MSc in Computational Methods and Imaging in Medicine

including the

Diploma and Certificate in Computational Methods and Imaging in Medicine

Programme Handbook

2005/2006

School of Computer Science
Faculty of Engineering and Physical Sciences, The University of Manchester
Disclaimer: The information contained in this handbook is correct at the time of your receiving it but the University, while retaining proper regard for the interests of students who have begun their programmes, reserves the right to alter the programmes or the timetable if the need arises.
The MSc in Computational Methods and Imaging in Medicine is a high quality Masters programme. It draws upon the international research reputation and the excellent teaching quality and facilities of the Computer Science School of Manchester University and of the Division of Imaging Science and Biomedical Engineering (ISBE) in the Faculty of Medicine, Dentistry, Nursing and Pharmacy. It combines a range of taught course units, with a research project undertaken in one of the many research areas available, or with industrial or health-service partners.

The programme is aimed at those who wish to become high quality professionals and researchers with the skills and knowledge to use computational systems across a wide range of applications to medicine.

This is the Handbook for the MSc in Computational Methods and Imaging in Medicine, and also for the Postgraduate Diploma in Computational Methods and Imaging in Medicine and the Postgraduate Certificate in Computational Methods and Imaging in Medicine.

The website for further information on these programmes is http://www.cs.manchester.ac.uk/Postgrad.
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1 Introduction

Manchester University is exceptionally strong both in its Computer Science and in its activities in the area of Medicine.

There is a long history of research in computing at Manchester University. The earliest stored program computer was built here in 1948 and since that time there has been a continuous high quality innovative programme of research\(^1\) across the broad spectrum of computer science. The School of Computer Science\(^2\) is now one of the largest in the U.K. and also one of the most active in both teaching and research. It provides access to some of the best computing facilities in the world, including, for example, The Manchester Supercomputing Centre, The Robotics Laboratory, The Visualisation Centre and the Virtual Reality Laboratories.

The Faculty of Medicine, Dentistry, Nursing and Pharmacy\(^3\) is one of the largest in Europe. It is centred on the University but includes links with many of the major hospitals and centres of medical research in the area, including Manchester Royal Infirmary; St. Mary’s, Hope, Christie, Wythenshawe, North Manchester General, Stepping Hill and Tameside General Hospitals; Booth Hall and Royal Manchester Children’s Hospitals; and local Community NHS trusts.

The MSc in Computational Methods and Imaging in Medicine draws upon the strength of the research and teaching in both these areas, and the industrial and health service links, to provide a high quality MSc programme at a level beyond that of undergraduate degrees.

The initial section of the programme consists of the taught course units. Students then undertake a half-year research project usually based upon one of the areas of research in the schools or an industrial assignment.

The programme is suitable for candidates with:

- an extensive Computer Science background who wish to specialise in Medical Applications, or,
- a Medical/Biological background and some computing experience who wish to enhance their skills and knowledge to the current advanced levels of activity in the area.

Candidates normally take the MSc in a one-year period. However, there is the opportunity to take a part-time MSc by accumulating credits over a longer period. We also offer both a Postgraduate Diploma and a Postgraduate Certificate in Computational Methods and Imaging in Medicine. These are based upon the same advanced taught course units as the MSc programme but require fewer credits and a shorter research project or, in the case of the Certificate, no project at all. In order to make the course units available to a wider range of participants, including those on release from work, some are taught in an intensive mode with all the lecturing and practicals for each course unit taking place within a week.

2 Programme Profile

There is increasing emphasis both in Medicine and Biological Sciences on a multi-disciplinary approach to Research and Development. Of particular importance is the application of computational and physical science methodologies in the medical and biological fields. Applications of computing in medicine are rapidly expanding across a wide variety of activities particularly in: medical and health informatics; computational aids to diagnosis; and medical image processing. There is, consequently, a growing demand from the NHS, healthcare industries and biomedical research organisations, for individuals with the knowledge and skills to apply information technology, and related mathematical methods and physical science, to problems in healthcare and biological research.

This new programme (2002) arose from a successful bid for training under the EPSRC Masters Level Training Package funded by the UK government. This bid established a major UK Centre for Advanced Training and Education in Computer Science. One facet of the proposal was for a new MSc in the area of Computational Methods and Imaging in Medicine.

The School of Computer Science already has considerable activity in this area, with the Medical Informatics group and also in Imaging Science. We have established links with groups in the Faculty

\(^{1}\)http://www.cs.manchester.ac.uk/Research/subweb

\(^{2}\)http://www.cs.manchester.ac.uk

\(^{3}\)http://www.medicine.man.ac.uk
of Medicine including the Division of Imaging Science and Biomedical Engineering (ISBE) in both teaching and research. Another component of the collaboration is the present postgraduate teaching and research support provided by the Visualisation Centre in Manchester Computing.

The programme aims to:

- produce high quality professionals and researchers who have the skills and knowledge to use computational systems across the wide range of applications to medical treatment,
- provide a vehicle for dissemination of leading-edge knowledge and skills, focusing on the research strengths of the ISBE division of the Medical Faculty, and the Medical Applications research in the School of Computer Science,
- provide an interdisciplinary platform for training and research between the Medical School and the School of Computer Science,
- attract high quality students from the UK and overseas who wish to enhance their knowledge and skills in the medical applications of computing.

The structure is intended to be attractive to both full-time one-year students and to part-time students who take the programme over a period of years accumulating credits to achieve a Certificate, a Diploma or an MSc. The aim is to have a broad participation both on the teaching side and amongst the students, in particular attracting external participants and those requiring a more flexible learning regime.

This MSc offers high-quality taught course units in terms of their content, depth and quality of delivery. It provides a rich learning environment with good contact with expert staff, in both the taught course units and the research projects.

3 General Information

3.1 Programme Staff

Programme Directors
Dr David Rydeczard, Room 2.111, Tel: 275 6164, Email: der@cs.manchester.ac.uk and
Dr Tom Sharpe, ISBE, Medical School, Stopford Bld, Tel: 275 5051, Email: tom.sharpe@manchester.ac.uk

3.2 School and Postgraduate Staff

Head of School
Prof. Chris Taylor, Room 2.125, Tel: 275 6154, Email: chris.taylor@manchester.ac.uk

Head of Graduate School
Prof. Roger Hubbard, Room 2.86, Tel: 275 6158, Email: roger@cs.manchester.ac.uk

Student Support Office: Postgraduate

General email address: pgooffice@cs.manchester.ac.uk
Gill Lester (Postgraduate Administrator), Room 2.4, Tel: 275 6210, Email: glester@cs.manchester.ac.uk
Janet Boyd (Postgraduate Secretary), Room 2.3, Tel: 275 6233, Email: jboyd@cs.manchester.ac.uk
Susie Hildreth (Postgraduate Secretary), Room 2.3, Tel: 275 7520, Email: hildreth@cs.manchester.ac.uk

Project Coordinator: Advanced MSc projects
Dr Rizos Sakellariou, Room 2.109, Tel: 275-6257, Email: rizos@cs.manchester.ac.uk
MEng projects are arranged by the Programme Director.
3.3 Contact Details

Student Support Office: Postgraduate
Room 2.3, Kilburn Building

School of Computer Science
The University of Manchester
Oxford Road
Manchester M13 9PL
United Kingdom

Tel: (+44) 161 275 6181
Fax: (+44) 161 275 6204
Email: pgoffice@cs.manchester.ac.uk

To visit the website of the School of Computer Science go to http://www.cs.manchester.ac.uk/.

