

**COURSE OUTLINES: AB0403 Decision Making with Programming and Data Analytics**

<b>Academic Year</b>	AY2022-23	<b>Semester</b>	2
<b>Course Coordinator</b>	Nguwi Yok Yen		
<b>Course Code</b>	AB0403		
<b>Course Title</b>	Decision Making with Programming and Data Analytics		
<b>Pre-requisites</b>	-		
<b>No of AUs</b>	3.0		
<b>Contact Hours</b>	2 hrs		
<b>A) Course Aims</b>			
<p><i>This is an introductory course designed for business or accountancy undergraduate student who has no programming background and is interested to learn how to manage data and conduct business analytics programmatically. It is oriented to enhance your technical skillset. The aim of this course is to provide a broad understanding on how to manage data, the process of preparing data for analysis, basic of analytics, and the means to communicate analytics outcome. This course will equip you with the ability to write customized solutions to inform business decision, integrate statistical libraries for data analysis, and construct visuals or reports for business understanding. This module will provide you with individual hands-on practices to hone your coding skillset and opportunity to develop coding solution in a team. We utilize Python language as the medium of learning because it is one of the most in-demand coding language and its user-friendly syntax is well suited for beginner level. You will utilize modern development tools to turn information into insights.</i></p>			
<b>B) Intended Learning Outcomes (ILO)/Objectives</b>			
<p>By the end of this course, you should be able to:</p> <ol style="list-style-type: none"> <li>1. Interpret different elements of programming components like programming syntax, control structures, data types and design methods.</li> <li>2. Write codes that allow you to solve simple business problem programmatically.</li> <li>3. Derive analytics outcome from managing data.</li> <li>4. Present data graphically that aid and support decision with appropriate statistical and graphing modules or use visualization software.</li> </ol>			
<b>C) Course Content</b>			
<ol style="list-style-type: none"> <li>1. Programming Basic</li> <li>2. Operators in Python</li> <li>3. Control in Python</li> <li>4. Using Functions and Defining Functions</li> <li>5. Data types: String, List, Tuple, Dictionary</li> <li>6. File Input and Output</li> <li>7. Structured Query Language (SQL)</li> <li>8. Data Preparation</li> <li>9. Descriptive Analysis</li> <li>10. Data Visualization</li> <li>11. Web Scraping</li> </ol>			

<b>D) Assessment (includes both continuous and summative assessment)</b>					
<b>Component</b>	<b>ILO Tested</b>	<b>NBS Learning Goal (Refer to Annex E for list)</b>	<b>Weighting</b>	<b>Team/Individual</b>	<b>Assessment Rubrics (Please insert rubrics as Appendix)</b>
1. Class Participation	1, 2, 3, 4	Oral Comm, Critical Thinking	10	Individual	See Rubric 1
2. LAMS Attempts (Online MCQ & Short Answers)	1, 2, 3, 4	AK <sup>1</sup> , PSDM <sup>2</sup>	10	Individual	LAMS Attempts
3. Practical Assessment (Online MCQ, Short Answers, Coding Questions)	1, 2, 3,4	AK <sup>1</sup> , PSDM <sup>2</sup>	40 (PA1 20% PA2 20%)	Individual	See Rubric 2
4. Group Project (Slides & Oral Presentation)	3, 4	Oral Comm, PSDM <sup>2</sup>	40 (Project work Part 1- 15% Part 2- 15% Presentation 10%)	Team <sup>3</sup>	See Rubric 3, 4
<b>Total</b>			<b>100%</b>		
<p><sup>1</sup>AK = Acquisition of Knowledge  <sup>2</sup>PSDM = Problem-solving &amp; decision-making  <sup>3</sup>Group project: Students are to work in groups, and the leader of each group is responsible to submit group project works and the related submission. All team members must present. Peer evaluation will be incorporated. Peer evaluation will adopt the use of Rubrics 4 to assess individual team member's contribution to be submitted through Eureka platform. It will be a mandatory submission for all students. Each student is required to fill in the contribution of all team members in the same group (including himself/herself). Do note that a poor peer evaluation will result in a reduction in the project grading of individual student.</p>					
<b>E) Formative feedback</b>					
Feedback will be provided during the class discussions. For practical assessment, the instructor will grade the submissions, discuss common mistakes and weaknesses. For the group project, graders will provide qualitative feedback for individual groups to point out what have been done right and what could have been done better.					
<b>F) Learning and Teaching approach</b>					
<b>Approach</b>	<b>How does this approach support students in achieving the learning outcomes?</b>				
LAMS Lesson & Seminar Discussion	Lesson content will be pre-recorded and students are expected to complete the relevant content before each seminar. Seminar discussions allow opportunities to clarify content, concepts and demonstrate the analytical tools to the students as well as to hear about				

	their intuition, experience and difficulties pertaining to the content. It also offers the opportunity to assess their ability to think critically and articulate clearly.
Coding Demonstration	This allows instructor to demonstrate programming codes and guide students through the steps of solving business analytics problem.
In-class Activities and Exercises	This would allow the students to get their hands dirty and solve simple to challenging problems and apply the programming and data modelling knowledge covered in the course.

