Postgraduate Programme Specification:
MRes in Advanced Computer Science <with specialisation in pathway>

1. Summary

<table>
<thead>
<tr>
<th>Award</th>
<th>Programme Title</th>
<th>Duration</th>
<th>Mode of study</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRes</td>
<td>Advanced Computer Science &lt;with specialisation in</td>
<td>1 year</td>
<td>Full-time</td>
</tr>
<tr>
<td></td>
<td>pathway&gt;</td>
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<tr>
<td>MRes</td>
<td>Advanced Computer Science &lt;with specialisation in</td>
<td>2 -4 years</td>
<td>Part-time</td>
</tr>
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<td></td>
<td>pathway&gt;</td>
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<tr>
<td>MRes</td>
<td>Advanced Computer Science &lt;with specialisation in</td>
<td>3-4 years</td>
<td>Modular</td>
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<tr>
<td></td>
<td>pathway&gt;</td>
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</tr>
<tr>
<td>PG Certificate</td>
<td>Advanced Computer Science</td>
<td>1 year</td>
<td>Full-time</td>
</tr>
<tr>
<td>PG Certificate</td>
<td>Advanced Computer Science</td>
<td>2 years</td>
<td>Part-time (exit award only)</td>
</tr>
<tr>
<td>PG Certificate</td>
<td>Advanced Computer Science</td>
<td>2 years</td>
<td>Modular</td>
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Role of this Programme Specification: to outline the intended knowledge, understanding, skills and attributes of a student completing that course. It also gives details of teaching and assessment methods as well as linking the course to the framework for HE qualifications and any subsequent professional qualification and career path.

Date of Completion: July 2015

Further Links: Programme web site at: http://studentnet.cs.manchester.ac.uk/pgt/

2. Aims and Intended Learning Outcomes

The aim of this programme is to provide students with a state-of-the-art collection of knowledge, understanding, and skills in the area of Advanced Computer Science. This collection aims to be of particular depth so as to provide the student with the relevant knowledge, understanding, and skills to prepare them for a career in Computer Science research. It is designed for students with a good first degree in Computer Science or related areas who which to deepen their understanding, knowledge, and skills, and aim at a research career in either Industry or Academia.

1. **At PG Certificate level:** Produce computing professionals with specialised knowledge of selected advanced topics and research skills in Computer Science

2. Provide a vehicle for dissemination of leading-edge knowledge and skills, focusing on the research strengths of a large School covering most major topics in Advanced Computer Science and its applications

3. Continue to attract the highest-quality students from the UK and overseas
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4. **At MRes level**: As above 1 – 3 together with 4 and 5:
Offer the opportunity to focus on one of a range of specialisations.

5. **At MRes level**:
Provide an opportunity to engage in a substantial research project in Advanced Computer Science, and provide high quality training and experience in research in Advanced Computer Science.

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## A. Knowledge & Understanding

Students will be able to:

<p>| | |</p>
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<tbody>
<tr>
<td><strong>A1.</strong> (At all levels)</td>
<td>Acquire a knowledge of a range of advanced topics in Computer Science beyond undergraduate level and at the forefront of research</td>
</tr>
<tr>
<td><strong>A2.</strong> (At all levels)</td>
<td>Understand, apply and develop leading-edge technologies by following themes from those listed in Figure 1.</td>
</tr>
<tr>
<td><strong>A3.</strong> (MRes)</td>
<td>Have a good knowledge &amp; understanding of research methodology &amp; practice</td>
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## B. Intellectual Skills

Students will be able to:

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<tbody>
<tr>
<td><strong>B1.</strong></td>
<td>Develop and evaluate original ideas in a research context (MRes level only)</td>
</tr>
<tr>
<td><strong>B2.</strong></td>
<td>Use methodologies for development of computational systems at an advanced level (All)</td>
</tr>
<tr>
<td><strong>B3.</strong></td>
<td>Perform problem-solving in academic and industrial environments (All)</td>
</tr>
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## C. Practical Skills

Students will be able to:

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<tr>
<td><strong>C1.</strong></td>
<td>Develop applications to satisfy given requirements</td>
</tr>
<tr>
<td><strong>C2.</strong></td>
<td>Organise &amp; pursue a scientific or industrial research project (MRes level only)</td>
</tr>
<tr>
<td><strong>C3.</strong></td>
<td>Use, manipulate and develop large computational systems</td>
</tr>
<tr>
<td><strong>C4.</strong></td>
<td>Perform independent information acquisition and management</td>
</tr>
</tbody>
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## D. Transferable Skills and Personal Qualities

Students will be able to:

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<tr>
<td><strong>D1.</strong></td>
<td>Work and communicate effectively as a team member</td>
</tr>
<tr>
<td><strong>D2.</strong></td>
<td>Prepare and present seminars to a professional standard (MRes level only)</td>
</tr>
<tr>
<td><strong>D3.</strong></td>
<td>Understand ethical issues related to professional activities</td>
</tr>
<tr>
<td><strong>D4.</strong></td>
<td>Write theses and reports to a professional standard (MRes level only)</td>
</tr>
<tr>
<td><strong>D5.</strong></td>
<td>Perform independent and efficient time-management</td>
</tr>
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</table>

These Aims and Intended Learning Outcomes are informed by the QAA subject benchmark for computing, and relate as following to those mentioned there: A1-A3 are covered in 5.1; B1–B3 are covered in 5.4; C1-
3. Teaching, Learning, and Assessment Methods

The programme’s teaching and learning forms and assessment methods are informed by the QAA subject benchmark for computing, and are designed to ensure that any student graduating with an MSc in Advanced Computer Science and IT Management have demonstrated the understanding, awareness, and skills at threshold level as described in Section 7 of the benchmark.

We use a variety of teaching forms, from face-to-face lectures via supervised and unsupervised labs, to self-study elements and supervised projects. Where appropriate, we use blended learning and enquiry-based learning. In general, knowledge-intensive parts of a course-unit are taught through lectures (either face-to-face or via alternative delivery), with aspects of self-study and enquiry-based learning. Other parts of our course units that are aimed at the students’ acquisition of skills (either intellectual or practical) are mostly taught through (supervised or unsupervised) labs and workshops. These are also often used to enhance the students’ communication and teamwork skills.

All our course units combine knowledge and understanding learning outcomes with suitable skills learning outcomes. Moreover, in Computer Science, applying a certain technology, formalism, or method is a key requirement for understanding it fully. As a consequence, all our taught course units use coursework as a part of formative assessment, to deepen (and assess) both knowledge and understand and to teach (and assess) relevant skills. As a default, our course-units are assessed 50% through coursework and 50% through exam, to give equal weight to normative and formative assessment, although other models are supported.

We are implementing a best-practice model for designing ‘implementation related coursework’ so that it (i) enhances students’ experience, (ii) enhance students’ skills in applying good (software) design practice, (iii) can be assessed fairly and effectively.

The defining regulations and procedures for the MSc programme are laid down in the University’s Ordinances and Regulations.

<table>
<thead>
<tr>
<th>Learning &amp; Teaching Processes for A (to allow students to achieve intended learning outcomes)</th>
<th>Assessment (of intended learning outcomes)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ALL</strong>&lt;br&gt;Because of the very wide range of topics and content, each advanced course unit utilises methods appropriate to the subject matter.</td>
<td><strong>A1 – A3</strong> are assessed by a mixture of written examinations, computer-based practical work, and a range of coursework assessments including assessed miniprojects, group projects, reports, essays etc.</td>
</tr>
<tr>
<td><strong>ALL</strong>&lt;br&gt;Small group lectures, supervised laboratory work, mini-projects (group &amp; individual) and independent preparatory learning are the main vehicles for dissemination of knowledge &amp; understanding during the first half of the programme</td>
<td><strong>A1 – A3</strong> is also assessed via the research project which includes an oral presentation of the research, and examination of the dissertation.</td>
</tr>
<tr>
<td><strong>MRes</strong>&lt;br&gt;Following the taught part of the programme, students undertake a programme of supervised individual research, leading to a 120 credit dissertation at MRes level</td>
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B1. is mainly demonstrated during the research project, and the three Research Seminars (COMP80xyz).

The intellectual ability B2. is learned through small-group lecturing and practical lab exercises designed to put theoretical knowledge into practice.

B3. is mainly demonstrated during the research project, mini-projects and problem-based learning in teams.

B1. & B3 are developed and assessed during the research project through presentation of a seminar and examination of the dissertation, as well as the three Research Seminars (COMP80xyz).

B2. is assessed through laboratory exercises, either marked on-line or by written report.

B3 is also assessed by reports from mini-projects (individual & group).

C1. and C3. are demonstrated in practical lab exercises and mini-projects, as well as during the research project.

C1. and C3. are assessed through laboratory exercises, either marked on-line or by written report.

C2. and C4. are demonstrated during the research project. C4. is also present in many course units.

C2. and C4. are developed and assessed during the Research Skills and Professional Issues unit and the Research Project through presentation of a seminar and examination of the dissertation

C4. is assessed by the three Research Seminars (COMP80xyz), the Research Project and by a report or marked presentation in some course units.