The School of Computer Science is located in the Kilburn Building.

For information about IBSE and the Medical School see the ISBE website.

4 Entry Qualifications

The Masters programme is open to students with first or good second class honours degrees in either a Computer Science or Biomedical discipline or a joint programme with at least 60% Computer Science or Biomedical content, or an overseas equivalent. Other educational backgrounds e.g. a mathematical science with sufficient computing content will be considered. All candidates must have computer programming experience sufficient for the programme. An honours degree in another subject together with sufficient relevant industrial/health experience is also acceptable. Applicants without a UK equivalent honours degree, but with sufficient relevant industrial and educational experience, will be considered for admission.

English Language Requirements. All students are required to be proficient in spoken and written English.

In order to be accepted on an MSc programme in the School of Computer Science applicants need to achieve an IELTS score of 6.5 (minimum) or TOEFL 600+ (paper-based) 250+ (computer-based) or Cambridge Proficiency Grade 'C' (minimum) before the programme start date.

In addition, overseas students who have attained the minimum IELTS score of 6.5, but less than 7.0, are required to attend the University’s English classes during the MSc year of study.

The final decision on the standard of English remains with the Admissions Tutor and other very strong evidence of proficiency may be acceptable.

Experience shows that even those students who have passed the required language test find it difficult sometimes to adjust to operating in English entirely. We therefore strongly recommend that all such students take additional measures, such as attending English language courses (the Language Centre at the University provides English Language programmes - see the website at http://langcent.man.ac.uk), reading English literature, speaking and writing English wherever possible.

5 Programme Structure

5.1 The Academic Year

The one-year MSc programme consists of taught course units running over two semesters. A semester is 12 weeks long. Each student normally takes 6 course units or their equivalent in credits (90 credits). The academic year begins towards the end of September: exact dates vary from year to year.

4http://www.isbe.man.ac.uk
At the end of the taught course units, there is a week’s course on Research and Professional Skills, after which students start work on a Research Project of their choice. This is to be completed and a dissertation submitted by the end of the academic year. In order to be allowed to submit the dissertation, students must pass the assessment for the taught course units.

5.2 Introductory Fortnight

The first fortnight of the academic year forms an introduction to the programme. It includes an Introduction to the School of Computer Science and to the Division of Imaging Science and Biomedical Engineering, as well as an introduction to the University and its services.

There is also an introduction to the subject of Computational Methods and Imaging in Medicine.

5.3 Syllabus and Pathways

For the one-year programme the first half-year consists of taught course units provided by the Division of Imaging Science and Biomedical Engineering (ISBE)\(^5\) in Medicine and by the School of Computer Science\(^6\).

The syllabus allows for a number of pathways. The choice of pathway depends upon your background and on whether you wish to specialise in one area of the subject.

**Semester 1: Core Course Units (12 weeks)**

1. DJ5051 Introduction to Human Biology (ISBE)
2. DJ9991 Introduction to Health Informatics (ISBE)
3. BS5081 Introduction to Programming in Java (ISBE/CS)
4. CY6001 Introduction to Biostatistics and Epidemiology (ISBE)

All course units are 15 credits.

Depending on your background and area of study, you are required to take:

- For those without 50% CS in their degree but good Biomedical background (2) and (3) above,
- For those without 50% CS in their degree and weak Biomedical background (1), (2) and (3) above,
- For those with good Computing background but poor Biomedical background, (1) and (2) above;
- Option (4) may be taken as long as only 3 core course units are taken overall. It is a prerequisite for Statistics II and for Epidemiology (see below).

**Semester 2: Advanced Course Units (12 weeks)**

Students will select three or four further course units to make 90 credits overall. There are two areas: Health Informatics and Imaging and Image Processing. All students must choose at least one course unit from the Health Informatics area. Each course unit is worth 15 credits. Choices are made depending both on your interests and on whether your background equips you for a course unit.

**Health Informatics**

- CS635 Decision Analysis and Decision Support Systems (Manchester Business School)
- CS331 Computational Biology (School of Computer Science)
- CY6102 Advanced Biostatistics (Evidence for Population Health Unit)
- DJ5172 Decision Support (CS/ISBE)
- EP5182 Advanced Epidemiology (EPHU)

\(^5\)http://www.isbe.man.ac.uk

\(^6\)http://www.cs.manchester.ac.uk
Imaging and Image Processing

- DJ1582 Medical Imaging (ISBE)
- DJ5082 Nuclear Medicine (ISBE)
- CS644 Advanced Machine Vision (ISBE/CS)

The first two course units above require Physics to degree level.
15 credits of 'flexibility' is allowed: subject to the Programme Director's approval, relevant course units at MSc level, either in the two schools or elsewhere, may be chosen to contribute 15 credits to the 90 required. Possibilities for flexibility are further course units in the ISBE modular MSc, course units from related disciplines, or course units from the MSc in Advanced Computer Science (see Advanced Computer Science syllabus at http://www.cs.manchester.ac.uk/Postgrad), such as:

- CS643 Machine Learning (15 credits) (School of Computer Science)
- CS648 Neural Networks (15 credits) (School of Computer Science)
- CS649 Mobile Robotics (15 credits) (School of Computer Science)
- CS636 Advanced Database Technologies (School of Computer Science)
- CS632 Computer Animation (School of Computer Science)

5.4 Registration for Course Units

Registration of the course units should be completed by the middle of the second week (week 1). Changes to course unit selections are accepted until week 8 for semester 1 course units, and until week 14 for semester 2 course units, but it is not possible to change the course unit selection after the second day of the taught period of the course unit. There is a 'course unit changes' form which must be completed by any student wanting to change their original course unit choices. This should be collected from and returned to the Postgraduate office. If the changes occur within the deadline, then the Postgraduate office will sign it, but if the changes are requested past the agreed deadline, the student will need to collect agreement signatures from the course unit coordinator whose unit they want to join and from the relevant Programme Director. Permission will be granted only in exceptional circumstances.

Research and Professional Skills

Towards the end of the taught course units, there is a one-week course unit on Research and Professional Skills (CS699). This course unit is zero credit-rated and compulsory. It is presented by various contributors including the Careers Service, the Post-Experience Vocational Education Unit, Programme Directors, Research staff and groups and Industrial Consultants.

5.5 The Structure of the Taught Course Units

The course units provided by the Computer Science School are given in an intensive mode. Each course unit consists of 3 parts:

1. The preparatory part. This is background work that is necessary in order to be able to understand the taught part of the course units. Students must ensure that they have done the requisite work before the taught part of the course unit, otherwise they will not be prepared and will not be able to continue with the course unit. This part of the course unit should take approximately five days and may be undertaken any time before the taught period.