### G) Reading and References

You may refer to any resources that aids your understanding, some suggested references are listed below.

Recommended Online Reference:

(PT) Python 3 Tutorial: <https://docs.python.org/3/tutorial/>

(SQ) SQLite Library: <https://www.sqlite.org/index.html>

(PL) Pandas Library: <https://pandas.pydata.org/>

(MP) Matplotlib Library: <https://matplotlib.org/>

Textbooks:

(WP) William F. Punch, The Practice of Computing Using Python, 3rd Edition, 2017, Pearson, ISBN 978-1-2921-6668-1.

(ML) Mark Lutz, Learning Python, 5th Edition, 2013, O'Reilly Media, ISBN 978-1-4493-5573-9.

(WW) William Wesley McKinney, Python for Data Analysis, 2nd edition, 2017, O'Reilly Media, ISBN 978-1-4919-5766-0.

### H) Course Policies and Student Responsibilities

You are expected to complete all assigned pre-class readings and activities, attend all seminar classes punctually and take all scheduled assignments and tests by due dates. You are expected to take responsibility to follow up with course notes, assignments and course related announcements for seminar sessions they have missed. You are expected to participate in all seminar discussions and activities. You are to attend lesson punctually.

(2) Absenteeism

Absence from class without a valid reason will affect your overall course grade. Valid reasons include falling sick supported by a medical certificate. If you miss a seminar, you must inform the course instructor via email prior to the start of the class.

Similarly for absence from assessment. Absence from assessment must be supported by valid approved reason. Valid approved reasons include unwell for the test or obtained approved Leave of Absence from school prior to the test. For the case of unwell for the test, only Singapore's issued medical certificate can be accepted. Make up test will be arranged for valid approved reason. Absence from make up test will receive zero mark.

### I) Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [academic integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

#### J) Course Instructors

Instructor	Office Location	Phone	Email	Consultation Hours
Dr Nguwi Yok Yen	S3-B2A-26	6790 6129	yokyen@ntu.edu.sg	By prior appointment via email
Prof Jack Tong	S3-B2A-17	6790 5660	jack.tong@ntu.edu.sg	By prior appointment via email
Mr Koh Choon Chye			cckoh@ntu.edu.sg	By prior appointment via email
Mr Chan Waixin			waixin.chan@ntu.edu.sg	By prior appointment via email
Dr Yeo Wee Kiang			weekiang.yeo@ntu.edu.sg	By prior appointment via email

#### K) Planned Weekly Schedule

Week	Topic	Readings/ Activities
1	<b>Introduction &amp; Programming Basic:</b> <ul style="list-style-type: none"> <li>• Programming environment</li> <li>• Programming syntax</li> <li>• Variables</li> <li>• Basic data types</li> </ul>	Installation guide; WP Chp 1; ML Chp 2, 3
2	<b>Operators in Python and Debugging:</b> <ul style="list-style-type: none"> <li>• Mathematical operators</li> <li>• Comparison operators</li> <li>• Logical operators</li> </ul>	WP Chp 1, 2
3	<b>Control:</b> <ul style="list-style-type: none"> <li>• Decision</li> <li>• Iterations</li> </ul>	WP Chp 2, 5 ML Chp 12, 13, 16
4	<b>Function:</b> <ul style="list-style-type: none"> <li>• Using functions</li> <li>• Defining functions</li> </ul>	WP Chp 2, 5 ML Chp 12, 13, 16
5	<b>Data Types:</b> <ul style="list-style-type: none"> <li>• String</li> <li>• List</li> <li>• Tuple</li> <li>• Dictionary</li> </ul>	WP Chp 7 ML Chp 7, 8
6	<b>File Input and Output:</b> <ul style="list-style-type: none"> <li>• File reading and writing</li> <li>• Processing text/CSV files</li> </ul>	WP Chp 7, 9 ML Chp 14 <b>PA 1 (Covers week 1 ~ week 5 materials)</b>

