

COURSE OUTLINES: BC3409 AI in Accounting and Finance

Academic Year	2022-2023	Semester	2
Course Coordinator	Teoh Teik Toe		
Course Code	BC3409		
Course Title	AI in Accounting and Finance		
Pre-requisites	BC2406		
No of AUs	4		
Contact Hours	3 hours seminar x 13 weeks = 39 hours		
A) Course Aims/Description			
<p>This is an introductory course designed for business or accountancy or Finance undergraduate students who are interested to learn how to manage data, conduct business analytics programmatically, create AI model to automate business processes and create predictive model to increase profitability or return. It is oriented to enhance their technical skillset.</p> <p>The aim of this course is to provide a broad understanding on how to manage data, the process of preparing data for analysis, basics of analytics, using AI to automate financial analysis process and generate accounting reports. This course will equip you with the ability to write customized solutions to make informed business decisions, integrate statistical libraries for data analysis, create AI models to automate accounting and financial process. This module will provide you with individual hands-on practices to hone your coding skills and opportunities to develop coding solutions in a team. We utilize R and 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 the beginner level. You will utilise modern development tools to turn information into insights including Keras' Deep Learning model, Google Brain TensorFlow, Hadoop, Spark and Cloud.</p>			
B) Intended Learning Outcomes (ILO)/Objectives			
<p>By the end of this course, you (as a student) would be able to:</p> <ol style="list-style-type: none"> 1. Write code that allow you to solve Accounting and Finance problem programmatically by creating AI models using R, Python, Keras, Hadoop, Spark and API. 2. Manage data to sufficiently derive, communicate analytics outcome and eventually create AI model in Accounting and Finance. 3. Implement a simple system in cloud including engineering work in implementing AI model in Accounting and Finance. 			
C) Course Content			
<p>This course adopts a blended learning approach where asynchronous e-learning and synchronous teaching in seminar setting are combined to achieve learning objectives. Asynchronous e-learning includes pre-recorded lectures and the weekly seminar provides a channel to exchange understanding and best coding practice. You will learn through a wide range of learning materials,</p>			

such as online references, textbooks, videos, pre-readings, in-class activities, coding discussion and paired work.

This course first provides an overview of the development environment of programming language. You will then move on to pick up language semantics like coding syntax, variables, methods, functions, mathematical operators, Boolean operators, decisions, compound decision, control structures and iterations. These will help you to build a holistic understanding on programming basics and the ability to write code independently. The data modelling part covers the understanding of business rules, entities, relationships, and attributes to construct a database followed by how it connects to code. The course will also cover foundation of business analytics including how to define problem statements in the business context, data preparation, data transformation, data consolidation, data analysis, and data visualization.

D) Assessment (includes both continuous and summative assessment)

Component	Course LO Tested	Learning Goals (Related Programme LO or Graduate Attributes)	Weightage	Team/Individual	Assessment Rubrics (attach rubrics in appendix)
1. Class Participation	1, 2, 3	Class Participation	15	Individual	See Rubric 1 (as shown in Annex B)
2. Practical Assessment	1,3	AK ¹ , PSDM ²	45	Individual	See Rubric 2 (as shown in Annex B)
3. Group Project	2,3	PSDM ²	30	Team	See Rubric 3 (as shown in Annex B)
4. Individual Presentation	2,3	Oral Comm	10	Individual	See Rubric 4 (as shown in Annex B)
Total			100%		

¹AK = Acquisition of Knowledge

²PSDM = Problem-solving & decision-making

E) Formative feedback

The seminar will be interactive and your inputs will be highly encouraged and assessed. Feedback will be provided during the class discussions. For practical assessment, the instructor will grade the submissions, review the grades with you, discuss common mistakes and weaknesses, and provide appropriate answer keys. For the group project, there will be a Q&A segment where the instructor will ask questions and provide feedback. Marks on both content and presentation will also be provided to you.