2. The taught period. This will be an intensive week of lectures, exercises, practical work and other activities. It will be the main point of contact with the lecturing staff associated with the course unit. Attendance during this period is compulsory in order to progress to the assessment.

3. An assessment exercise/examination. Each course unit with have either an assessment exercise or an examination, or, in most cases, both. The assessment exercise is intended to be taken after the taught period and should take approximately five days. Each course unit will set a deadline for this exercise to be completed. In all cases, it should be completed before the examination period of that semester. At the end of the first semester, and approximately half-way into the second, there will be examinations on that semester's course units.
The taught course units in the Faculty of Medicine, Dentistry, Nursing and Pharmacy are provided in a more extended mode. Each course unit lasts 12 weeks, followed by a 3 week revision and assessment period, and involves 3 hours of contact time and 4-8 hours of directed learning per week. The contact time involves classroom teaching, practical work, demonstrations and problem solving. In addition, students are expected to undertake project work, directed reading, literature searches etc. for assessments, and non-directed work that may include reading textbooks and journals, and reviewing programme notes. Most course units have an examination at the end of the semester. The emphasis of the taught part of the programme is on understanding principles and acquiring the skills necessary to apply them.

5.6 Research Projects

For the research component, research projects are designed by members of staff to enable the student to develop Research and Development skills and to gain practical experience of applying the techniques covered in the taught part of the programme to realistic situations. Projects relate to current research and development areas, and are undertaken within research groups or in an industrial/medical setting. Keen students may propose their own projects so long as the project is suitable for the award of an MSc and that it can be accommodated. Research projects last approximately six months and culminate in the submission of a dissertation.

Research projects may also be undertaken with industrial/medical partners. These are arranged on a yearly basis and students interested in such projects are matched to relevant industrial partners when available.

Students are encouraged to attend the regular programme of research seminars, given by invited speakers, covering a wide variety of topics in computer science. Guidance is provided on the skills required for undertaking the research project, and writing the dissertation, through a course on Research and Professional Skills. Guidance notes on the management of research projects and dissertation writing are also provided in an Appendix to the Handbook.

The research project is an important part of the programme, equal with the taught components and worth 90 credits as course unit CS690. It not only gives students an introduction to scientific research at the highest level, but is an opportunity to gain a deep understanding of an area of the subject.

5.7 Awards by Credit Accumulation

As well as the one-year MSc programme, we offer an MSc, a Diploma and a Certificate in Computational Methods and Imaging in Medicine, by accumulating credits over a period, normally no more than four years. These qualifications are suitable for part-time students and for those who are on release for training and skills enhancement.

The requirements and regulations governing award by credit accumulation are described later in this document.

6 Administration and Application Details

6.1 Application Procedure

There is an on-line application system at:

http://www.manchester.ac.uk/degreeprogrammes/postgraduates/apply/.

Alternatively a printable application form can be downloaded from

http://www.manchester.ac.uk/studyhere/postgraduate/downloadapplicationform/.

All relevant information is on the postgraduate website. Application forms as well as printed documentation are available on request from the Postgraduate Admissions Secretary. Questions about the programme may be directed to the same address.
The Postgraduate Admissions Secretary
School of Computer Science
University of Manchester
Manchester M13 9PL
Tel: +44 (0) 161 275 6181
Fax: +44 (0) 161 275 6204
Email: pg-compsci@manchester.ac.uk

The application should be accompanied by references from two academic referees or from one academic referee and one manager/project leader. To enhance the case we encourage the submission of a CV and a statement of aims in undertaking the MSc. A copy of the applicant’s degree certificate, official transcript of programme marks (referees usually do not provide this information) and A-level marks (final school grades) should be enclosed. If the applicant’s native language is not English, a copy of a recent IELTS test certificate is also be needed.

We may invite applicants for an interview or we may make an offer of a place on the basis of the written application alone. We welcome visits from those who wish to know more about us before finally deciding whether to accept an offer.

All offers are subject to formal approval of qualifications by the University of Manchester and conditional offers will only be honoured if the stipulated requirements have been met before the start of the programme, including English proficiency.

Admissions are determined entirely on academic grounds and the provision of facilities. The Admissions Tutor reserves the right to refuse applications for these reasons.

There is a University appeals procedure in place to deal with complaints regarding the admissions process. A copy of the policy statement can be obtained by writing to the Academic Registrar’s Office, University of Manchester, Oxford Road, Manchester, M13 9PL. Any questions regarding the application process should be directed to the Postgraduate Admissions Secretary (at the above address).

6.2 When to apply

We will accept enquiries and applications at most times of the year but applicants are advised to act sooner rather than later. Normally, enquiries start building up from November onward. By the end of July the programme may be full, and applicants are therefore encouraged to send in their completed application form, along with the required additional information, to the Postgraduate Admissions Secretary by the end of June. Applicants who are in the final year of their undergraduate programme, can send in their transcript of marks achieved to date; they do not have to wait for their final year transcript/degree certificate.

Late arrival at the start of the programme is discouraged and enrolments more than two weeks late are not normally allowed, so potential self-funding students should not leave decisions to the last moment.

6.3 Fees and Funding

Full details of current fees for this programme are available on the fees webpage (http://www.manchester.ac.uk/studyhere/postgraduate/costsofaprogramme).

Queries regarding the fees or methods of payment should be addressed to the Student Services Centre, Tel: +44 (0) 161 275 5000, Email: ssc@manchester.ac.uk.
The programme is supported by an Engineering and Physical Sciences Research Council (EPSRC) grant. This allows for some help to support students financially. However, competition for financial support is strong, and is only available for UK and EU students. It usually amounts to the payment of the fees. Exceptionally, an additional bursary may be awarded.

We welcome students seconded by industrial companies. The British Council has in the past funded students on our course, but students from outside the EU normally need to secure their own funding.

7 Assessment Regulations and Procedures

7.1 Assessment

The assessment of the MSc consists of two parts (1) an assessment of the taught course units undertaken, and (2) an assessment of the project dissertation. In order to be allowed to progress to the Research Project, students must pass the taught part of the course. The award of an MSc is then made entirely on the basis of the project dissertation.

1. Each student will be assessed on 90 credits' worth of coursework and examination questions.

   Coursework is likely to include practical laboratory exercises (individually or in groups), written essays, seminar presentations, and/or other forms appropriate to each individual course unit; for each full course unit, this usually carries two thirds of the mark. The examinations usually consist of a two-hour paper for each course unit, usually carrying one third of the marks, and are held in the teaching in each semester. Past examination papers are available at the School's Postgraduate website.

   The regulations for passing the taught course units are as follows:

   A candidate is required to register for 90 credits' worth of coursework course units, and will normally be considered as passing the coursework course units if:

   (a) the credit weighted average is 50% or more on the course units, and

   (b) the credit weighted average of the practical work is 40% or more, and the credit weighted average of the examination results is 40% or more, and

   (c) course units whose overall results are below 40% amount to no more than 30 credits.

   The final decision on whether a student passes is taken by the MSc examination board.

