School of Science, Technology and Engineering

MSc Data Science and Artificial Intelligence
Level: 7
Module: Python Programming for AI and Data Science

Assessment:	Programming portfolio and supporting material
Module Tutor:	Steve Harris
Weighting in Module:	100%
Hand out:	Tuesday 27th September 2022
Hand in:	**on or before Monday 12 noon 5th December 2022**
	Via Brightspace portal

What is required?

1. A programming portfolio and supporting material

Learning outcomes to be assessed:

1. Demonstrate knowledge and understanding of programming for Artificial Intelligence and Data Science.
2. In combination with appropriate theory, develop robust programming solutions to solve Artificial Intelligence and Data Science problems.
3. Assess, understand, create and improve programming solutions.

Assessment & Grading Criteria:

1. Demonstrate knowledge and understanding of programming for Artificial Intelligence and Data Science.
2. In combination with appropriate theory, develop robust programming solutions to solve Artificial Intelligence and Data Science problems.
3. Assess, understand, create and improve programming solutions.

<u>ASSESSMENT BRIEF:</u>

The assessment for this module requires:

1. A personal software project created with Python. This must demonstrate a range of techniques covered during the module lectures. You should also consider demonstrating techniques you have learned through self-directed learning.

PERSONAL PROJECT 100% of module mark

You are free to develop a project which is of interest to you based around the areas of artificial intelligence or data science. Alternatively, you may select one of the project briefs provided below. In order to help you understand the scope of this project, it should take roughly the same amount of time to plan, research, writeup and check a 5,000 word essay. That is just a time comparison and is in no way an indication of the number of lines of code you must write. It is impossible to specify a precise number of lines of code for such a project as programming code can be written in several different ways to achieve the same goal. **If you are in doubt about the scope of the project, please ask a module tutor.**

The code for the personal project must be presented within one PyCharm project but may contain more than one code file is necessary.

Your code must be clearly commented. The comments must be aimed at beginner programmers, so you must explain the logic of your code clearly for readers who are not experienced programmers. Comments must **focus on explaining WHY** you are doing certain things, **NOT WHAT you are doing**. For example, you do not need to explain what a FOR LOOP is in your code (that is assumed knowledge) but you do need to explain why you are using it. This will provide the assessors with an opportunity to assess your **understanding of your code**. If sections of code remain uncommented, then assessors have no way of knowing if you actually understand the code. It will then be assumed that you have copied this code from another source without referencing it or understanding it.

If you follow online tutorials or other sources, these must be fully referenced within your code, in a section placed at the end of the document called "Code References". These must be formatted in Harvard style and be placed within the code as comments.

You must use Python version 3.9 for your assignment.
Your work will only be assessed using python 3.9. If you develop your project using another version of Python and the project does not execute or behave correctly when assessed with 3.9 you risk losing marks.

You must also include any support material for the project, for example installation and user instructions, datafiles, and any other material to assist with the assessment of your project.

You must have your personal project approved by the module leader. This is to ensure that your project is a suitable size and complexity for the module.

Example Projects

If you are unsure what type of project to build, it is suggested that you select one of the projects below. Please talk to the module leader if you would like further suggestions.

COVID-19 Cases
Using "COVID-19 Cases World.csv" dataset provided in the *Module Content | Datasets for Tasks* page of Brightspace design a python script which provides the user with options to present at least 4 and no more than 10 items of summary information on the dataset and individual columns (min/max values, averages, standard deviation etc) and at least one graph of a portion of the data. You are free to select which type of analysis you carry out on the dataset and which portion of the data you display as a graph. You should consider how to demonstrate as wide a range of

abilities, for example, abilities in matplotlib can be demonstrated by providing a set of data in a well-documented line graph, and further extended by demonstrating how to present other data in a bar chart. You may also consider providing a graphical user interface to replace the command line choices.

Vending Machine

Create a python script which models the logic required to operate a vending machine. You may wish to consider using a Finite State Machine, although there are alternative methods to approach this scenario. The following requirements must be met:
- the vending machine can accept 5, 10, 20, 50p coins only.
- Costs for items are:
    o 5p Slim Bar
    o 10p = Far Bar
    o 20p = Mar Bar
    o 50p = Twin Bar
- a coin must be entered into the machine before any choice can be made.
- only one coin can be entered at a time.
- entering multiple coins to build up credit to make multiple purchases in one transaction is not possible
- multiple purchases CAN be made with a single coin
- The correct change must be provided to the user when the user decides the purchase process is complete.

Maze Generator

This is a more advanced topic and only suitable for students who already have a good level of programming experience.
Using either the matplotlib https://matplotlib.org/ or turtle library https://docs.python.org/3/library/turtle.html write a python script which draws a maze. For this project, you should access a copy of the book *Mazes For Programmers*, (reference below) as this offers a very good description of how to start generating mazes. You should start with the Binary Tree Algorithm p 3-12. There are two parts to this project:
- Working out how to draw a line between two specific locations in a grid to represent a wall using either the matplotlib or turtle library.
- Following the logic of generating the maze as described in the book.

