ASSESSMENT AND INTERNAL VERIFICATION FRONT SHEET (Individual Criteria)

Course Title	B.Sc. Software Development		Lecturer Name & Surname	Frankie Inguanez Alan Gatt	
Unit Number & Title	ITSFT-606-1618 Applied Computational Intelligence				
Assignment Number, Title / Type	01 – Optimisation and Classification				
Date Set	19/12/2022		Deadline Date	19/12/2022	
Student Name			ID Number		Class / Group

☐ *Student's declaration prior to handing-in of assignment:*
- ❖ *I certify that the work submitted for this assignment is my own and that I have read and understood the respective Plagiarism Policy*

☐ ☐ **Student's declaration on assessment special arrangements (Tick only if applicable)**
- ❖ *I certify that adequate support was given to me during the assignment through the Institute and/or the Inclusive Education Unit.*
- ❖ *I declare that I refused the special support offered by the Institute.*

Student Signature:		**Date :**	**01/12/2021**

Assessment Criteria	Maximum Mark	Mark Achieved
KU1 Outline and distinguish the different kind of solution algorithms possible.	5	
KU2 Identify the basic components needed in linear programming.	5	
KU3 Outline different forecasting techniques.	5	
KU4 Recognise the different categorisations of data.	5	
AA3 Complete a forecasting report using different techniques.	7	
KU6 Solve a logistical problem using linear programming techniques.	5	
Total Mark	32	

Assessor's feedback to student

(If necessary, use reverse side of page for IV feedback on assignment brief / sample of assessment decisions)

	Name & Surname	**Signature**	**Date**
Internal Verifier : Approval of *assignment brief*		For approval signature, please refer to electronic audit trail	
Lecturer / Assessor : Issue of results and feedback to student		For approval signature, please refer to electronic audit trail	
Internal Verifier : Approval of *assessment decisions (Sample)*		For approval signature, please refer to electronic audit trail	
Learner's signature upon collection of corrected assignment.			

Instructions to Students

Read the following instructions carefully before you start the assignment. If you do not understand any of them, ask your lecturer.

- This assignment is a time-constrained assignment and should be completed in **2 hours**.

- You should attempt all questions and submit any work even as part submission for a question since you could be rewarded marks for your work.

- This assignment caries a total of 32% from the final module mark.

- You are required to save your work and submit on VLE

- Copying is strictly prohibited, and any students caught will be subject to the respective MCAST Disciplinary Procedures.

Section A (KU1)

One question will be chosen at random from the following:

Q01) Correctly identify a Non-Deterministic Polynomial Problem:
- Quick sort
- Bubble sort
- Merge sort
- Travelling Salesman Problem

Q02) Correctly identify a Polynomial problem
- Quicksort
- Sudoku Solver
- Time tabling
- Travelling Salesmen

Q03) A non-deterministic polynomial problem is easily solved and easily verified:
- True
- False

Q04) A polynomial problem is hard to solve but can be verified easily:
- True
- False

One question will be chosen at random from the following:

Q05) The optimization of an objective by identifying the mix of two or more variables is:
- NP Hard Problem
- Linear Programming Problem
- Simple Linear Regression Problem
- Classification Problem

Q06) A model representing the linear relationship between one or more predictors to a target variable is known as a:
- Linear Programming
- Regression Analysis
- Clustering
- Unsupervised Learning

Q07) Predictor variable is a column/feature within a dataset that represents the objective, meaning what is to be predicted.
- True
- False

Q08) The target variable is a column/feature within a dataset that is used to predict the final target or objective of the problem:
- True
- False

One question will be chosen at random from the following:

Q09) Correctly identify an example usage of linear programming
- Classify different flower species
- Find the optimal allocation of resources to maximise profits or minimise costs
- Gather several entries/observations in groups such as store to warehouse allocation
- Predict the life expectancy of a group of people

Q10) Regression analysis is used to:
- Create groups of similar observations called clusters.
- Find the optimal allocation of resources to maximise profits or minimise costs
- Gather several entries/observations in groups such as store to warehouse allocation
- Predict the price of housing based on other features such as floor space.