2. A dissertation worth 90 credits is assessed as follows: The general requirements for presentation of a dissertation are set out in the Faculty Ordinances and Regulations. The MSc dissertation is evaluated by two internal examiners at Manchester (a supervisor and another not involved with your work on the project) who submit written reports. These reports and the theses themselves are considered by the external examiner at a specially convened examination meeting. Agreed recommendations are then made to the MSc panel of the Faculty which gives final approval.

   The project report for the Diploma is assessed by the same procedure, applied to a project of 30 credits (instead of 90 credits).

   Details about dissertation format etc can be found on the university website. A guide to the project and dissertation is provided later in this handbook.

   All work must be original: students presenting work which is copied from any other source (unless explicitly allowed), including from other students, are breaking university regulations, and will be dealt with under these regulations. Guidance on plagiarism is provided later in this handbook.

7 http://www.intranet.man.ac.uk/red/ass/examinations/thesisregs/regulations.pdf

7.2 MSc with Distinction

An MSc with Distinction is awardable under the following circumstances:

1. the student must have passed the assessment for the taught course units with an overall average of at least 70% with no evidence of weakness in any subject area, and
2. the dissertation is submitted on-time and the examiners award a mark of at least 70%. The External Examiner will be consulted before a final recommendation is forwarded to the MSc Panel. Diploma students can gain a distinction if they satisfy the same rules.

7.3 MSc with Merit

An MSc with Merit is awardable under the following circumstances:

1. the student must have passed the assessment for the coursework course units with an overall mark of at least 60% with no mark below 50% in any course unit at the first attempt, and
2. the examiners award a mark of at least 60% to the dissertation.

Diploma students can gain a merit if they satisfy the same rules.

7.4 Awards by credit accumulation

As well as the one-year MSc course, the School offers an MSc, a Diploma and a Certificate in Computational Methods and Imaging in Medicine, by accumulating credits over a period, normally no more than four years. These qualifications are suitable for part-time students and for those who are on release for training and skills enhancement.

The MSc in Computational Methods and Imaging in Medicine requires a total of 90 credits in taught course units (6 course units), assessed as described above, and a 90 credit full project. The whole must normally be taken within four years, and students are encouraged to take it within a shorter period, either over two years; or in a three-year scheme in which 45 taught credits (3 course units) are taken in each of the first two years and the research project in the third. These arrangements can be modified to suit personal circumstances.

The Diploma in Computational Methods and Imaging in Medicine requires a total of 90 credits in taught course units. A student passes the 90 credits at the Diploma level if:

1. the credit weighted average is 40% or more on the course units, and
2. the credit weighted average of the practical work is 40% or more, and the credit weighted average of the examination results is 40% or more, and
3. course units whose overall results are below 40% amount to no more than 30 credits.

In addition, for the Diploma, students are required to successfully complete a mini-project worth 30 credits.

The Certificate in Computational Methods and Imaging in Medicine is awarded to students who have successfully taken 60 taught credits (4 course units) with a result of 40% or more in each course unit.

The final decision on whether a student passes at Diploma or Certificate level is taken by the MSc examination board.

Upgrading from a Certificate to a Diploma or to an MSc, or from a Diploma to an MSc is permitted as long as the final award is achieved within a four-year period from first registering for the lower qualification.

7.5 Procedure for students who fail

Students who fail the assessment for the taught part of the course are permitted single resits of failed examinations on the next occasion that the examinations are normally set. If a candidate satisfies the criteria for a Diploma or Certificate, they may at the discretion of the Examiners be given the option to re-register accordingly. If in the opinion of the Examiners a candidate fails to meet acceptable standards of performance, they will be excluded from the course and their registration will be cancelled. In all such circumstances the Programme Director will discuss the candidate's circumstances with the aim of achieving the most satisfactory outcome.
7.6 Attendance

Attendance of the taught course units is compulsory and poor attendance attracts penalties on coursework. The Postgraduate Office should be notified of absences due to illness of less than 7 days by means of self-certification forms, which are available from the Postgraduate Office. Longer absences must be certified by a medical note signed by a general practitioner or hospital doctor. It is in your interests to keep us fully informed of medical or other problems you have so that the effect these may have on your work can be taken into account in examination meetings.

The University’s policy regarding ‘Work and Attendance’ is available at http://www.manchester.ac.uk/policies.

7.7 Interruptions

An interruption is a formal break, usually of one month or longer, in your course of study. A request is made via the Programme Director to the MSc Panel and circumstances will dictate whether and under what terms it may be granted. The University is generally under an obligation to inform any sponsor if an interruption is granted. The University is sympathetic and helpful in genuine cases of difficulty.

7.8 Sickness

In the case of sickness which affects your work or its assessment, you must follow the guidelines on Ill Health in this Handbook.

7.9 Academic Appeals

No appeal can be made against the academic judgement of Examiners.

However, a student has right of appeal on procedural grounds: on the grounds of prejudice or bias or of inadequate assessment, and on grounds that the examiners were not in possession of information relating to circumstances that may have affected the student’s academic performance. There is also provision for appeal against decisions on Masters dissertations.

Full details may be found on the University’s policies website under ‘Academic Appeals’.

8 Advice on Essay Writing

For help in developing your essay writing skills (and as preparation for writing your dissertation) useful webpages have been compiled by the Faculty of Humanities:

- Study skills: Essay writing

Here are some other UK based sites which you might want to pursue:

- How to write an essay (University of Birmingham, Department of English)
- Essay-Writing (University of Leeds, Institute of Communication Studies)

9 Guide to MSc Projects

9.1 Introduction

The individual project is in many ways the most important single component of the MSc programme. It provides the opportunity for you to demonstrate independence and originality, to plan and organise a large project over a long period, and to put into practice the techniques you have been taught throughout the course. Whatever your level of academic achievement so far, you can show your individuality and inspiration in this project. It should be the most satisfying piece of work in your course.

8 http://www.manchester.ac.uk/policies
9 http://www.humanities.manchester.ac.uk/studyskills/assignments
10 http://www.bham.ac.uk/english/bibliography/students/essay.htm
11 http://ics.leeds.ac.uk/icsmodbb/ay2004/STHR1030.pdf
9.2 The Project Coordinator

The project coordinator for Advanced MSc projects Dr Rizos Sakellariou is responsible for the overall organisation of MSc projects. You can email him whenever you have any problem with the organisation of your individual project.

For MEnt projects, the project co-ordinator is your Programme Director, who should be consulted over any aspect of the management of your project.

9.3 Choosing a Project

The idea for your project may be a proposal from a member of staff or your own, or perhaps a combination of the two. After project proposals are published (around mid-January), you should discuss the projects that interest you with the supervisors as soon as possible so that you have plenty of time to think about the best choices for you. Not every project is suitable for every student; some may be specifically tailored to a particular degree and some may only suit students with a very specific set of interests. Each proposal will indicate these constraints in order to help you to make an informed choice.

Project proposals originating outside the school (e.g. from actual or potential employers or sponsors) are encouraged, but you must provide clear details of what the project involves and have the approval of the Programme Director. In exceptional cases permission may be given to do the project work in another institution or country, subject to suitable arrangements for regular contact with your supervisor in the school being made and approved.