D1. is evident in team practical projects used in a number of course units, supported through eLearning environment

D1. is assessed through reports and marked presentations.

D2. is demonstrated in three Research Seminars (COMP80xyz), and also within a number of course units.

D2. is assessed during the three Research Seminars (COMP80xyz), where there is feedback on presentation skills.

D3 and D4. are assessed by the research project dissertation, and the Project Progress Report.

D3. is demonstrated in three Research Seminars (COMP80xyz).

D4. is demonstrated through lab practical and mini-project reports and the research project dissertation.

D5. is demonstrated by the ability to meet a number of deadlines throughout the year, and to effectively carry out a research project on time

D5. is assessed by course unit teachers & the exams office, who must ensure coursework and dissertations are submitted on time. The research project internal examiners assess progress of the project at the project seminar.

Learning & Teaching Processes for C

C1. and C3. are demonstrated in practical lab exercises and mini-projects, as well as during the research project.

C1. and C3. are assessed through laboratory exercises, either marked on-line or by written report.

C2. and C4. are demonstrated during the research project. C4. is also present in many course units.

C2. and C4. are developed and assessed during the Research Skills and Professional Issues unit and the Research Project through presentation of a seminar and examination of the dissertation

C4. is assessed by the three Research Seminars (COMP80xyz), the Research Project and by a report or marked presentation in some course units.

Learning & Teaching Processes

D1. is evident in team practical projects used in a number of course units, supported through eLearning environment

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D5. is demonstrated by the ability to meet a number of deadlines throughout the year, and to effectively carry out a research project on time

D5. is assessed by course unit teachers & the exams office, who must ensure coursework and dissertations are submitted on time. The research project internal examiners assess progress of the project at the project seminar.

Support for student learning and development:

In addition to the Director of PGT, we have an MRes Programme Director in place whose main responsibility is the pastoral care for the MRes in ACS students and, as a member of the school PG Committee, to monitor students’ attendance and progress, and to overlook the general running of the MRes in ACS. Students are encouraged to contact the Director when problems arise and are informed of this during the introductory period. During the period of the second Semester and the research project, an individual assigned supervisor is also available. The relationship with the supervisor is outlined in the Programme Handbook and the three Research Seminars.
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We also have an effective Student Support Office, with several staff who work principally with postgraduate students, whose members provide support for students in all aspects of their learning and development, and work closely with the directors and the PG committee through monthly meetings and other means.

We implement a project model where the students submit, around mid-April, a Project Progress Report (worth 30 of the 120 credits of the project). In this way, students are encouraged to develop early a clear vision and plan for their project and communicate it to their supervisors in writing, so that potential issues regarding technical misunderstandings or writing problems can be detected early and appropriate actions be taken.

Together with the CDT and PhD students, the MRes students actively participate in the school's annual research symposium in November, thereby gaining an understanding of the breadth and kind of research that is carried out at the school. This participation informs them about possible directions for their research project.

All students are directed to the Faculty's PDP web site and encouraged to participate, and the site is also linked from the MSc Handbook: http://studentnet.cs.manchester.ac.uk/pgt/study-curriculum.php

4. Programme Structure

A student following this programme chooses two themes, each consisting of a conceptually coherent set of two course units of 15 credits each, and they take three course units out of these. In addition, they follow three Research Seminars COMP80122, COMP80131, COMP80142 of 5 credits each. This will provide students with the necessary knowledge and skills in Research methodology, ethics and professional issues, as well as communication and presentation skills. As part of COMP80122, students actively participate in the school's annual research symposium, held in the reading week between Period 1 and 2.

This makes up the 60 credits taught part of the programme.

The MRes research project is worth 120 credits and consists of the following parts: a taster project (10 credits) plus the research project (110 credits), which can but do not have to be related to the same subject and supervised by the same supervisor. The taster project is assessed via a short report. The research project is assessed in two parts, through the Project Progress Report (30 credits) and the Dissertation (80 credits).

A student who chooses two themes that belong to a given pathway, and whose project is in an area suitable for this pathway (which is determined by the examiners) can choose to graduate with an

MRes in Advanced Computer Science with specialisation in <Pathway>.

A full list of pathways and related themes can be found in Figure 2.

Course units in general:

Course units are taught in an intensive mode over a period of 6 weeks: 1 day a week for the first 5 weeks are 'taught' days consisting of lectures, supervised labs etc., which are complemented with 1.5 days a week for the first 5 weeks of practical exercises and 2.5 days of a coursework completion week (the 6th week) are also practical exercises. Some of the practical exercises are assessed work.

