National Progression Award Outcomes and Performance Criteria

DATA CITIZENSHIP

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| **MODULE** | **OUTCOME** | **PERFORMANCE CRITERIA** |
| Data Citizenship Unit Level 4 (J2HN44) | **Outcome 1:** State the use of data in society. | 1. State the reasons for the growth of data. 2. State how data is used and misused by individuals, organisations and society. 3. Describe types of data bias and its impact on society. 4. State common sources of public and private data. 5. State the rights and responsibilities of data subjects and data owners. |
| **Outcome 2:** Describe data literacy concepts. | 1. Describe the characteristics of high quality data. 2. Describe how data can be analysed. 3. Describe types of data visualisations. 4. Describe simple methods of managing and securing data. |
| **Outcome 3:** Interpret simple data | 1. Create visualisation to identify patterns and trends in the data. 2. Draw conclusions from data. 3. Make recommendations based on conclusions and communicate findings |
| Data Citizenship Unit Level 5 (J2HN45) | **Outcome 1:** Describe the use of data in society. | 1. Describe the reasons for the growth of data. 2. Describe how data is used and misused by individuals, organisations and society. 3. Describe types of bias and its impact on individuals and society. 4. Describe sources of public and private data and the concept of open data. 5. Describe the rights and responsibilities of data subjects and data owners. |
| **Outcome 2:** Explain data literacy concepts. | 1. Explain the characteristics of high quality data. 2. Explain how data can be analysed. 3. Explain types of data visualisations and the best use of each type. 4. Explain methods of managing and securing data. |
| **Outcome 3:** Interpret data. | 1. Extract information from data visualisations and dashboards. 2. Interpret data to identify patterns and trends and draw conclusions. 3. Create appropriate visualisations from data. 4. Communicate findings and make recommendations based on conclusions |
| Data Citizenship Unit Level 6 (J2HN46) | **Outcome 1:** Explain the use of data in society. | 1. Explain the technological, economic and societal reasons for the growth of data. 2. Explain how data is used and misused by individuals, organisations and society. 3. Explain types of bias and its impact on individuals and society. 4. Explain types and sources of large datasets and the philosophy of open data. 5. Explain the rights and responsibilities of data subjects and data owners. |
| **Outcome 2:** Explain data literacy concepts. | 1. Explain the concepts of data volume, variety, velocity, veracity and value. 2. Explain how data can be analysed and the tools that can be used to perform analysis. 3. Explain data visualisations and data storytelling. 4. Explain methods of data management and data security. 5. Explain the role of domain knowledge within data science. 6. Explain the concept of data ethics. |
| **Outcome 3:** Interpret complex data | 1. Extract information from data visualisations and dashboards. 2. Evaluate a dataset in terms of its quality including potential bias. 3. Interpret data to identify patterns and trends and draw conclusions. 4. Create appropriate visualisations from data. 5. Communicate findings and make recommendations based on conclusions. |

DATA SCIENCE

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| **MODULE** | **OUTCOME** | **PERFORMANCE CRITERIA** |
| Data Science Unit Level 4 (J2G244) | **Outcome 1:** Describe data science. | 1. State the reasons for the development of data science. 2. Describe contemporary applications of data science. 3. Describe the steps in solving a problem using data science. 4. Identify sources of bias in data science including historical bias. |
| **Outcome 2:** Describe simple ways of analysing data | 1. Describe common data types and data formats. 2. Describe structured and unstructured data. 3. Describe simple methods of cleaning and transforming data. 4. Describe basic descriptive statistics used to summarise a dataset. 5. Describe simple data visualisations. |
| **Outcome 3:** Analyse a small dataset to identify patterns. | 1. Perform simple data cleaning and structuring. 2. Perform basic analyses including sort, filter, group and summarise. 3. Visualise the data to provide basic insights. 4. Create a simple report to communicate insights. |
| Data Science Unit Level 5 (J2G245) | **Outcome 1:** Describe the tools and techniques of data science. | 1. Describe the reasons for the development and growth of data science. 2. Describe contemporary applications of data science. 3. Describe the data science life cycle including the potential for bias at each stage. 4. Describe the tools that can be used at each stage in the life cycle. 5. Identify sources of public and private datasets. 6. Describe the role of domain knowledge and subject matter experts in data science |
| **Outcome 2:**  Describe methods of routine data analysis. | 1. Describe common data types and data formats. 2. Describe the composition of a structured dataset. 3. Describe methods of cleaning and transforming data. 4. Describe methods of securing and managing data. 5. Describe descriptive statistics used to summarise a dataset including measures of central tendency and dispersion. 6. Describe the selection of data visualisations to illustrate different types of data. |
| **Outcome 3:**  Analyse a dataset to identify patterns and trends. | 1. Define the required analyses. 2. Capture data from an external source. 3. Perform routine data cleaning and structuring. 4. Perform analyses including query, sort, filter, consolidate, group and summarise. 5. Visualise the data to provide insights. 6. Create an interactive data dashboard to identify patterns and trends. |
| Data Citizenship Unit Level 6 (J2G246) | **Outcome 1:**  Explain the principles of data science. | 1. Explain the relationship between artificial intelligence, machine learning, big data and data science. 2. Explain the technological, economic and societal reasons for the development and growth of data science. 3. Describe contemporary applications of data science and the types of problem that data science can address. 4. Explain the data science life cycle and the significance of domain expertise. 5. Explain descriptive analytics and predictive analytics. 6. Explain the principle of open data and sources of open data. 7. Explain data ethics, including data bias, with reference to national and international standards and frameworks. |
| **Outcome 2:** Explain data science techniques. | 1. Describe common data types and data formats including structured and unstructured data. 2. Explain techniques for data capture, cleaning and transformation including data modelling. 3. Explain data management and data security techniques. 4. Explain statistical techniques involved in data science. 5. Explain techniques for data visualisation, data dashboards and data storytelling. |
| **Outcome 3:**  Analyse a dataset to make predictions. | 1. Define the required analyses and data models. 2. Create a relational data model from external sources of data. 3. Perform data transformation to complete, correct and structure data. 4. Perform descriptive and predictive analyses on the data. 5. Create data visualisations and data dashboards to provide insights. 6. Identify potential sources of bias in the analysis. |