If you have your own idea for an individual project it is your responsibility to find a member of staff who both approves of the proposed programme of work and is willing to supervise it. External projects cannot be approved unless a suitable internal supervisor can be found. Not all project ideas are suitable for an MSc dissertation since certain academic requirements have to be met. The project coordinator will assist you in finding a supervisor but you cannot assume that one can be found in every case.

9.4 Assessment

General requirements. All MSc projects are required to contain some element of original work. This does not mean that they have to produce ground-breaking, innovative research results (although some do). It means that they have to cover some new ground. An implementation project could develop a complex application which does not already exist, or enhance some existing application or method to improve its functionality or performance. Projects which are predominantly survey reports can be backed up with experimentation, implementation, theoretical or conceptual analysis, new illustrative examples, etc. Your supervisor will advise on how to develop your project appropriately. A distinction level project involves a combination of sound background research, a solid implementation or piece of theoretical work, and a well-structured and well presented report detailing the project's background, objectives and achievements.

Assessment. For the purpose of the MSc degree and the award of distinctions, the only thing that can be taken into consideration is the quality of your final dissertation. Formally, your project work is assessed on the basis of your dissertation only. You cannot compensate for a poor write-up by a well-conducted project. You cannot get credit for ideas or experiments not included in the dissertation. Dissertations not meeting minimal standards of presentation will not be accepted for award of the MSc degree, no matter how good the project work itself.

Other considerations. Remember that your attitude to, and performance in, the individual project is taken very seriously by prospective employers and other institutions to which you may be applying. Your project work is usually reported in some detail in academic references provided for you by your supervisor or other staff members. In this respect you do obtain credit for the way in which you approach your individual project.
### 9.5 Allocation

You must complete the Project Choice Form available from the Postgraduate Office after the project proposals are announced (mid-January). If you choose from the published proposals your first choice of project cannot be guaranteed since individual supervisors can only take responsibility for a limited number of projects. In some cases you may be allocated the project but another member of staff will be assigned to supervise it. Failing this, you may be allocated your second choice.

When considering a project, you must consult the prospective supervisor, so that you agree on pre-requisites, background and project aims and objectives. You will need his or her signature in order to be allowed to choose a project. If you are enrolled in a specialized MSc programme you must make sure that your project is approved by the Programme Director as suitable for the programme.

### 9.6 Equipment

You are permitted to develop software (or hardware, if appropriate) on your own equipment, provided that you can duplicate it in the School for demonstration to your supervisor. However, you should prepare a fail-back position in case your equipment misbehaves. Remember that the software on some cheap home computers is not reliable. It is not unusual for a potentially good project to be spoilt by bugs in compilers, libraries etc. on home computer equipment.

If you wish to use software which is not currently provided, please inform your supervisor immediately. A request can then be made to purchase it if an acceptable alternative is not available. A purchase request will need the support of your supervisor and is not guaranteed to be approved.

Please note that there is no excuse for failing to keep adequate backups on your home computer. If you lose your program or your data or your report because of a system failure, no allowance can be made. Extensions will not be given at the end of the project for you to re-type a lost report, for example.

### 9.7 Supervision

The relationship between yourself and your supervisor is often critical to the success of the project. You will be given guidance in the Research Skills course unit (CS699) on how to manage this relationship, and how to cope with research in general.

You must make sure that you arrange regular meetings with your supervisor. The meetings may be brief once your project is under way but your supervisor needs to know that your work is progressing. You should inform the supervisor of your address and any changes to it, so that he or she can contact you, if necessary. If you need to talk to your supervisor between meetings and cannot locate him/her in their office, leave a note, or send electronic mail, asking them to suggest a time when they will be available. When you go to see your supervisor, you should have prepared a written list of points you wish to discuss. Take notes during the meeting so that you do not forget the advice you were given and the conclusions that were reached.

### 9.8 The Dissertation

The dissertation is an extremely important part of the project. We give advice below on how to structure and present your dissertation. Regulations will be found on the University website\(^{12}\) by the time you start writing up.

The dissertation serves to show what you have achieved and should demonstrate that:

- You understand the wider context of computing by relating your choice of project, and the approach you take, to existing products or research.
- You can apply the theoretical and practical techniques taught in the course to the problem you are addressing, and that you understand their relevance to the wider world of computing.
- You are capable of criticizing your own work objectively and making constructive suggestions for improvements or further work based on your experiences so far.

\(^{12}\)http://www.manchester.ac.uk/policies
— You can explain your thinking and working processes clearly and concisely to third parties who may not be experts in the field in which you are working.

Remember that second markers, and other readers, will not have followed the project throughout. Make the presentation reasonably self-contained. State the objectives clearly; provide sufficient background material.

Many students underestimate the importance of the dissertation. You should consider that the aim of the project is to produce a good dissertation and that software, hardware, theory etc. that you develop during the project are merely a means to this end. Do not make the mistake of leaving the write-up to the last minute. Ideally you should produce the bulk of the report as you go along and use the last month or two to bring it together into a coherent document.

Remember that quantity does not automatically guarantee quality. A 150 page report is not twice as good as a 75-page one, nor a 10,000 line implementation twice as good as a 5,000 line one. Conciseness, clarity and elegance are invaluable qualities in report writing, just as they are in programming, and will be rewarded appropriately. Also, it is important to appreciate that the appropriate size and structure of a report can vary significantly from one project to the next. Despite these variations, however, most good reports have the following components in common.

**Presentation.** Below we give an outline of how the dissertation should be presented. This is for guidance only: University regulations for the dissertation can be found on the University’s policies webpage and should be followed exactly. The dissertation must be bound in the university approved manner. The University Library offers a binding service, as do other local binderies.

**Title page.** This must be in the standard form described in University regulations.

**Acknowledgements.** It is usual to thank those individuals who have provided particularly useful assistance, technical or otherwise, during your project. Your supervisor will obviously be pleased to be acknowledged as he or she will have invested quite a lot of time overseeing your progress.

**Contents page.** This should list the main chapters and (sub) sections of your report. Choose self-explanatory chapter and section titles and use double spacing for clarity. If possible you should include page numbers indicating where each chapter/section begins. The table of contents should not have more than two levels of headings (say chapters and sections within chapters).

**Abstract.** The abstract is a very brief summary of the report’s contents. It should be about half a page long. Somebody unfamiliar with your project should have a good idea of what it is about having read the abstract alone and will know whether it will be of interest to them.

**Introduction.** This is one of the most important components of the report. It should begin with a clear statement of what the project is about so that the nature and scope of the project can be understood by the reader. It should summarise everything you set out to achieve, provide a clear summary of the project’s background and relevance to other work and give pointers to the remaining sections of the report which contain the bulk of the technical material.

**Background.** The background section of the report should set the project into context by relating it to existing published work (or unpublished work) on which the project builds. The background section is sometimes included as part of the introduction but more usually is a separate chapter, or collection of chapters if the project involved an extensive amount of research. The published work may be in the form of research papers, articles, textbooks, technical manuals, or even existing software or hardware of which you have had experience. You must acknowledge the sources of your inspiration; you are expected to have seen and thought about other people’s ideas; your contribution will be putting them into practice or developing them in some new direction. One rule is clear: if you present another person’s work as your own and do not cite your sources of information/inspiration

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10[http://www.manchester.ac.uk/policies](http://www.manchester.ac.uk/policies)

14[http://www.manchester.ac.uk/policies](http://www.manchester.ac.uk/policies)
you are cheating. When referring to other pieces of work, cite the sources at the point they are referred to or used, rather than just listing them at the end. The University takes a very strict line on plagiarism, and its standard notice on the subject is included in this Handbook (and is available on the University website).

