PROGRAMME SPECIFICATION – POSTGRADUATE PROGRAMME

KEY FACTS

Programme name	Data Science
Award	MSc
School	Mathematics, Computer Science and Engineering
Department or equivalent	Department of Computer Science
Programme code	PSDASC
Type of study	Full Time/Part Time
Total UK credits	180
Total ECTS	90
Partner (partnership programmes only)	None
Type of partnership	

PROGRAMME SUMMARY

The MSc in Data Science will prepare you for a successful career as a data scientist. Data Science (DS) is the area of work concerned with the extraction of insight from large collections of data. The MSc DS will develop your specialist skills in data acquisition, information extraction, aggregation and representation, data analysis, knowledge extraction and explanation, which are in high demand in the IT business, security and health sectors, intelligent transport, energy efficiency and the creative industries. The next generation of scientific discovery and innovation will be data-driven as previously unrecognised patterns are discovered by analysing massive and mixed data sets.

The course covers the study and integration of advanced methods and techniques from knowledge representation and reasoning, statistical machine learning, high-performance computation, pattern recognition, service-oriented computing, computer programming, data warehousing, and data visualisation. It will enable you to specialise in an application area of data science, from health to retail, and engage with researchers to develop your scientific knowledge and skills in each of the above core areas.

The course will include hands-on, lab-based tutorials and coursework, and the use of DS tools and technologies which will equip you to pursue a practical MSc DS project in an application area of choice. During the project, you will solve a real-world problem using big data from industry, academia or government, e.g. collecting and processing real data, designing and implementing Big Data methods and tools, applying and evaluating big data techniques to solve a real problem in one of the above application areas.

The course is designed for those who have completed a first degree in science and technology subjects including computing, math, physics, engineering, information science and economics, or from areas such as business, psychology or health who have a demonstrable mathematical aptitude or relevant work experience.

Aims

This programme aims to prepare you with the knowledge, skills and values needed for a technical career as a data scientist by:

- equipping you with the breadth of knowledge, skills and techniques required by the data science profession,
- developing your knowledge in specialised and advanced topics in data science,
- enabling you to work with and learn from active researchers in machine learning, high-performance computing and data visualization,
- enabling you to critically evaluate the technical, social and management dimensions of data-intensive systems and technologies

There are three types of awards that you can get (please see the section "**WHAT AWARD CAN I GET?**").

Postgraduate Certificate in Data Science
For all of you completing the Postgraduate Certificate you will have had the opportunity to examine the theories related to the analysis, design, and evaluation of data science systems, and demonstrated sufficient ability in at least four taught modules (60 credits), which can be any combination of modules among the available ones.

Postgraduate Diploma in Data Science
For all of you completing the Postgraduate Diploma, in addition to the above you will have explored the theory and practice, and demonstrated ability in all the different aspects of data science, considering such aspects from different perspectives and demonstrating critical insight on the applicable methods and techniques used in data science. You will have demonstrated ability in analysing, designing, developing and evaluating data science systems, which equates to passing all eight taught modules, worth 120 credits.

MSc in Data Science
For all of you completing the MSc in Data Science, in addition to the above you will have demonstrated original application of knowledge in the area, either through the analysis, design, and evaluation of a data science artefact, the design and implementation of a data science solution that meets a client's needs, or the critical evaluation and extension of the knowledge in the area through a research-led project, which can involve the development of software artefacts as well, e.g. to support data analysis and visualization. This will be achieved through your individual project, a substantial module worth 60 credits that you can commence once you have successfully passed all your taught modules.

WHAT WILL I BE EXPECTED TO ACHIEVE?

On successful completion of this programme, you will be expected to be able to:

Knowledge and understanding:
- demonstrate knowledge and understanding of and the ability to use data science methods and techniques (e.g. in data analysis, pattern recognition and machine learning, high-performance computing, knowledge extraction, visual analytics)
- review and critically evaluate the literature and current developments and challenges in data science, such as designing distributed solutions or efficient learning algorithms

- analyse and solve problems and develop innovative solutions, processing real data, designing and implementing big data methods and tools, selecting, applying and evaluating big data techniques
- identifying and managing scientific and technical risks and uncertainty associated with data science and its applications

Skills:
- analyse, develop and select robust algorithms and tools that can handle uncertainty and large amounts of data
- design, develop, adapt and critically evaluate data science computer programs and systems
- use the latest hardware and software technologies to create high-performance systems with a high level of capacity
- design and use data visualization tools to communicate topics in data science effectively to technical and non-technical audiences

Values and attitudes:
- understand professional, social, cultural and ethical issues related to data analysis in the context of the scientific process
- embrace technical challenges as an opportunity for personal development
- rationally exploit both traditional and novel technological approaches
- rigorously assess alternative approaches and novel designs
- gain skills about professional ethics and privacy in the context of data protection

This programme has been developed in accordance with the QAA Subject Benchmark Statement for Computing (2011).

HOW WILL I LEARN?

