Title": "APS 1040H: Quality Control for Engineering
Management", "Program": "na", "Area": "BA, DA", "Industry": "Management" }, { "Title":
"APS 1050H: Blockchain Technologies", "Program": "na", "Area": "BA", "Industry": "Finance,
IT" }, { "Title": "APS 1051H: Portfolio Management Praxis Under Real Market Constraint",
"Program": "na", "Area": "BA", "Industry": "Finance, Management" }, { "Title": "APS 1052H:
A.I. in Finance", "Program": "na", "Area": "DS, DA", "Industry": "Finance" }, { "Title": "APS
1080H: Introduction to Reinforcement Learning", "Program": "na", "Area": "DS, DA",
"Industry": "All" }, { "Title": "CHE 507H: Data-based Modelling for Prediction and Control",
"Program": "CHE", "Area": "DS, DA", "Industry": "Others" }, { "Title": "CHE 1148H: Process
Data Analytics", "Program": "CHE", "Area": "DS, DA", "Industry": "Others" }, { "Title": "CHE
1434H: Six Sigma for Chemical Processes", "Program": "CHE", "Area": "na", "Industry":
"Others" }, { "Title": "CIV 1504H: Applied Probability and Statistics for Civil Engineering",
"Program": "CIV", "Area": "DA", "Industry": "Civil" }, { "Title": "CIV 1506H: Freight
Transportation and ITS Applications", "Program": "CIV", "Area": "BA", "Industry": "Civil" }, {
"Title": "CIV 1507H: Public Transport", "Program": "CIV", "Area": "BA, DA", "Industry":

```

```

"Civil" }, { "Title": "CIV 1532H: Fundamentals of ITS and Traffic Management", "Program":
"CIV", "Area": "BA", "Industry": "Civil, Management" }, { "Title": "CIV 1538H: Transportation
Demand Analysis", "Program": "CIV", "Area": "BA", "Industry": "Civil" }, { "Title": "CEM
1002H: Empirical Study of Cities", "Program": "CEM", "Area": "BA", "Industry":
"Management" }, { "Title": "ECE 537H: Random Processes", "Program": "ECE", "Area": "na",
"Industry": "All" }, { "Title": "ECE1504H: Statistical Learning", "Program": "ECE", "Area":
"DS", "Industry": "All" }, { "Title": "ECE 1505H: Convex Optimization", "Program": "ECE",
"Area": "na", "Industry": "All" }, { "Title": "ECE 1510H: Advanced Inference Algorithms",
"Program": "ECE", "Area": "DS", "Industry": "All" }, { "Title": "ECE 1657H: Game Theory and
Evolutionary Games", "Program": "ECE", "Area": "na", "Industry": "Others" }, { "Title": "ECE
1778H: Creative Applications for Mobile Devices", "Program": "ECE", "Area": "na", "Industry":
"IT" }, { "Title": "ECE 1779H: Introduction to Cloud Computing", "Program": "ECE", "Area":
"DS, DA", "Industry": "IT" }, { "Title": "MIE562H Scheduling", "Program": "MIE", "Area":
"na", "Industry": "Others" }, { "Title": "MIE 1413H Statistical Models in Empirical Research",
"Program": "MIE", "Area": "DS", "Industry": "IT, Finance" }, { "Title": "MIE 1501H:
Knowledge Modelling and Management", "Program": "MIE", "Area": "BA, DA", "Industry":
"Management" }, { "Title": "MIE 1512H: Data Analytics", "Program": "MIE", "Area": "DA",
"Industry": "All" }, { "Title": "MIE 1513H: Decision Support Systems", "Program": "MIE",
"Area": "DS", "Industry": "All" }, { "Title": "MIE 1620H: Linear Programming and Network
Flows", "Program": "MIE", "Area": "DS", "Industry": "IT" }, { "Title": "MIE 1621H: NonLinear
Optimization", "Program": "MIE", "Area": "DS", "Industry": "All" }, { "Title": "MIE 1622H:
Computational Finance and Risk Management", "Program": "MIE", "Area": "DA", "Industry":
"Finance" }, { "Title": "MIE 1623H: Introduction to Healthcare Engineering", "Program": "MIE",
"Area": "DA", "Industry": "Healthcare" }, { "Title": "MIE1628H: Big Data Science", "Program":
"MIE", "Area": "DS", "Industry": "IT" }, { "Title": "MIE 1653H: Integer Programming
Applications", "Program": "MIE", "Area": "DS", "Industry": "IT" }, { "Title": "MIE 1721H:
Reliability", "Program": "MIE", "Area": "DA, BA", "Industry": "Others" }, { "Title": "MIE
1723H: Engineering Asset Management", "Program": "MIE", "Area": "DA, BA", "Industry":
"Management" }, { "Title": "MIE 1727H: Statistical Methods of Quality Assurance", "Program":
"MIE", "Area": "BA", "Industry": "Other" }, { "Title": "MSE 1063H: Application of Artificial
Intelligence in Process Metallurgy", "Program": "MIE", "Area": "DS", "Industry": "Other" }}]

```

37

```

38  function sendDataToServer(survey) {
39      //send Ajax request to your web server.
40      const courses = Recommender(survey.data);
41      const message = $("#completeMessage")
42      message.css({"display": "block"})
43      const recommendedCourses = $("<div id='recommendedCourses'>")
44      for (course of courses) {
45          const courseDiv = $("<div class='course'>")
46                                  .css({"font-size": "130%", "margin":
"5px"})
47          courseDiv.html(course.Title)
48          recommendedCourses.append(courseDiv)
49      }
50      message.append(recommendedCourses)

```

```

51     }
52
53     function Recommender(data) {
54
55         for (course of courses) {
56             course.score = 0;
57             //program
58             if (course.Program == data.question1) { course.score += 0.5 };
59             //DA, DS, BA
60             if (course.Area.includes(data.question2)) { course.score += 1.5 } //BA or
other
61             else if (course.Area.includes(data.question3)) { course.score += 1.5 };
//DA or DS
62             //Industry
63             for (question4 of data.question4) {
64                 if (course.Industry.includes(question4)) {
65                     course.score += 1
66                 };
67             }
68             if (course.Industry == "All") {course.score += 0.3}
69         }
70
71         function sort(array) {
72             return array.sort(function(a, b) {
73                 var x = a.score; var y = b.score;
74                 return ((x > y) ? -1 : ((x < y) ? 1 : 0));
75             });
76         }
77
78         sortedCourses = sort(courses)
79         console.log(sortedCourses)
80         return(sortedCourses.slice(0,5))
81     }
82
83     var survey = new Survey.Model(surveyJSON);
84     $("#surveyContainer").Survey({
85         model: survey,
86         onComplete: sendDataToServer
87     });
88
89 </script>
90 </html>

```

---