**Body of report.** The central part of the report usually consists of three or four chapters detailing the technical work undertaken during the project. The structure of these chapters is highly project dependent. Usually they reflect the chronological development of the project, e.g. design, implementation, experimentation, optimisation, although this is not always the best approach. However you choose to structure this part of the report, you should make it clear how you arrived at your chosen approach in preference to the other alternatives documented in the background. For implementation projects you should describe and justify the design of your program at some high level, e.g. using dataflow diagrams, pseudocode, ADT specifications, Z, VDL, etc., and should document any interesting problems with, or features of, your implementation. Integration and testing are also important to describe. Your supervisor will advise you on the most suitable structure for these middle sections.

**Conclusions and future work.** All projects should conclude with an objective evaluation of the project's successes and failures and suggestions for future work which can take the project further. Even the very best pieces of work have their limitations. You will not have time, and you should not try, to tie up every loose end. You are expected to provide a proper critical appraisal of what you have done. Your assessors are bound to spot the limitations of your work and you are expected to be able to do the same.

**Bibliography.** This consists of a list of all the books, articles, manuals etc. used in the project and referred to in the report. You should provide enough information to allow the reader to find the source. You should give the full title and author and should state where it is published, including full issue number and date, and page numbers where necessary. In the case of a text book you should quote the name of the publisher as well as the author(s).

**Appendix.** The appendices contain information which is peripheral to the main body of the report. Information typically included are things like program listings, tables, proofs, graphs or any other material which would break up the flow of the text if it appeared. Large program listings are rarely required, and should be compressed as much as possible, e.g. by printing in multiple columns and by using small font sizes, omitting inessential code etc.

**User guide.** For projects which result in a new piece of software you should provide a proper User Guide providing easily understood instructions on how to use it. A particularly useful approach is to treat the User Guide as a walk-through of a typical session, or set of sessions, which collectively display all the features of your package. Technical details of how the package works are rarely required. Keep it concise and simple. Do not bother including instructions at the level of 'Turn on the machine, and then insert disk'. The use of diagrams illustrating the package in action can often be effective. A user guide is sometimes included as a chapter in the main body of the report, but is often better as an appendix to the main report. Do not include user guides for trivial pieces of code where these are not the main subject of the dissertation.

**Format.** The University requires that dissertations are submitted in a certain format whose description is available on the University's policies webpage. Make sure that your dissertation is in the required format (there are various 'style files' to help with this), otherwise it may not be accepted at submission time.

### 9.9 Assessment of the Dissertation

Dissertations are normally assessed on the following broad criteria:

18http://www.manchester.ac.uk/policies
Background research. This assesses your awareness of relevant background work and how your project builds upon or exploits existing techniques or results. For implementation projects, it assesses the way you arrived at your initial project specification, work programme and list of objectives.

General competence. This assesses your general approach, the clarity of your objectives, and your ability to relate the significance of your achievements to the state-of-the-art.

Technical accuracy. This assesses the main technical output from the project, as regards correctness, elegance, usability etc. of the final product, theoretical or practical, and the techniques employed.

Report. This assesses the quality of the write-up itself: the organisation of the material, quality of the prose, clarity of explanations, spelling, punctuation, legibility, relevance of diagrams, etc. Note that reports falling below minimum acceptable standards will not be accepted.

Finally... Remember that one of your supervisor's main responsibilities is to advise on how to write-up your project results. You are not expected to be able to produce a perfect dissertation without help. You should discuss with your supervisor all aspects of the dissertation, but particularly its structure and how to present the material. You might find it useful to look at MSc dissertations from previous years.

9.10 Project Seminars

Students give a seminar in the first two to three months of the project, although project supervisors may decide to postpone the seminar if they think a later time is more suitable. The seminar will give you experience in communicating your work to others in a formal manner and will also allow you and your supervisor to consider the progress you have made up to this point. The seminar is a compulsory part of CS699, although it does not contribute to the final project mark. You will receive feedback and comments from your supervisor and a second marker, usually the other internal project examiner. They will fill out and sign a feedback form together, which addresses presentation skills and progression. The assessment and feedback criteria are outlined in this form. Other students and staff will also attend the seminars, and this is an excellent opportunity to obtain feedback from them. The question and answer session after the seminar is therefore an invaluable part of the process. Indeed, one of the main aims of this is to help each student with the project by providing useful ideas, feedback and encouragement.

Guidelines on seminar organisation can be found on the seminar organisation page.

9.11 Pitfalls

Why do some projects go wrong? Here are some of the common causes of failure:

- Choosing or starting the project too late. Submit your project request form on time and start the project as soon as you can. The longer you leave it the harder it is to get motivated, especially when all your friends seem to be flying ahead. You should aim to have completed most of the project by early August, thus leaving sufficient time to fill in gaps and write the dissertation.
- Failing to meet your supervisor regularly. If you arrange a meeting with your supervisor, turn up at the agreed time. If you are stuck for any reason and you have no meeting arranged, contact him or her immediately. You gain no sympathy from anyone if you lose contact with your supervisor and produce a poor project as a result. Your supervisor will be happy to help you but he or she can do nothing if they are unaware that you are having trouble. Also, make sure that you are prepared for each meeting with your supervisor. This may take the form of a completed piece of work that you have done ready to demonstrate to your supervisor; or it

http://www.cs.manchester.ac.uk/Postgrad/ACS-CS/webpages/seminar.pdf
http://www.cs.manchester.ac.uk/Postgrad/ACS-CS/webpages/seminar-organisation.html
may be that you have hit some problem, in which case come along prepared to explain the problem so that you both can attempt to solve it. Always bring your laboratory workbook and any results you have to each supervision.

- Allowing too little time for the report. You should try to produce as much of your report as you can as you go along, even though you don’t know in advance its exact structure. Written work along the way has two forms: (1) written accounts which describe a piece of work you have completed along the way. Write these at the time that each stage is completed—it is much easier then; and (2) an evolving plan of your dissertation—chapters, sections and their contents. This changes as the project evolves, but will provide guidance to the overall structure. The last two weeks of the project should be dedicated to pulling together the material you have accumulated and producing a polished final product.

- Failing to plan a fall-back position if the planned work is not completed on time. Try to plan your project in stages so that if things go wrong in a later stage you have a completed stage to fall back on.

- Trying to satisfy an external customer at the expense of your academic work. Do not let any outside interests interfere with your work. The guidance for your project should come from your supervisor, not your prospective employer.

- Over- or under-ambition. Try to be realistic about what you can achieve in the time available. A good project requires a lot of input from you and should prove to be technically challenging throughout. At the same time, however, it is better to do a small job well than it is to fail to do a big job. Your supervisor will advise you on this or her expectations of the project and this will help you to set your sights accordingly.