The teaching and learning methods used are such that the levels of both specialisation of content and autonomy of learning increase as you progress through each module and the programme. This progression will be guided by active researchers in Machine Learning, Pattern Recognition, Data Visualization, and High-Performance Computing, culminating with an individual project containing an original piece of research conducted largely independently with appropriate academic supervision and, where appropriate, in collaboration with industrial partners.

The standard format is that taught modules are delivered through a series of 20 hours of lectures and 10 hours of tutorials/laboratory sessions. Lectures are normally used to:

(a) present and exemplify the concepts underpinning a particular subject;
(b) highlight the most significant aspects of the syllabus;
(c) indicate additional topics and resources for private study.

Tutorials are used to help you develop skills in applying the concepts covered in the lectures, normally in practical problem solving contexts.

Laboratory sessions serve a similar purpose as the tutorials but their strategy is to demonstrate application of concepts and techniques through the use of state-of-the-art software development tools and environments.

You are expected to undertake independent study and substantial coursework assignments for each module, amounting approximately to 120 hours per module.

The coursework takes many forms, including programs, theoretical work, and essays, and is primarily formative.

The individual project is a substantial task that develops a research related topic and is performed under the supervision of academic staff. The assessment of projects relies on a project report. During the project, you will be given an opportunity to solve a real problem using big data from industry, academia or government, e.g. collecting and processing real data, designing and implementing Big Data methods and tools, applying and evaluating big data techniques to solve a real problem, e.g. in the areas of security, health, transport, energy, retail, online learning, or the creative industries.

The individual project can be carried out as a 6-month internship e.g. in one of the companies with which City has a long-standing relationship and history of collaboration in the big data and data science area. These include Cancer Research UK, Facebook's London office, Amazon UK, the BBC, the NHS, the British Library, Octo Telematics, Microsoft, AT&T, Google, Selex, Tableau, Oracle, IBM, and many Tech City companies.

In addition to lecture, laboratory and tutorial support, each student will be assigned a personal tutor, and the programme is supported by City's Moodle learning environment, which will contain resources for each of the modules. This includes materials such as lecture notes and lab sheets, as well as interactive components, such as a discussion forum.

WHAT TYPES OF ASSESSMENT AND FEEDBACK CAN I EXPECT?

Typically, the assessment methods include a combination of written examination and coursework. The assessment of certain modules is based on coursework only, as detailed in each module's specification. The written examinations will contain theoretical questions, including small essays and mathematical aspects, and practical questions requiring the analysis and exemplifying of data science methods and techniques.

Assessment and Assessment Criteria

Assessment criteria are descriptions, based on the intended learning outcomes, of the skills, knowledge or attitudes that you need to demonstrate in order to complete an assessment successfully, providing a mechanism by which the quality of an assessment can be measured. Grade-related criteria are descriptions of the level of skills, knowledge or attributes that you need to demonstrate in order to achieve a certain grade or mark in an assessment, providing a mechanism by which the quality of an assessment can be measured and placed within the overall set of marks. Assessment Criteria and Grade-Related Criteria will be made available to you to support you in completing assessments. These may be provided in programme handbooks, module specifications, on the virtual learning environment or attached to a specific assessment task.

The assessment criteria will reflect the learning outcomes of the modules and the programme as a whole.

<u>Feedback on assessment</u>

Feedback will be provided in line with our Assessment and Feedback Policy. In particular, you will normally be provided with feedback within three weeks of the submission deadline or assessment date. This would normally include a provisional grade or mark. For end of module examinations or an equivalent significant task (e.g. an end of module project), feedback will normally be provided within four weeks. The timescale for feedback on final year projects or dissertations may be longer. The full policy can be found at:
https://www.city.ac.uk/__data/assets/pdf_file/0008/68921/assessment_and_feedback_policy.pdf

<u>Assessment Regulations</u>

In order to pass this Programme, you should complete successfully or be exempted from the relevant modules and assessments and will therefore acquire the required number of credits.

The pass mark for each module is 50%.

If you fail an assessment component or a module, the following will apply:

1. Compensation: where you fail up to a total of 20 credits at first or resit attempt (15 credits for a Postgraduate Certificate), you may be allowed compensation if:
    *   Compensation is permitted for the module involved (see the What will I Study section of the programme specification), and
    *   It can be demonstrated that you have satisfied all the Learning Outcomes of the modules in the Programme, and
    *   A minimum overall mark of no more than 10% below the module pass mark has been achieved in the module to be compensated, and
    *   An aggregate mark of 50% has been achieved in the Programme overall.

Where you are eligible for compensation at the first attempt, this will be applied in the first instance rather than offering a resit opportunity.

If you receive a compensated pass in a module you will be awarded the credit for that module. The original component marks will be retained in the record of marks and your original module mark will be used for the purpose of your Award calculation.

2. Resit: where you are not eligible for compensation at the first attempt, you will be offered one resit attempt according to the University's assessment regulations.