One question will be chosen at random from the following:

Q11) Regression Analysis falls under which type of machine learning techniques?
- Supervised
- Unsupervised
- Linear Programming
- Reinforcement Learning

Q12) Clustering falls under which type of machine learning techniques?
- Supervised
- Unsupervised
- Reinforcement Learning
- Aggregation

Q13) Which plot/table is used to determine metrics such as accuracy for a classification model?
- Box Plot
- Confusion matrix
- Correlation Plot
- Histogram

Q14) A true negative classification is when a classifier correctly determines that the current observation is not the target class being investigated:
- True
- False

Q15) A false negative classification is when a classifier incorrectly determines that the current observation is not the target class being investigated:
- True
- False

Section B (KU2)

A shop owner is selling three different items A, B, C, each yielding a profit of €225, €200 and €250 respectively. The owner can only store a total of 2,000 units. The supplier requires that a minimum amount of each is ordered, 10 units, 15 units and 20 units respectively. The owner has a budget of €10,000 and each item costs €175, €125, and €200 respectively. Can you recommend the ideal mix to maximize profits? You can assume that only whole products can be created (whole numbers/integers).

This task is assessed as follows, each using Python and indicating appropriately with code comments:

1. Identify the variables
2. Provide the Objective Function
3. Provide the Constraints
4. Solve the problem and indicate the objective value and variable values

N.B. Add comments to explain what you are doing and the expected output

Section C (KU6)

A homeowner wants to install some solar panels, in three locations, his main residence rooftop, his garage rooftop and his penthouse rooftop. Each property has a different available floor space given below. There are three different types of solar units for him to choose from, each with a different footprint, electricity generation and cost. Can you identify the ideal mix of solar panels in each property to maximize the electricity generation whilst remaining within a budget of €16,000?

Solar Unit Type	Cost per unit	Area per unit	Electricity generation
1	€200	2 m^2	2 kwh
2	€260	4 m^2	3 kwh
3	€350	5 m^2	4 kwh

Property	Available Area
Home	100 m^2
Garage	20 m^2
Penthouse	80 m^2

This task is assessed as follows, each using Python and indicating appropriately with code comments:

1. Identify the variables
2. Provide the Objective Function
3. Provide the Constraints
4. Solve the problem and indicate the objective value and variable values

Section D (KU4)

You have been provided with a dataset created by NASA about the sound pressure level of airfoils tested in wind tunnels. The dataset is available from the UCI Machine Learning Repository. The aim of the research is to determine the ideal airfoil parameters at different speeds yet maintain a low sound pressure level.

This task is assessed as follows:
1. Identify the predictor variables, target variable, ID, and irrelevant variables.
2. Display several plots to determine which numerical predictor variables are unbalanced. Correctly identify these in your comments.
3. Display several plots to determine the presence of outliers in any variable. Correctly identify these in your comments.

Section E (KU3)

Take the dataset and try to investigate the following research question:

1. Is there a correlation between the thickness and the sound pressure level?
2. Is there a correlation between the length and the sound pressure level?
3. Is there a correlation between the angle and the sound pressure level?

This task is assessed as follows:
1. Calculation and visualisation of a linear regression model
2. Calculation of correlation between variables
3. Interpretation of results
4. Recommend the ideal model

Section F (AA3)

Take the dataset and perform several multiple linear regression models and identify the ideal to predict the sound pressure level.

This task is assessed as follows:
1. Creation and assessment of two linear multiple regression models. One with all predictor variables, and another with at least 3 predictor variables.
2. Interpretation of results with justification using statistics namely adjusted R-squared and p-values

N.B. This question requires multiple linear regression for full marks.

Marking Scheme

KU1	Section A	Max	Awarded
	Correctly answer 4 questions (1.25 marks per question)	5	
	Total	**5**	

KU2	Section B	Max	Awarded
	Correctly document the variables, objective function, constraints and bounds in mathematical notation within comments for the problem.	2	
	Correctly code the objective function in Python.	1	
	Correctly add constraints in Python.	1	
	Correctly display the objective value and variable values.	1	
	Total	**5**	

KU6	Section C	Max	Awarded
	Correctly document the variables, objective function, constraints and bounds in mathematical notation within comments for the problem.	2	
	Correctly create a linear model with constraints for the problem in Python.	2	
	Correctly solve the problem and display the objective function and variables values.	1	
	Total	5	

KU4	Section D	Max	Awarded
	Provide code and comment on whether data is normally distributed	2	
	Provide code and comment on whether there are any outliers	2	
	For each variable identify if it is a predictor or target variable	1	
	Total	**5**	

KU3	Section E	Max	Awarded
	Calculate and visualise linear regression model	3	
	Interpret results	2	

KU3	Section E	Max	Awarded
	Total	**5**	

AA3	Section F	Max	Awarded
	Correctly create a multiple linear regression model	2	
	Identify the ideal regression model	1	
	Interpret the result via F-statistic, R-squared and p-values for each model	4	
	Total	**7**	