- Submission of preliminary drafts. Do not submit your dissertation without getting your supervisor read through it first. He or she will invariably have comments and suggestions for improvement. Don’t leave this to the last moment—give your supervisor a good period to read and comment as he or she will possibly have several to look at, and it can take a while to read through a draft. You should normally expect to revise the complete draft at least once. Dissertations failing to meet minimum standards will not be accepted for award of the MSc degree.

The dissertation has to be your own original work. Guidance on the use of the work of others and on plagiarism can be found elsewhere in this handbook.

9.12 Research Project Timetable

Mid January. Project proposals are posted on the web and announced to students—go to the postgraduate information page and navigate from there. Having perused the list, you should:

- Obtain a Project Subscription form from the Student Support Office in the School.
- Go and see the supervisors of the projects you are interested in to discuss the projects in detail.
- Get them to sign the Project Subscription form. This is vital; you will not be assigned a project unless you have seen the supervisor first. Bear in mind that members of staff may be away even during term time, so do not leave this until the last moment.
- When you have completed your enquiries, return the form to the Student Support Office in the School (we suggest that you keep a copy). You should indicate at least three choices on the form (in order of preference). This is important: you may be given any of these, so do not select a project unless you are really prepared to do it! Of course, the allocation scheme will respect your preference order—typically, every year around 70% of the students who submit a form by the deadline are allocated their first choice—but clashes of one kind or another always happen.

Please perform this exercise as quickly as possible (i.e. start thinking about a project immediately after the projects are announced—typically, around mid-January – or well beforehand if you wish to arrange your own project) and

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18http://www.cs.manchester.ac.uk/Postgrad/currentstudents.php
hand in your form by the deadline (typically, in the 2nd half of February). Please note that there is no advantage if you hand your form in early (but there is a disadvantage if you hand in after the deadline).

The project coordinator will then collate the data and attempt, in discussion with programme directors and supervisors, to give as many people as possible their first choices, or, failing that, one of their most preferred choices. Please note that, in general, only one person will get to do one project. Also, there is a limit to the total number of projects that a staff member is capable of supervising. For these reasons, there is a strong likelihood of disappointment if you plump for popular projects/supervisors. Unfortunately there is no way of knowing the pattern of demand in advance (you might like to ask staff members about the level of interest in projects when you see them). If you are unsuccessful, there will be a further round of the process in March.

A final point: It is possible that you wish to do a project of your own devising, or follow up an idea that has arisen in conversation with a staff member. If you wish to do a project that does not appear on the list then you should first get the agreement of a staff member to supervise you, and then hand in a description of the project (signed by the supervisor) to the Student Support Office in the School, again by the deadline. Projects with industrial partners may also be available.

**Second half of February.** Project preferences must have been handed into the Student Support Office in the School.

**End of February.** First round of the MSc project allocation is now on the web. Students still without projects should continue making selections on a fresh form (available from the Postgraduate Office) and should

- hand them in as soon as possible from this point on; allocation will be done on a first-come first-served basis every few days.

**Start of Easter Vacation.** Project allocation complete. Start working on your project as soon as you have completed your examinations. Plan your work. You have the whole summer before you and it is very easy to underestimate the time required to complete the project. Do not write the dissertation in the last week but write it as you work on the project.

**June–early July.** Project seminar (see Section 9.10 for details).

**Mid Summer.** You must give prior notice of your intention to submit by completing a ‘Notice of Submission’ form obtainable from the University’s policies webpage[^19]. A fee is payable for late notice. The rules regarding the form of the dissertation are currently being made and will in due time appear on the University’s policies webpage[^20]. You will be made aware of the rules, and you will also be told where to submit both, the Notice of Submission Form as well as the dissertation itself.

**Second week of September.** The deadline for the submission of MSc dissertations varies from year to year but is usually in the second week of September. Two bound copies of your dissertation must be submitted. Bear in mind that binding may take some time—please allow for this.

To let us know that you have submitted, could you please email pgooffice@cs.manchester.ac.uk.

**Submitting late.** If you are unable to submit by the deadline in the second week of September you must request the permission to submit late. The relevant form is available on the Faculty’s webpage[^21].

[^19]: [http://www.manchester.ac.uk/policies](http://www.manchester.ac.uk/policies)
[^20]: [http://www.manchester.ac.uk/policies](http://www.manchester.ac.uk/policies)
[^21]: [http://www.eps.manchester.ac.uk/informationforcurrentstudents/](http://www.eps.manchester.ac.uk/informationforcurrentstudents/)
10 Student Support Services

The School and University offer a wide range of student support services. You are encouraged to make use of these services—they are there for you. If you need any help, whether it be academic help, in finances, in your personal life, with relationships or the family, in legal matters, or with health, there are services provided for you. Do not hesitate to use these services.

It is important that any factor that affects your work is communicated to the School, usually directly to the Programme Director. This is entirely confidential. Such factors may be taken into consideration during the assessment process, and we can compensate for any disruption to, or difficulties during, your work here.

You may well want to make the Programme Director your first port of call. She or he will be able to handle some of the issues directly or advise you what other services are relevant.

If you have difficulties of any sort that you don’t want to talk to the programme management about, you may care to consult:

- The advice service of the School of Computer Science. This is located in room 2.9 near the school office and is open 1.30-2.00pm each weekday (except for Wednesdays) during term time. The service offers advice on School and university matters and help with anything that concerns you, whether in your studies, in the School, in the university or in your life outside the university. Each day a member of staff is available with knowledge of the School and university and who is willing to listen and help with whatever you bring along. All visits to the advice centre are strictly confidential.

If you wish to contact one of the advisors at any time other than in a lunchtime session, please do so. A list of the advisors is posted on the advice centre door.

The University operates an excellent professional counselling service:

- The Student Counselling Service. It is based in Crawford House in the University Precinct Centre, is open 9.00-5.00 weekdays, and can be phoned on 275 2804.

For special academic problems, you may wish to contact

- The Academic Advisory Service. It is located in the Williamson Building, Room 2.11a, phone 275 3033.

Other services available are:

- The Student Union, which has a wide range of services, including a welfare officer, and a legal advice service.
- The Student Union Advice Centre, Steve Biko Building, Oxford Rd, 275 2300.
- The Student Health Service, Waterloo Place opposite the Kilburn Building, 275 2858.
- The Accommodation Office, Precinct Shopping Centre, 275 2888.
- Manchester Student Homes has a ‘Virtual Accommodation Bureau’ (an on-line property database), which contains information on all the available student properties.
- The Careers Service, Crawford House, Precinct Centre.
- The Student Services Centre, Burlington Street, between the library and the refectory, 275 5900.
- The International Students Advice Team, 275 2196.
- The University Language Centre, Email: iwlp@manchester.ac.uk.

Contact details for information on english language courses: 305 3397, englslg@manchester.ac.uk.

A more detailed list of services for students can be found at this address: http://www.campus.manchester.ac.uk/studentsupportandservices/.