DATA SCIENCE PROJECT

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| **MODULE** | **OUTCOME** | **PERFORMANCE CRITERIA** |
| Data Science Project Unit Level 5 (J2GT45) | **Outcome 1:** Develop a project plan within a group context. | 1. Identify the problem being addressed in a project brief 2. Describe the background to the problem 3. Describe the potential benefits of solving the problem 4. Create a plan of activities for each role assigned within the group |
| **Outcome 2:** Collect data safely and securely. | 1. Identify the data, and appropriate data sources, required for the analysis 2. Assemble the required dataset 3. Employ secure methods for storing the data 4. Recognise legal and privacy considerations with the required data 5. Identify any data quality issues 6. Identify sources of bias in the data. |
| **Outcome 3:** Analyse the collected data to extract insights | 1. Prepare and pre-process data for analysis 2. Calculate dataset summary metrics 3. Interpret analysis to identify insights 4. Create graphs to visualise insights |
| Data Science Project Unit Level 6  (J2GT46) | **Outcome 1:** Develop a project plan to address the problem. | 1. Define the problem being addressed 2. Explain the background to the problem 3. Explain potential benefits of solving the problem 4. Compare different approaches to address the problem 5. Select and justify a specific approach 6. Plan for the steps taken to address the problem |
| **Outcome 2:**  Collect data safely and securely | 1. Identify the data required, and appropriate sources, for the chosen approach 2. Assemble the required dataset. 3. Employ secure methods for storing the data sample 4. Recognise privacy considerations with the required data 5. Identify sources of bias in the collected data sample 6. Review the impacts of data quality issues |
| **Outcome 3:**  Analyse the collected data to extract insights | 1. Prepare and pre-process data for analysis 2. Calculate dataset summary metrics 3. Interpret analysis to identify insights 4. Create graphs to visualise insights |

PROGRAMMING UNIT

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| **MODULE** | **OUTCOME** | **PERFORMANCE CRITERIA** |
| Programming Unit Level 5 (HY2C45) | **Outcome 1:** Write algorithms to solve routine problems. | 1. Describe common methods of writing algorithms 2. Create algorithms by breaking down routine problems into logical steps using stepwise refinement 3. Represent sequence, selection, iteration and subroutines using algorithms 4. Refine an algorithm to improve its efficiency |
| **Outcome 2:** Explain programming concepts. | 1. Explain the concept of syntax and semantics 2. Explain the concepts of data types and data structures, including naming conventions 3. Explain the concepts of instructions, sequence, selection, iteration and subroutines 4. Explain the correct construction of expressions, including operators, assignment statements and the order of evaluation 5. Explain the correct use of arithmetic, relational and logical operators 6. Explain the concepts of program testing and debugging |
| **Outcome 3:** Write a computer programme | 1. Implement data structures in code, adhering to naming conventions 2. Implement an algorithm in code 3. Implement expressions in code 4. Implement subroutines in code 5. Combine instructions, sequences, selections and iterations to create a complete, working program, which accurately implements an algorithm 6. Debug code to eliminate errors |
| Programming Unit Level 6 (HY2C46) | **Outcome 1:** Write algorithms to solve complex problems**.** | 1. Describe techniques for writing algorithms 2. Create algorithms by breaking down complex problems into logical steps using stepwise refinement 3. Represent sequence, selection, iteration, subroutines and recursion using algorithms 4. Explain the concept of algorithmic efficiency 5. Refine an algorithm to improve its efficiency |
| **Outcome 2:**  Explain programming concepts. | 1. Explain the concept of syntax and semantics 2. Explain the concepts of data types and data structures including abstract data structures 3. Explain the concepts of instructions, sequence, selection, iteration, subroutines and recursion 4. Explain the correct construction of expressions, including operators, assignment statements and the order of evaluation 5. Explain the correct use of arithmetic, relational and logical operators 6. Explain the concepts of program testing and debugging 7. Explain the purpose of internal documentation |
| **Outcome 3:**  Write a complex computer program | 1. Implement data structures, including abstract data structures, in code 2. Implement an algorithm in code 3. Implement expressions in code 4. Implement subroutines in code 5. Document code internally 6. Combine instructions, sequences, selections and iterations to create a complete, working program, which accurately implements an algorithm 7. Test and debug code to eliminate significant errors |