		<b>17 Feb (Fri Evening)</b>
7	<b>Structured Query Language (SQL):</b> <ul style="list-style-type: none"> <li>• SQL basic</li> <li>• Data Manipulation Language</li> </ul>	SQL Documentation <b>Project Part 1 Submission Due</b>
<b>Recess Week</b>		
8	<b>Data Preparation:</b> <ul style="list-style-type: none"> <li>• Dataframe</li> <li>• Data cleaning</li> </ul>	WW Chp 4, 5, 7 PL Documentation
9	<b>Descriptive Analysis:</b> <ul style="list-style-type: none"> <li>• Data wrangling</li> <li>• Descriptive analysis</li> </ul>	WW Chp 4, 5, 7 PL Documentation
10	<b>Data Visualization:</b> <ul style="list-style-type: none"> <li>• Plotting in Python</li> <li>• matplotlib</li> </ul>	MP Documentation
11	<b>Project Consultation &amp; PA</b>	<b>PA 2 (Covers week 1 ~ week 10 materials) 31 Mar (Fri Evening)</b>
12	<b>Web Scraping (eLearning)</b>	
13	<b>Project Presentation</b>	<b>Project Part 2 Submission Due</b>

**ANNEX B: ASSESSMENT CRITERIA**

**Rubric 1 (Participation)**

Traits	Performance		
	Lacking (0-3)	Good (4-7)	Excellent (8-10)
<b>Participation frequency</b>	Does not contribute in lesson	Occasionally contributes in lesson	Contributes in all lessons
<b>Participation quality</b>	No contributions/Contributions lack substance	Contributions demonstrate knowledge of subject matter	Contributions demonstrate understanding and insightful

**Rubric 2 (Practical Assessment)**

Traits	Performance	
<b>Demonstrates understanding in data types</b>	<b>Not Yet</b> Does not demonstrate understanding of programming. Confuse about the usage of data types.	<b>Substantially Developed</b> Able to differentiate and use suitable data types in programming. Make good judgement base on the given problem. Good naming convention and coding practice.
	Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed	
<b>Demonstrates ability of using appropriate coding elements.</b>	<b>Not Yet</b> Does not demonstrate ability to use coding element.	<b>Substantially Developed</b> Excellent use of good coding practice, effective application of coding elements and algorithm. Good use of control structures, iteration and function design.
	Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed	
<b>Devise strategies to construct proper model or code for analysis</b>	<b>Not Yet</b> No data model or code was developed to suitably aid the analysis.	<b>Substantially Developed</b> Well-constructed solution and code and form comprehensive analysis which examine the data from different perspectives.
	Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed	

**Rubric 3 (Group Project)**

Traits	Performance	
<b>Analyses and evaluates problem and recommends appropriate programming solution (Group)</b>	<b>Not Yet</b> No analysis of problem and no solution is provided. Contradicting solution is given.	<b>Substantially Developed</b> Excellent analysis of problem and propose well supported solution. Solution illustrates coherent understanding to solve the problem. Provides convincing understanding on syllabus taught and solution.
	Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed	
<b>Appropriate data and provides suitable analysis related to the issue. (Group)</b>	<b>Not Yet</b> Merely repeats information provided, taking it as truth, or denies evidence without adequate justification. Inadequate analysis and lack of understanding on data.	<b>Substantially Developed</b> Examines the data; questions its accuracy, precision, relevance, completeness and perform appropriate data cleaning. Carefully examines data with substantiated analysis supported by evidence.
	Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed	
<b>Deliverables Outcome (Group)</b>	<b>Not Yet</b> Deliverables are basic and do not illustrates the contributions well. Inadequate efforts in designing and writing the relevant deliverables.	<b>Substantially Developed</b> Deliverables are well designed and well written. Guide reader to understand the issues, analysis and solutions well.
	Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> <u>6</u> <u>7</u> <u>8</u> <u>9</u> <u>10</u> Substantially Developed	
<b>Communication Content (Individual)</b>	<b>Not Yet</b> Presentation lacks sufficient content. Repeating similar points. Central message is not clear.	<b>Substantially Developed</b> Presentation conveys the message well. Able to showcase contribution to project with sufficient points.
	Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> Substantially Developed	
<b>Communication Structure (Individual)</b>	<b>Not Yet</b> No clear structure. Organizational pattern (specific introduction and conclusion, sequenced materials within the body, and transitions) is not observable.	<b>Substantially Developed</b> Organizational pattern is clearly and consistently observable and makes the content of the presentation cohesive. Presentation captures audience’s attention.
	Evaluation: Not Yet <u>1</u> <u>2</u> <u>3</u> <u>4</u> <u>5</u> Substantially Developed	