If you are successful in the resit, you will be awarded the credit for that module. The mark for each assessment component that is subject to a resit will be capped at the pass for the module. This capped mark will be used in the calculation of the final module mark together with the original marks for the components that you passed at first attempt.

If you do not meet the pass requirements for a module and do not complete your resit by the date specified you will not progress and the Assessment Board will require that you be withdrawn from the Programme.

If you fail to meet the requirements for the Programme, the Assessment Board will consider whether you are eligible for an Exit Award, as per the table below.

If you would like to know more about the way in which assessment works at City, please see the full version of the Assessment Regulations at:
http://www.city.ac.uk/__data/assets/word_doc/0003/69249/s19.doc

WHAT AWARD CAN I GET?

Master's Degree:

	HE Level	Credits	Weighting (%)
Taught	7	120	67
Dissertation	7	60	33

Class	% required
With Distinction	70
With Merit	60
Without Classification	50

Postgraduate Diploma:

	HE Level	Credits	Weighting (%)
Taught	7	120	100

Class	% required
With Distinction	70
With Merit	60
Without Classification	50

Postgraduate Certificate:

	HE Level	Credits	Weighting (%)
Taught	7	60	100

Class	% required
With Distinction	70
With Merit	60
Without Classification	50

WHAT WILL I STUDY?

Taught component

There are in total 8 taught modules, 6 core and 2 elective modules.

Module Title	SITS Code	Module Credits	Core/ Elective	Compensa-tion Yes/No	Level
Principles of Data Science	INM430	15	Core	Yes	7
Machine Learning*	INM431	15	Core	Yes	7
Big Data	INM432	15	Core	Yes	7
Visual Analytics	INM433	15	Core	Yes	7
Neural Computing	INM427	15	Core	Yes	7

Research Methods and Professional Issues*	INM373	15	Core	Yes**	7
Advanced Databases*	INM370	15	Elective	Yes	7
Information Retrieval*	INM305	15	Elective	Yes	7
Data Visualization*	INM402	15	Elective	Yes	7
Digital Signal Processing and Audio Programming*	INM378	15	Elective	Yes	7
Cloud Computing*	INM429	15	Elective	Yes	7
Deep Learning: Optimization*	INM707	15	Elective	Yes	7
Computer Vision*	INM460	15	Elective	Yes	7
Semantic Web Technologies and Knowledge Graphs	INM713	15	Elective	Yes	7

*For part-time students, these modules are studied in the second year of the part-time mode

** Compensation will only be applied at resit.

Elective modules are subject to availability and limits on student numbers. With the approval of the course director, choosing other elective modules than listed here is also possible.

Dissertation component

Module Title	SITS Code	Module Credits	Core/ Elective	Compensa-tion Yes/No	Level
Individual Project	INM363	60	Core	No	7

INM373 Research Methods and Professional Issues must be passed with a mark of at least 50% without compensation to proceed with INM363 Individual Project.

You are normally required to complete all the taught modules successfully before progressing to the dissertation

TO WHAT KIND OF CAREER MIGHT I GO ON?

Data Science students can expect to achieve employment as data scientists in a range of businesses, from health to retail, or in government. The emphasis of this programme on areas that City has renowned research expertise, machine learning and visual analytics, and City's internships and links with many industrial partners will particularly enable students to gain appointments as specialists in data science, data analysis and visualization in the security, health, transport and energy sectors, the creative industries, and a host of organisations within Tech City.

Graduates starting a new business can benefit from City's London City Incubator and City's links to Tech City, providing support for start-up businesses. If you would like more information on the Careers support available at City, please go to: http://www.city.ac.uk/careers/for-students-and-recent-graduates.

WHAT STUDY ABROAD OPTIONS ARE AVAILABLE?
- None

WHAT PLACEMENT OPPORTUNITIES ARE AVAILABLE?

Internships: you can participate in our professional placement programme, which is supported by the Professional Liaison Unit. This will enable you to undertake your dissertation within an industrial or research placement over an extended period compared to regular projects.

HOW DO I ENTER THE PROGRAMME?

You can apply online at:
http://www.city.ac.uk/courses/postgraduate/data-science-msc

Entry requirements: You should have a UK first or an upper second-class honours degree (or equivalent) in a subject area such as computing, mathematics, physics, engineering, information science, economics, or a related discipline with mathematical and computational content. We will also accept applicants with degrees in business, economics, psychology and health, if they demonstrate some statistical, mathematical and computer scripting aptitude, e.g. by referring to qualifications, courses and experience. We may accept applicants with lower second-class degrees if they have relevant work experience, but this is at our discretion. We recommend your personal statement explains why you are interested in Data Science, points to relevant experience and indicates which particular aspects of our course that interest you.

English language requirements: If your first language is not English, one of the following qualifications is also required:
  IELTS: 6.5 (minimum of 6.0 in all four components) OR
  TOEFL 92 (minimum of 20 in Listening, Reading and Speaking, and 22 in Writing)

For the availability of scholarships please enquire at the Programmes Office of the Department of Computer Science.

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