DATA SECURITY

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| **MODULE** | **OUTCOME** | **PERFORMANCE CRITERIA** |
| Data Security Level 5 (H9E245) | **Outcome 1:** Describe the legal and ethical obligations around storing and sharing personal and business data | 1. Describe the laws that apply to the storing and sharing of data. 2. Describe the ethical considerations of organisations when storing and sharing data. 3. Describe real life examples of best practice in the application of ethics within organisations. |
| **Outcome 2:**  Explain the causes and effects of data security breaches. | 1. Define a data security breach. 2. Identify contemporary real life examples of data security breaches. 3. Explain common causes of data security breaches. 4. Explain the potential effects of a data security breach on individuals. 5. Explain the potential effects of a data security breach on organisations. |
| **Outcome 3:**  Protect data against security breaches. | 1. Identify software that can be used to enhance data security. 2. Identify hardware that can be used to enhance data security. 3. Identify workplace rules that can be used to enhance data security. 4. Apply selected methods of enhancing data security to a specific situation. 5. Create a data security solution for a recent data security breach. |
| Data Security Level 6 (H9E246) | **Outcome 1:**  Analyse the approach to data security made by organisations. | 1. Explain the cyber security challenges faced by small, medium and large companies. 2. Explain the cyber security challenges faced by different sectors. 3. Identify sources of best practice in cyber security. 4. Identify different types of security personnel and their roles in small, medium and large companies. 5. Compare physical, perimeter and internal network security. 6. Explain the importance of cyber resilience. 7. Investigate approaches to good business cyber security. |
| **Outcome 2:**  Investigate technologies and strategies used by businesses to protect customer data. | 1. Identify the major suppliers in the cyber security goods and services sectors. 2. Define current types of technology used for cyber security defence. 3. Explain how current defence technology works and the associated risks. 4. Explain the importance of patching and why software needs regularly patched. 5. Explain table top exercises and their purpose. 6. Explain real life strategies used by businesses to protect customer data. |
| **Outcome 3:**  Create a security strategy for a small business | 1. Define the cyber security risks faced by small businesses. 2. Explain potential solutions to cyber security risks faced by small businesses. 3. Create a security strategy for a small business. |

MACHINE LEARNING

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| **MODULE** | **OUTCOME** | **PERFORMANCE CRITERIA** |
| Machine Learning  Level 5 (J2G645) | **Outcome 1:** Describe the purpose, applications and key features of machine learning. | 1. Describe the advances in technology that have given rise to the growth in machine learning as a facet of artificial intelligence 2. Describe real-world uses of machine learning, identifying any ethical issues with its use 3. Explain the role that algorithms play in machine learning 4. Describe the difference between supervised and unsupervised machine learning problems 5. Describe the key elements required for supervised learning in machine learning |
| **Outcome 2:**  Explain the importance of good quality data and feature selection in effective machine learning. | 1. Describe the characteristics of good quality data and approaches to data collection that help secure it 2. Explain techniques for identifying and reducing bias in datasets 3. Explain the role of training and test datasets in developing and evaluating a machine learning model 4. State the role of feature identification in model development and describe methods in common use 5. Manipulate datasets with software tools to generate descriptive analytics with a view to feature selection |
| **Outcome 3:**  Apply standard machine learning techniques to create and evaluate a classification model | 1. Identify the main types of algorithm used for classification 2. Explain how a decision tree works to develop a classifier model 3. Produce a classifier model by submitting pre-prepared data to a machine learning classifier algorithm 4. Evaluate the measures of model fit for this classifier 5. Describe the characteristics of under-fitting and over-fitting in a classifier model 6. Describe approaches to model improvement in a classifier problem |
| Machine Learning  Level 6 (J2G646) | **Outcome 1:**  Explain the purpose, applications and key features of data preparation and feature selection for machine learning. | 1. Explain how machine learning attempts to approximate an unknown mapping function from inputs to outputs 2. Describe the purpose and methods of data scaling and normalisation in relation to machine learning 3. Describe the purpose and methods of feature extraction and selection in model development in machine learning 4. Explain data bias and describe methods to reduce bias |
| **Outcome 2:**  Explain how machine learning models can be evaluated, and their predictive performance improved by ensemble methods | 1. Explain the purpose and process of model validation 2. Explain the concepts of over-fitting and under-fitting, and bias and variance 3. Describe the common measures of model performance used in supervised learning 4. Describe common strategies to address problems with model performance 5. Explain the role that ensemble methods play in improving performance |
| **Outcome 3:**  Describe the application of regression models to problems of prediction and classification. | 1. Describe the purpose of a linear regression model and associated measures of goodness of fit 2. Describe the common algorithms for fitting a linear regression model 3. Describe the purpose of logistic regression as applied to binary classification |
|  | **Outcome 4:**  Derive a prediction model from a given dataset using linear regression. | 1. Select and use appropriate analytic tools to examine and choose appropriate features in a given dataset with a view to making predictions 2. Select and use a linear regression algorithm to fit a regression model to a given dataset, and interpret its output in terms of performance 3. Use an ensemble method to improve the performance of this regression model |