F) Learning and Teaching approach	
Approach	How does this approach support students in achieving the learning outcomes?
Seminar Discussions	Lecture content will be pre-recorded and you are expected to complete the relevant content before each seminar. Seminar discussions allow ample opportunities to clarify content, concepts and demonstrate the analytical tools to you as well as to hear about your intuition, experience and difficulties pertaining to the content. It also offers the opportunity to assess your ability to think critically and articulate clearly.
Coding Demonstration	This allows the instructor to demonstrate programming codes and guide you through the steps of solving business analytics problem.
In-class Activities and Exercises	This would allow you to get your hands dirty and solve simple to challenging problems and apply the programming and data modelling knowledge covered in the course.
Code Discussions	This teaching format allows you to have a highly interactive learning environment where you will benefit from getting online and immediate feedback about your coding solution from instructor and peers coding evaluation.

All the above approaches are integrated together to progressively help you achieve ILO 1 to 3

G) Reading and References
<p><u>Recommended Online Reference:</u></p> <p>(PT) Python 3 Tutorial: https://docs.python.org/3/tutorial/</p> <p>(TFT) TensorFlow Tutorial: https://www.tensorflow.org/tutorials/</p> <p>(KT) Keras Tutorial: https://keras.io/</p> <p>(HT) Hadoop Tutorial: https://www.tutorialspoint.com/hadoop/index.htm</p> <p>(ST) Spark Tutorial: https://spark.apache.org/docs/latest/quick-start.html</p> <p>(CFA) CFA: https://www.cfainstitute.org/</p> <p>(ACCA) ACCA: https://www.accaglobal.com/sg/en.html https://www.accaglobal.com/sg/en/student/getting-started/acca-qualification-structure.html</p> <p>(CIMA) CIMA: https://www.cimaglobal.com/</p> <p><u>Textbooks:</u></p> <p>(TT) TeikToe Teoh, AI in Business and Finance, 2021</p> <p>(AB) Avrim Blum, Foundation of Data Science, 2015</p> <p>(PH) Patrick Henry Winston, Artificial Intelligence, 3rd Edition, Addison-Wesley Publishing Company</p>

ISBN 0-201-53377-4.

(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.

(SR) Sebastian Raschka, **Python Machine Learning**, 2017, 2nd edition, Packt Publishing, ISBN 978-1787125933.

(SB) Steven Bird, Ewan Klein & Edward Loper, **Natural Language Processing with Python**, 3rd edition, 2009, O'Reilly, ISBN 978-0596516499.

H) Course Policies and Student Responsibilities

Your responsibilities include attendance, punctuality, preparation and participation.

- (1) Attendance: You are required to attend at least 75% of the seminars.
- (2) Punctuality: You are expected to be punctual and arrive before the start of class, as late arrivals will be disruptive to class activities and considered disrespectful to the instructor and fellow students. For submission of course requirements, you are required and expected to follow the submission deadlines.
- (3) Preparation: You are expected to prepare for each seminar by viewing pre-recorded lectures, reading and working on all assigned material prior to seminar. The quality of you and your peers' learning will largely depend on how well prepared you are for class.
- (4) Participation: Once in class, you are expected to contribute to class discussions and exercises as well as ask questions whenever in doubt. You are also expected to observe respectful behaviour such as raising your hand before speaking, not interrupting other students, not using electronic devices unless required for problem solving exercises, and not causing any distractions to fellow students.
- (5) It is compulsory for you to complete a peer evaluation for the group work that you had done in this course. All members must be present during the final presentation.

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	Office Consultation Hours
Teoh Teik Toe	S3-B2C-110	65148988/ 9790 5202	ttteoh@ntu.edu.sg	By prior appointment via email

K) Planned Weekly Schedule

Week	Topic	Course LO	Readings/ Activities
1	Intro to AI: <ul style="list-style-type: none"> • Today's AI • Setup Anaconda and RStudio • Financial LAM 	1	AB Chapter 5, 7, 12; PH Chapter 6, 22;
2	Regression <ul style="list-style-type: none"> • Linear Regression • Logistic Regression • Financial LAM 	1,2	TT Chapter 10,11
3	Decision Tree <ul style="list-style-type: none"> • CART • Random Forest • XGBoost • Financial LAM 	1,2	TT Chapter 10,11
4	Weka <ul style="list-style-type: none"> • Pre-processing of data • Data Visualization • Feature Selection • Classifier • Financial LAM 	1,2	WK
5	Neural Network <ul style="list-style-type: none"> • Perceptron • MLP 	1,2	TT Chapter 10,11