Buck, J. (2015) *Mazes for programmers: code your own twisty little passages*. Edited by J. Carter. Dallas: Pragmatic Bookshelf.

Level 7 Module Grading Criteria

Level 7					
In accordance with the FHEQ, at the end of Level 7 students should have a systematic understanding of knowledge, and a critical awareness of current problems and/or new insights, much of which is at, or informed by, the forefront of their academic discipline, field of study or area of professional practice. They will be able to demonstrate originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in the discipline. They should have a conceptual understanding that enables them to evaluate critically current research and advanced scholarship in the discipline and to evaluate methodologies and develop critiques of them and, where appropriate, to propose new hypotheses. They will also be able to deal with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate their conclusions clearly to specialist and non-specialist audiences. In addition, they will be able to demonstrate self-direction and originality in tackling and solving problems, and act autonomously in planning and implementing tasks at a professional or equivalent level.					
		Assessment category			
		Coherent and detailed knowledge and understanding of the subject area, at least some of which is informed by the latest research and/or advanced scholarship within the discipline	**Cognitive and intellectual skills**	**Application of theory to practice (for courses with a professional practice element)**	**Reading and referencing**	**Presentation, style and structure** Work that significantly exceeds the specified word limit may be penalized
Pass mark, demonstrating achievement of all associated learning outcomes	90%-100%	Exemplary systematic, theoretical and conceptual understanding of knowledge at or informed by the forefront of the field of study, demonstrating highly sophisticated grasp of the subject matter	Exceptional critical evaluation and awareness of current problems, and contemporary issues and debates that draws on new insights or perspectives within the field. Work demonstrates exemplary ability to synthesise current research and advanced scholarship in an original, creative and innovative manner.	Sophisticated, systematic and innovative application of knowledge and theory to professional practice within the discipline. Flawless use of systematically selected literature to justify and express reasoned judgements and decisions in relation to complex issues and problems at a professional level	A very high level of critical engagement across a systematic and fully appropriate range of relevant and current academic, research, policy- and practice-related literature demonstrating deep and selective reading and initiative along with highly consistent accurate referencing	Exemplary presentation of work that is fluent and flawless throughout.
	80%-89%	Excellent systematic, theoretical and conceptual understanding of knowledge at or informed by the forefront of the field of study and showing sophisticated depth, breadth, detail and clarity	Sophisticated critical evaluation and awareness of current problems, and contemporary issues and debates that draws on new insights or perspectives within the field. Work demonstrates a very high level of originality and creativity in the student's approaches to synthesising current research and advanced scholarship within the subject area	An excellent level of originality and innovation in the application of knowledge and theory to professional practice within the discipline. Demonstration of excellent critical awareness and evaluation and the ability to effectively critique and employ current academic literature in making reasoned judgements and decisions in relation to complex issues and problems at a professional level	A very high level of critical engagement across an extensive range of relevant and current academic, research, policy- and practice-related literature demonstrating deep and appropriate reading and initiative along with highly consistent accurate referencing	Outstanding presentation of work that is logically and coherently structured with a strong or original central argument(s), conveyed with a high level of fluency and eloquently communicates compelling, coherent conclusions to specialist and non-specialist audiences

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Level 7		Coherent and detailed knowledge and understanding	Cognitive and intellectual skills	Application of theory to practice	Reading and referencing	Presentation, style and structure
Pass mark, demonstrating achievement of all associated learning outcomes	70% – 79%	A high level of systematic, theoretical and conceptual understanding of knowledge at or informed by the forefront of the field of study and showing considerable depth, breadth, detail and clarity	A high level of critical evaluation and awareness of current problems, and contemporary issues and debates that draws on new insights or perspectives within the field. Work demonstrates a significant level of originality and creativity in synthesising current research and advanced scholarship within the subject area	A high level of originality and innovation in the application of knowledge and theory to professional practice within the discipline. Demonstration of excellent critical awareness and evaluation and the ability to select and use academic literature in making reasoned judgements and decisions in relation to complex issues and problems at a professional level	A high level of critical engagement across an extensive range of relevant and current literature demonstrating wide and appropriate reading and initiative along with highly consistent accurate referencing	Excellent presentation of work that is logically and coherently structured with a strong or original central argument(s), conveyed with a high level of clarity of expression and which clearly communicates valid, coherent conclusions to specialist and non-specialist audiences
	60% – 69%	An effective, systematic, theoretical and conceptual understanding of knowledge mostly at or informed by the forefront of the field of study and showing good depth, breadth, detail and clarity	An effective level of critical evaluation and awareness of current problems and contemporary issues and debates that draws on new insights or perspectives within the field. Work demonstrates some effective originality and creativity in synthesising current research and scholarship within the subject area	A good level of originality and innovation in the application of knowledge and theory to professional practice. Demonstration of consistently good critical awareness and evaluation and reasonable ability to use the academic literature in making reasoned judgements and decisions in relation to complex issues and problems at a professional level	A good level of critical engagement across a good range of relevant and current academic, research, policy- and practice-related literature demonstrating appropriate reading and some initiative along with consistent accurate referencing	High quality presentation of work that is largely logically and coherently structured with a generally strong central argument conveyed with a clarity of expression and which communicates clear conclusions to specialist and non-specialist audiences
	50% – 59%	A sufficient but limited level of systematic, theoretical and conceptual understanding of knowledge at times at or informed by the forefront of the field of study but showing adequate depth, breadth, detail and clarity	A sufficient but limited level of critical evaluation and awareness of current problems and contemporary issues and debates, with some reference to new insights or perspectives within the field. Limited evidence of originality and creativity in synthesising current research and scholarship within the subject area	A reasonable but limited level of originality and innovation in the application of knowledge and theory to professional practice within the discipline. Demonstration of some good critical awareness and evaluation and some ability to use the academic literature in developing judgements and decisions in relation to complex issues and problems at a professional level	Sufficient critical engagement with a reasonable range of relevant and current academic, research, policy- and practice-related literature demonstrating mainly appropriate reading but limited initiative and/or some minor inconsistencies and inaccuracies in referencing	Generally good presentation of work that is sufficiently logical and coherent in structure with a discernible central argument. May present limited originality and lack some clarity of expression, but an identifiable conclusion reasonably communicated to specialist and non-specialist audiences