**Rubric 4 (Peer Evaluation)**

**Teamwork & Interpersonal Skills (Peer Evaluation) Rubric**

**Learning Objective: The ability to work effectively with others in a group setting.**

Traits	Performance	
<p><b>1. Roles and Responsibility (RR)</b> Behaves professionally by upholding responsibility and assuming accountability for self and others in progressing towards the team’s goal.</p>	<p><b>Scant</b> Unclear about his/her own role; refuses to take a role in the group; insists to work individually and has limited coordination or communication with others.</p>	<p><b>Substantially Developed</b> Always fulfills responsibilities; performs his/her role within the group with enthusiasm and demonstrates willingness to work collaboratively.</p>
<p><b>Evaluation: Scant 1 2 3 4 5 6 7 Substantially Developed</b></p>		
<p><b>2. Communication (CM)</b> Identifies appropriate mechanisms to coordinate and correspond with team members.</p>	<p><b>Scant</b> Modes of communication are not appropriate, causing confusion and miscommunication among team members.</p>	<p><b>Substantially Developed</b> Modes of communication are appropriate, and maintaining timely communication and correspondence with team members.</p>
<p><b>Evaluation: Scant 1 2 3 4 5 6 7 Substantially Developed</b></p>		
<p><b>3. Conflict Resolution (CR)</b> Resolves conflicts using a variety of approaches.</p>	<p><b>Scant</b> Does not recognize conflicts or is unwilling to resolve conflicts.</p>	<p><b>Substantially Developed</b> Consistently resolves conflicts through facilitating open discussion and compromise.</p>
<p><b>Evaluation: Scant 1 2 3 4 5 6 7 Substantially Developed</b></p>		
<p><b>4. Contributions (CT)</b> Contributes positive input for the team; effectively utilizes one’s knowledge and expertise.</p>	<p><b>Scant</b> Largely disinterested in working in a group and refuses to participate; observes passively or is unwilling to share information with other team members.</p>	<p><b>Substantially Developed</b> <u>Actively attends and participates in all activities and provides meaningful contribution in articulating ideas and opinions.</u></p>
<p><b>Evaluation: Scant 1 2 3 4 5 6 7 Substantially Developed</b></p>		
<p><b>5. Relationship (RS)</b> Maintains cooperative interaction with other team members regardless of individual /cultural differences and respects diverse perspectives.</p>	<p><b>Scant</b> Rarely listens to others and does not acknowledge the opinions that differ from his/her own.</p>	<p><b>Substantially Developed</b> Engages in respectful relationships with all other members in the team. Embraces and accepts diverse points of view without prejudice.</p>
<p><b>Evaluation: Scant 1 2 3 4 5 6 7 Substantially Developed</b></p>		

**References:**

*Teamwork Value Rubric - Association of American Colleges and Universities.* Retrieved from <http://www.aacu.org/value/rubrics/pdf/teamwork.pdf>



**ANNEX E: LIST OF NBS LEARNING GOALS**

LEARNING GOAL	LEARNING OBJECTIVE	CHECK
<b>TASK SKILLS</b>		
<b>Acquisition of Knowledge</b>	<i>Instructors, please define.</i>	<input type="checkbox"/>
<b>Ethical Reasoning</b>	The ability to recognize and understand ethical issues, and apply sound ethical reasoning.	<input type="checkbox"/>
<b>Critical Thinking &amp; Creative Thinking</b>	The ability to define, examine, evaluate, analyze and synthesize various arguments and knowledge to form independent judgment.	<input type="checkbox"/>
	The ability to provide insight in an innovative way characterized by high degree of adaptiveness.	<input type="checkbox"/>
<b>Problem Solving &amp; Decision Making</b>	The ability to identify problem, generate a plan to solve problem, implement and evaluate the plan and make sound business decision.	<input type="checkbox"/>
<b>Planning &amp; Execution</b>	The ability to set clear priorities and plans of action for the task and define task objectives to fulfill goals within a planned schedule for execution.	<input type="checkbox"/>
<b>PEOPLE SKILLS</b>		
<b>Oral Communication &amp; Written Communication</b>	The ability to communicate well with others verbally so that it clearly expresses the intended message and is understandable and useful to the receiving party.	<input type="checkbox"/>
	The ability to communicate well with others in writing so that it clearly expresses the intended message and is understandable and useful to the receiving party.	<input type="checkbox"/>
<b>Negotiation</b>	The ability to systematically plan and prepare for negotiation and apply negotiation skills in personal and professional practice.	<input type="checkbox"/>
<b>Cultural Intelligence</b>	The ability to function effectively in situations characterized by cultural diversity.	<input type="checkbox"/>
<b>Teamwork &amp; Interpersonal Skills</b>	The ability to work effectively with others in a group setting.	<input type="checkbox"/>
<b>Motivation &amp; Development of Self &amp; Others</b>	The ability to develop a better understanding of one's strengths and weaknesses, and learn to view others and mistakes positively as sources of personal and professional development.	<input type="checkbox"/>

Please write to NBS Accreditation office ([nbsaccro@ntu.edu.sg](mailto:nbsaccro@ntu.edu.sg)) for sample rubrics.