	<ul style="list-style-type: none"> Financial LAM 		
6	Recurrent Neural Network <ul style="list-style-type: none"> RNN GRU LSTM CNN Financial LAM 	1,2	TT Chapter 14
7	Consultation for Final Assignment <ul style="list-style-type: none"> Financial LAM 	3	
8	Clustering and Association Rules <ul style="list-style-type: none"> Kmean Elbow Apriori Financial LAM 	1,2	CA, AR
9	Time Series <ul style="list-style-type: none"> MA Exponential Smoothing Holt Winter ARIMA AI and Programming LAM 	1,2	TS
10	Chatbot using SnatchBot <ul style="list-style-type: none"> Basic Flow Variable If Statement AI and Programming LAM 	1,2	TT Chapter 14
11	RPA using UiPath <ul style="list-style-type: none"> Basic Flow Variable If Statement For Loop AI and Programming LAM 	1,2	RPA (Video)
12	Consultation for Group Project <ul style="list-style-type: none"> AI and Programming LAM 	3	
13	Conclusion and Project Presentation <ul style="list-style-type: none"> Group project presentation 		Group Project

Annex B**Rubric 1 (Class Participation)****Learning Objective:**

ILO 1. Write codes that allow you to solve Accounting and Finance problem

programmatically by creating AI model using R, Python, Keras, Hadoop, Spark and API.

ILO 2. Manage data to sufficiently derive, communicate analytics outcome and eventually create AI model in Accounting and Finance.

ILO 3. Implement a simple system in AWS including engineering work in implementing AI model in Accounting and Finance.

Traits	Performance	
Attendance	Not Yet Missed more than 2 classes without valid reason	Substantially Developed Full attendance in class or miss 1 class without valid reason
	Evaluation: Not Yet 1 2 3 4 5 Substantially Developed	
Engagement	Not Yet Hardly focuses in class (e.g. using mobile phone, unnecessary chatting)	Substantially Developed Occasionally engages in distracting activities (e.g. using mobile phone, unnecessary chatting) in class or fully engaged.
	Evaluation: Not Yet 1 2 3 4 5 Substantially Developed	
Contribution frequency and quality	Not Yet Does not speak up or contribute in class or contribute with no substance	Substantially Developed Occasionally speak up or all time speak up with knowledge of subject matter and insight
	Evaluation: Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed	

Rubric 2 (Practical Assessment – assess Acquisition of Knowledge and Problem Solving & Decision Making)**Learning Objective:**

ILO 1. Write codes that allow you to solve Accounting and Finance problem programmatically by creating AI model using R, Python, Keras, Hadoop, Spark and API.

ILO 3. Implement a simple system in AWS including engineering work in implementing AI model in Accounting and Finance.

Traits	Performance	
Demonstrates ability to acquire reference to solve the problem	Not Yet Does not demonstrate or not able to identify appropriate resources.	Substantially Developed Able to look for resources needed to solve the problem and ability to adopt it into different context.
	Evaluation: Not Yet 1 2 3 4 5 Substantially Developed	
Demonstrates ability of using appropriate coding elements	Not Yet Does not demonstrate ability to use coding element.	Substantially Developed 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 1 2 3 4 5 Substantially Developed	
Devise strategies to construct proper AI and data model or codes for analysis	Not Yet No AI, data model or codes were developed to suitably aid the analysis.	Substantially Developed Well-developed AI, data model and codes and form comprehensive analysis which examine the data from different perspectives.
	Evaluation: Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed	

Rubric 3 (Group Project – assess Problem Solving & Decision Making)

Learning Objective:

ILO 2. Manage data to sufficiently derive, communicate analytics outcome and eventually create AI model in Accounting and Finance.

ILO 3. Implement a simple system in AWS including engineering work in implementing AI model in Accounting and Finance.