DATA SCIENCE STATISTICS

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| **MODULE** | **OUTCOME** | **PERFORMANCE CRITERIA** |
| Data Science Statistics  Level 5 (J2G845) | **Outcome 1:**  Describe statistical methods as they relate to data science. | 1. Distinguish between descriptive and inferential statistics. 2. Describe sampling methods and the significance of sampling in data science. 3. Describe probability and the significance of probability in data science. 4. Describe the characteristics of the normal distribution. 5. Describe common descriptive statistical features of the normal distribution including standard deviation. 6. Describe methods of calculating trends in datasets. |
| **Outcome 2:**  Describe dataset features and tools for analysing datasets. | 1. Describe quantitative and qualitative data. 2. Describe continuous and discrete data, and structured and unstructured data. 3. Describe the coefficient of correlation between datasets 4. Describe the tools used to analyse datasets. 5. Describe the selection of visualisation for specific types of data. |
| **Outcome 3:**  Carry out statistical calculations on datasets using data analysis tools | 1. Derive a range of descriptive statistics from the datasets. 2. Derive correlation co-efficient for the datasets. 3. Derive visualisations of the datasets to show patterns and trends.   Compare the datasets in terms of their descriptive statistics and correlation co-efficient |
| Data Science Statistics  Level 6 (J2G846) | **Outcome 1:**  Explain statistical methods, theorems and algorithms as they relate to data science. | 1. Explain sampling theory and sampling methods. 2. Explain probability, including conditional probability, and the significance of probability in data science. 3. Explain the normal and the standard normal distributions and a range of descriptive statistics relating to these distributions. 4. Explain the central limit theorem and its application in data science. 5. Explain linear regression and Bayes’ Theorem and their application to data science. 6. Explain hypothesis testing and its relevance to data science. |
| **Outcome 2:**  Explain the factors contributing to a statistical study within the framework of a data science project | 1. Explain statistical study planning. 2. Explain common flaws in statistical study design. 3. Explain selection of sampling methods. 4. Explain selection of statistical methods for analysing datasets. 5. Explain selection of statistical methods for comparing two datasets. 6. Explain the selection of data visualisations for different types of datasets |
| **Outcome 3:**  Carry out a statistical study with the aim of contributing to a data science project | 1. Justify the sampling frame. 2. Justify the selection of descriptive and inferential statistics. 3. Justify the selection of data visualisations. 4. Derive descriptive and inferential statistics. 5. Create data visualisations of study result. |

STATISTICS UNIT

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| **MODULE** | **OUTCOME** | **PERFORMANCE CRITERIA** |
| Statistics  Level 6 (H95Y46) | **Outcome 1:**  Use statistical skills in real-life contexts by: | 1.1 Applying statistical literacy skills to data  1.2 Applying statistical skills to normally distributed data  1.3 Applying statistical skills to correlation and linear regression  1.4 Applying statistical skills to data analysis, interpretation and communication |
| **Outcome 2:**  Produce a statistical analysis on given data set(s) by: | 2.1 Undertaking a correlation and regression analysis  2.2 Undertaking a data analysis |

DISCLAIMER

Although we have tried our best to ensure the Outcomes and PCs listed here are accurate and up to date, we highly recommend using the Group Award Specification and the Unit Specifications provided by sqa.org.uk to confirm the content of units and courses.

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