



Agensi Kelayakan Malaysia
Malaysian Qualifications Agency

ADDENDUM ON PROGRAM STANDARD: COMPUTING

Preamble

In response to the demand of MQA stakeholders requesting to add on two more areas in the Programme Standards Computing which is Data Science and Cybersecurity, the Programme Standards for Computing is hereby amended as set out in this addendum (“Addendum”).

This Addendum is to be read in conjunction with Programme Standards for Computing, Malaysia Qualification Framework (MQF), Code of Practice for Programme Accreditation (COPPA) and all other higher education quality assurance policies.

A. Cybersecurity

Higher Education Providers (HEPs) that are interested to offer Bachelor’s Degree and / or Master’s Degree by Coursework specialising in the field of Cybersecurity should observe the following amendments to the Programme Standards for Computing.

1. Naming Convention

In consistence with the Programme Standards for Computing, HEPs may determine the specific nomenclature for the Cybersecurity specialization based on the four (4) major disciplines i.e. Computer Science, Software Engineering, Information Technology, and Information Systems. Some frequently used names include Cybersecurity, Digital Security, System Security, and IT Security. HEPs should ensure that the nomenclature used is consistent with the curriculum of the specific programme.

2. Curriculum Design and Delivery

- (a) Bachelor’s Degree. At least 18 credits of the Specializations/Field Electives component should be allocated to a combination of Cybersecurity body of knowledge (BOK) as set out in Appendix 1 of this Addendum. The remainder of the credits in the same component may be allocated for prerequisite modules for the Cybersecurity BOK and/or modules related to the field of Cybersecurity.

- (b) Master’s Degree by Coursework. All Cybersecurity BOK as set out in Appendix 1 of this Addendum should be covered.

B. Data Science

Data Science has attracted significant attention and interest in the industry despite still being an evolving field. While there is a broad consensus that Data Science practice requires skills in computer science, mathematics and statistics as well as information systems, details on the body of knowledge (BOK) is still being deliberated and to date Association for Computing Machinery (ACM) has yet to define this. Nevertheless, industry demands and government promotion for data science professionals has led to significant interest for HEPs to offer courses in data science.

Bachelor's Degree in Computing specializing in Data Science should observed the following amendments to the Programme Standards for Computing:

1. Discipline Allowed having Data Science specialization

Given that the core BOK Computer Science discipline already encompasses the broad areas skills required by the Data Science practice described above, as a start, it would be logical to make data science as a specialization only for the Computer Science discipline. This will also ensure the students embarking on this programme will maximize their employment in any areas of computing, while expanding their opportunities in data science practice.

2. Naming Convention

In consistence with the Programme Standards for Computing, HEPs may determine the specific nomenclature for the Data Science specialization based on the one (1) major discipline i.e. Computer Science. Some frequently used names include Data Science (to be deliberated - Advanced Analytics, Big Data Analytics, Big Data, Artificial Intelligence). HEPs should ensure that the nomenclature used is consistent with the curriculum of the specific programme.

BODY OF KNOWLEDGE**a) Cybersecurity**

The body of knowledge for the Cybersecurity specialization and corresponding detail topics are listed below. For more information, refer to “ACM: Cybersecurity Curricula 2017”.

Body of Knowledge	Details Topics	Corresponding ACM Knowledge Area
Information Assurance	<ul style="list-style-type: none"> • Security requirements and their role in design • Secure software development • Security Foundational Concepts in Security • Principles of Secure Design • Defensive Programming • Reverse engineering 	Software Security and Component Security
Network Security	<ul style="list-style-type: none"> • Holistic approach • Recovery • End-to-end secure communications • Vulnerabilities and threats • Secure component design principles • Security testing • Connection attacks • Transmission attacks • Network Defense 	Connection Security and System Security
Data Security	<ul style="list-style-type: none"> • Access control • Data integrity and authentication • Basic cryptography concepts • Information storage security • Digital forensics 	Data Security
Societal and Organizational Security	<ul style="list-style-type: none"> • Cybercrime • Security Awareness • Identity management • Privacy • Risk management • Governance and policy • Cyber Laws, ethics, and compliance • Cyber security planning • Business Continuity, Disaster Recovery, and Incident Management 	Human Security, Organizational Security and Societal Security

b) Data Science

The body of knowledge for the Data Science specialization and corresponding detail topics are listed below. For more information, refer to “ACM: Computer Science Curricula 2013 (or later)”.

Expected BOK to be covered

Body of Knowledge	Details Topics	Corresponding ACM Knowledge Area references
Intelligent Systems	<ul style="list-style-type: none"> • Fundamental Issues in Intelligent Systems • Search Strategies • Basic Knowledge Representation and Reasoning • Introduction to Machine Learning • Introduction to AI 	IS/Fundamental Issues. IS/Basic Search Strategies. IS/Basic Knowledge Representation and Reasoning. IS/Basic Machine Learning.
Advanced Machine Learning	<ul style="list-style-type: none"> • Regression • Classification • Anomaly Detection • Deep Learning • Evaluation of Machine Learning Models 	IS/Advanced Machine Learning. IS/Perception and Computer Vision.
Statistical Methods for Data Science	<ul style="list-style-type: none"> • Descriptive statistics • Probability • Random variables • Sampling & Confidence Intervals • Hypothesis testing e.g T-Test • ANOVA • Statistical Programming e.g using Python or R 	HCI/Statistical Methods. PL/Advanced Programming Constructs.
Information Management for Data Science	<ul style="list-style-type: none"> • Database Systems (including NoSQL) • Data Modelling (including JSON etc) • Query languages (SQL and NoSQL queries) • Indexing • Parallel and distributed Databases 	IM/Databases IM/Data Modeling IM/Query Languages IM/Indexing IM/Distributed Databases. CN/Data, Information and Knowledge.
Advance Analytics and Data Mining	<ul style="list-style-type: none"> • Data Mining Process • Data mining algorithms • Clustering • Data cleansing • Data visualization 	IM/Data Mining
Data Science	<ul style="list-style-type: none"> • Introduction to Data Science • Data Science process • Data Engineering and wrangling for data science • End to end Data Science Project/Capstone 	External references, Professional Programs for Data Science

Other General Expectations

- They must have programming skills suitable for statistics and data science e.g. R or Python.
- Final year project must be related to solving data science problem using.
- All programming projects should be focused on strengthening their experience on how to process and manipulate data.

Recommended BOK to be covered

Body of Knowledge	Details Topics	Corresponding Area reference
Big Data	<ul style="list-style-type: none"> • Big Data Architectures • Big Data Stores • Parallel Programming • Parallel programming mini projects for data science 	AR/Multiprocessing and Alternative Architectures PD/Parallel Performance PL/Advanced Programming Constructs PL/Concurrency and Parallelism
Intelligent Systems	<ul style="list-style-type: none"> • Advanced Search • Advanced Representation and Reasoning • Reasoning under uncertainty. • Agents • Natural Language Processing. • Robotics • Perception and Computer Vision. • Reinforcement Learning 	IS/Advance Search IS/Advanced Representation and Reasoning IS/Reasoning under uncertainty IS/Agents IS/Natural Language Processing IS/Robotics IS/Perception and Computer Vision

Other Recommendations

- Industry attachment must be related to data related employment where possible.