Traits	Performance	
Demonstrates a basic understanding of essential coding elements	Not Yet Does not demonstrates understanding on coding basic.	Substantially Developed 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	
Analyses and evaluates problem and implements appropriate solution	Not Yet No analysis of problem and no solution is provided. Contradicting analysis is given.	Substantially Developed Excellent analysis of problem and propose well supported solution. Solution illustrates coherent understanding to solve the problem. Provides convincing analysis 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	
Identifies and assesses the quality of data given and provides additional analysis related to the issue.	Not Yet Merely repeats information provided, taking it as truth, or denies evidence without adequate justification. Analyses inadequately and understanding of the data.	Substantially Developed Examines the data and source of evidence; questions its accuracy, precision, relevance, and completeness. 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	

Rubric 4 (Individual – assess Oral Communication)**Learning Objective:**

ILO 2. Manage data to sufficiently derive, communicate analytics outcome and eventually create AI model in Accounting and Finance.

ILO 3. Implement a simple system in AWS including engineering work in implementing AI model in Accounting and Finance.

Traits	Performance	
Communication Outcome	Not Yet Central message is not explicitly stated in the presentation. Main points are not clearly identified, audience unsure of the direction of the message.	Substantially Developed Central message is precisely stated; main points are clearly identified.
	Evaluation: Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed	
Relevant Content	Not Yet Content is erroneous or irrelevant; references and supporting materials are absent. Lacks of depth in content and little insights are exhibited. Presentation falls outside set time parameters. Lack of appropriate visualization.	Substantially Developed Content is accurate, thorough, and directly on point; strong support and references are provided. Exhibits depth and insight in content. Effective use of time and stays within time parameters. Excellent use of visualization to present data.
	Evaluation: Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed	
Communication Structure	Not Yet No clear structure, no explanation for solution. Organizational pattern (specific introduction and conclusion, sequenced materials within the body, and transitions) is not observable.	Substantially Developed Organizational pattern is clearly and consistently observable and makes the content of the presentation cohesive.
	Evaluation: Not Yet 1 2 3 4 5 6 7 8 9 10 Substantially Developed	

CONFIDENTIAL PEER EVALUATION FORM FOR TEAM PROJECT

Member's name: _____

Seminar group and team number: _____

Please use the attached Peer Evaluation Rubric to evaluate yourself and your team members on each of the 5 stated attributes (on a scale of 1 to 7). State your ratings for yourself and each of your team members in the table below. For your self-assessment, insert "(Self)" after your name in the table below.

Index #	Name of team members	1 - RR	2 - CM	3 - CR	4 - CT	5 - RS	Average Rating
1							
2							
3							
4							
5							
6							

If any of your ratings above is < 4, please provide a brief explanation to justify the ratings.

Index #	Brief explanation to justify a rating of < 4

You may attach supporting documents (like emails and screen shots), if any, to support your explanations above.

Peer Evaluation Instructions

All members are required to complete a peer evaluation for each member of the team (i.e., including a self-assessment). The completed peer evaluation form must be submitted individually to the instructor immediately after the team project has been submitted for grading (For the group-assignment, students must submit individually the completed peer evaluation form immediately after the last assignment has been submitted for grading). Identity of appraisers will be kept confidential and will not be revealed to other team members.

We may use a member's ratings (on a scale ranging from 1 to 7) to award marks for the team project to other members by computing the average rating that a member receives from other members (i.e., excluding each member's self-rating). A member's mark for the team project will be computed as follows:

If a member's average rating is ≥ 5.5 , the member will receive 100% of the overall mark awarded to the team project.

If a member's average rating is < 5.5 but ≥ 4 , the member will receive 80% of the overall mark awarded to the team project.

If a member's average rating is < 4 but ≥ 2 , the member will receive 50% of the overall mark awarded to the team project.

If a member's average rating is < 2 , the member will receive 30% of the overall mark awarded to the team project.

Teamwork & Interpersonal Skills (Peer Evaluation) Rubric**Learning Objective: The ability to work effectively with others in a group setting.**

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

References:

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