Level 7		Coherent and detailed knowledge and understanding	Cognitive and intellectual skills	Application of theory to practice	Reading and referencing	Presentation, style and structure
Marginal fail	45% – 49%	Knowledge and understanding of the subject matter is incomplete, uninformed or limited in its scholarship within the field of study, or lacking sufficient depth, breadth, detail or clarity	Critical evaluation is limited or lacks awareness of current problems and contemporary issues and debates. Insufficient reference made to new insights or perspectives within the field, or insufficient evidence of originality and creativity in synthesising current research and scholarship within the subject area	Insufficient degree of originality or innovation in the application of knowledge and theory to professional practice within the discipline. Demonstration of poor critical awareness and evaluation or a lack of ability to use the academic literature in developing judgements and decisions in relation to complex issues and problems at a professional level	Insufficient critical engagement with relevant and current academic, research, policy- and practice-related literature. Lack of evidence of wider reading or a lack of initiative or inconsistent and inaccurate referencing	Presentation of work shows insufficient organisation or central argument, and is lacking in logical and coherent structure. Poor clarity of expression weakly communicating to specialist or non-specialist audiences
Fail	30% – 44%	Limited knowledge and understanding of the subject matter shown. Work is not sufficiently informed by scholarship within the field of study and is insufficient in depth, breadth, detail or clarity	Insufficient evidence of critical evaluation and awareness of current problems and contemporary issues and debates. Insufficient reference to new insights or perspectives within the field and lacking in originality and creativity in synthesising current research and scholarship within the subject area	Little evidence of originality and innovation and a significant lack of application of knowledge and theory to professional practice demonstrating little critical awareness and evaluation and a lack of ability to use the academic literature to make judgements and decisions in relation to complex issues and problems at a professional level	Little evidence of critical engagement with relevant and current literature. Poor use of appropriate sources and/or inconsistent and inaccurate referencing	Often poorly presented work that is disorganised, has an ill-formed central argument, and lacks a logical and coherent structure. A lack of clarity of expression or fails to communicate effective conclusions to specialist or non-specialist audiences
	<30%	Inadequate and limited knowledge and understanding of the subject matter shown. Work is not informed by scholarship within the field of study and significantly lacks depth, breadth, detail or clarity	Descriptive work with little or no evidence of critical evaluation and awareness of current problems and contemporary issues and debates. No evidence of awareness of new insights or perspectives within the field. Little or no synthesis of current research and scholarship within the subject area	No evidence of originality and innovation and little to no application of knowledge and theory to professional practice. Demonstrates no critical awareness and evaluation and a distinct lack of ability to use the academic literature in an effective manner	No evidence of critical engagement with relevant and current literature. Lack of use of appropriate sources and inconsistent and inaccurate referencing	Poorly presented and disorganised work that lacks a logical and coherent structure, lacks a well-formed central argument and shows a significant lack of clarity of expression with very weak or irrelevant conclusions, that may be incoherent to specialist or non-specialist audiences

* Work that significantly exceeds the specified word limit may be penalised.

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Hand out:	Tuesday 28th September 2021
Hand in:	**on or before 12 noon 3rd December 2021**
	Via Brightspace portal

	Criteria	Feedback	Mark	
Project	Knowledge and understanding of Python			/30
	User experience (For example: installation & user instructions, ease of understanding of application, ability to cope with incorrect user behaviour, complexity of features.)			/30
	Self-Directed Learning			/30
	Commenting of Code & Presentation			/10
		Total	0	/100