Chronology of the programme:

The (full time version of the) programme lasts 1 year, and starts in September with a Welcome Week, during which
• introductory talks for each course unit are offered
• the structure of the programme, expectations, rules & regulations, pathways and themes are explained (the allocation of course units to themes and themes to pathways is shown in the Curriculum map and in the Handbook)
• (in case they haven’t yet) students choose themes and course units
• students take part in an on-line course about plagiarism and
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Semester 1: September – January
Students take 45 credits-worth of course units in the 1st semester, i.e. three of the course units identified in Figure 1 below, two from one Semester 1 theme, and one from a Semester 1 theme which has to take place in Period 1.
In addition, in Period 2, they
- follow COMP80131: Scientific methods 1 - Scientific evaluation, experimental design and statistical methods (5 credits),
- work on the 10 credit Taster project, which is part of the 120 credits research project,
- actively participate in the school’s research symposium during Reading week.

Semester 2: January - May
In Semester 2, students follow only two course units:
- COMP80122: Scientific Methods 2 - Fundamental Aspects of Research Methodology (5 credits) in Period 3,
- COMP80142: Scientific Methods 3 - Academic writing and impact studies (5 credits) in Period 4,

By the end of January, the project allocation process takes place, and students work on the background and start the research of their project, and prepare their Project Progress Report. The project progress report counts 30 credits of the 120 credits of the research project, and is to be submitted in early-mid April.

In addition to passing the taught course units, the weighted average of the marks awarded to the Taster Project and the Project Progress Report must be at least 40%.

The student continues to work on his/her project, and writes up a dissertation (or Group and Individual Reports for group projects). The dissertation counts 80 credits towards the 120 credits of the project mark (the other 40 credits are made up from the 30 credits of the Project Progress Report and the 10 credits of the Taster Project).

Summary of the exit qualifications:
A student with 60 credits from the taught part can exit with a PG Certificate.
The PG Certificate cannot carry a pathway specialisation.

4. Mechanisms for Programme Revision

There is an annual Programme Review, which reflects on the year that is coming to an end, and which informs an annual PGT Action Plan that is reviewed by faculty. This action plan regularly includes items relating to programme revision. Progress against the Action Plan is a standing item on PG Committee Meetings.
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Figure 1: Course Units and themes they belong to

1. (1) Data on the Web:
   (a) COMP60411 Modelling Data on the Web
   (b) COMP62421 Querying Data on the Web

2. (1) Data Engineering and Systems Governance:
   (a) COMP60711 Data Engineering
   (b) COMP60721 IT Governance

3. (1) Learning from Data:
   (a) COMP61011 Foundations of Machine Learning
   (b) COMP61021 Modelling & Visualization of high-dimensional data

4. (1) Parallel Computing in the Multi-Core Era:
   (a) COMP60611 Parallel Programs and their Performance
   (b) COMP60621 Designing for Parallelism and Future Multi-core Computing

5. (1) Security:
   (a) COMP61411 Cryptography
   (b) COMP61421 Cyber Security

6. (1) Software Engineering 1:
   (a) COMP61511 Software Engineering Concepts in Practice
   (b) COMP62521 Agile Software Development
Figure 2: Pathways and Themes

<table>
<thead>
<tr>
<th>Pathway</th>
<th>Requirement</th>
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<tbody>
<tr>
<td>Advanced Computer Science</td>
<td>through not a pathway, a student can choose any two themes for an MRes in Advanced Computer Science.</td>
</tr>
<tr>
<td>Advanced Web Technologies</td>
<td>for this pathway, a student follows both course units of the Data on the Web theme plus any other course unit.</td>
</tr>
<tr>
<td>Artificial Intelligence</td>
<td>for this pathway, a student chooses Learning from Data and any other course unit.</td>
</tr>
<tr>
<td>Computer Security</td>
<td>for this pathway, a student follows both course units of the Security theme plus any other course unit.</td>
</tr>
<tr>
<td>Computer Systems Engineering</td>
<td>for this pathway, a student follows both course units of the Mobile Computing theme plus any other course unit.</td>
</tr>
<tr>
<td>Data and Knowledge Management</td>
<td>for this pathway, a student chooses any two themes from Data on the Web, Learning from Data, and Data Engineering and Systems Governance.</td>
</tr>
<tr>
<td>Multi-core Computing</td>
<td>for this pathway, a student follows both course units of the Parallel Computing in the Multi-core Era theme plus any other third course unit.</td>
</tr>
<tr>
<td>Software Engineering</td>
<td>for this pathway, a student chooses the Software Engineering 1 theme and any other third course unit.</td>
</tr>
</tbody>
</table>