22http://www.campus.manchester.ac.uk/counselling/
23http://www.campus.manchester.ac.uk/academicadvisoryservice/
24http://www.uman.ac.uk/
25http://www.uman.ac.uk/advice/
26http://www.accommodation.man.ac.uk/
27http://www.accommodation.manchester.ac.uk/mshcontact/
28http://www.careers.manchester.ac.uk/
29http://www.man.ac.uk/asc
30http://www.campus.manchester.ac.uk/asc/internationalteam/
31http://www.lancsat.manchester.ac.uk/
10.1 International Students

The University provides special facilities and support for overseas students. See the international students' website32 for full details.

The International Society33 provides a meeting point for overseas students, provides support and advice and also organises many activities, including welcome activities in the first few weeks of the academic year. See their website for more details.

Each year, there is a range of welcome activities and orientation courses for overseas students on your arrival. See both the University welcome page34 and the International Society welcome page35.

The University of Manchester Language Centre36 provides a range of courses for those who wish to acquire the English language, from beginners' courses, through to advanced courses, and specialist and technical courses.

Confirmation of registration

If you are an international student, please note that if you require a letter for your visa application, visa extension or your sponsor confirming that you are registered in this School, you must provide one week's notice of this request to the Student Support Office.

11 University Learning Resources

With over 3.5 million books, some 7,000 current periodical subscriptions and a wide range of electronic resources, the John Rylands University Library37 is one of the largest academic libraries in the UK.

Admission to the library, which is located at the end of Burlington Street, is controlled by turnstiles operated using your University swipe card, which also serves as your library card. The computer catalogue of the library provides details of the books and periodicals available and can be used to reserve and renew books. It can be accessed using dedicated terminals distributed throughout the library and through the library's website (http://www.library.manchester.ac.uk). Graduate students may borrow 12 books plus additional books from a short loan collection which contains duplicate copies of books in heavy demand. The majority of periodicals are restricted to the library to ensure ready availability. Any material that is not available in the library may be ordered through the document supply unit. The main information desk is at the top of the escalator where staff will be pleased to help you to make best use of the library and the computing facilities. Additional information desks are distributed throughout the library together with self-service photocopiers. A range of guides is available including a general library guide, bookmark guides, which contain basic information specific to individual subjects and a series of general guides which cover various library services and facilities. In addition, a series of information sources guides, which describe the printed and electronic information sources relevant to particular subjects are available, together with leaflets describing the content and use of particular electronic databases.

Nearly 200 electronic services, including the main scientific, engineering, biological and medical databases, are available through a library web-based service called Rybase. About 250 computers in the library can be used to access these services and the other resources available through the University network, including word-processing and other software, e-mail and the internet. The electronic databases provided by the library may also be accessed from elsewhere on the University network. The library website provides information and news about the library and its services, access to the library catalogue and links to electronic publications and the catalogues of other libraries. A section on navigating the internet provides access to internet subject guides and links to a wide range of information resources and internet search tools. Each year sessions are arranged to introduce new students to the library and the information resources that are available.

http://www.manchester.ac.uk/studyhere/internationalstudents/
http://www.internationalsociety.org.uk/
http://www.man.ac.uk/international/welcome/
http://www.Eng.man.ac.uk/itsoe/welcome.html
http://www.langent.manchester.ac.uk/
http://www.library.manchester.ac.uk

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A training suite in the library is used to provide hands-on training in the use of electronic databases. These sessions are normally arranged by programme directors; however, library subject specialists can provide additional tours and training as required. If you need any help or information about the library, its resources and services please do not hesitate to contact 275 3738.

12 Health and Safety

The School has a Health and Safety Committee which is made up from representatives of all sections within the School. It is the responsibility of this committee to investigate complaints and potential hazards, to examine the cause of all accidents and to carry out periodic inspections of all areas of the School. At registration you will be required to assent to the school code of behaviour which relates to health and safety in the computer building as well as the responsible use of computer equipment.

Buildings

The School is housed in two buildings: the Kilburn Building and the IT Building.

The buildings are generally open between 08.00 and 18.00 (Mon – Fri). If you are working outside these hours then you are required to sign in at the loading-bay porters’ lodge. To remain in the building between 6 pm and 9 pm or enter on Saturday 10 am – 4 pm (term-time only), you require your school ‘Out of Hours Pass’. You will be told during the Introductory Fortnight how to obtain it.

In accordance with University policy, smoking is prohibited throughout all buildings.

Emergency Evacuation

It is the responsibility of every individual to familiarise themselves with the School’s buildings and be aware of the fire exits (which are clearly marked).

- During evacuation of buildings do not use the lifts.
- After evacuation of any building please assemble well away from the building, in the University Precinct or Booth Street East Car Park, and do not block any exits.
- Do not return to any building until authorised to do so.

Fire Action

Fire action notices are located at, or adjacent to, fire alarm actuation points, and all staff and students should make themselves acquainted with this routine.

Operating the Fire Alarm

The manual fire alarm system can be activated by breaking the glass in the red contact boxes sited at strategic points throughout the premises.

To call the Fire Brigade

Dial 9-999 on the nearest available telephone and give details of the location of the fire, i.e. Fire at Kilburn Building, University of Manchester, Oxford Road.

Use of Fire Appliances

Fire appliances are sited at strategic points throughout the School to deal with fires. Fires should only be tackled provided there is no personal danger.

Training

A full evacuation drill will be carried out at least once per year to ensure that all staff and students become fully conversant with the emergency procedure.
The Kilburn Building.
- On hearing the intermittent alarm you should prepare yourself to leave the building.
- On hearing the continuous alarm you should evacuate the building immediately by the nearest exit.
- The alarm is tested at 2 pm every Wednesday and no action is required.

Note, after 18.00 (Mon – Fri) and at weekends the building should be evacuated as soon as the intermittent alarm rings.

The IT Building. There is no intermittent alarm in this building.
- On hearing the continuous alarm you should evacuate the building immediately by the nearest exit.
- The alarm is tested at 2 pm every Thursday and no action is required.

First Aid

There are several first-aiders in Computer Science. These people are listed on the (green) First Aid notices posted around the School and also in the Health and Safety document posted on the Health and Safety notice board. If none of the First Aiders can be located then contact any of the porters’ lodges (exts. 56292, 56263 and 55711).

The student health officer (ext. 32858) can also render assistance, as can the emergency call-out service of the Occupational Health Unit (ext. 56972).

13 University Regulations, Procedures and Policies

The university website http://www.manchester.ac.uk/policies contains details of university regulations, procedures and policies, including those for work and attendance, for MSc dissertations, for appeals, on plagiarism, etc.

13.1 Ill Health

It is a requirement of your registration with the University of Manchester that you register with a local general practitioner. A list of GP practices can be obtained from the Student Health Service, any University hall of residence or a local Pharmacy. According to guidance issued by the General Medical Council it would not be regarded as good practice for a family member to be the registered GP or to offer treatment except in the case of an emergency.

You should always consult your GP (or for emergencies the Accident and Emergency Department of a hospital) if your illness is severe, if it persists or if you are in any doubt about your health. You should also consult your GP if illness keeps you absent from the University for more than 7 days including week-ends. If you do consult a GP and they consider that you are not fit for attendance at the University, then you should obtain a note from the doctor to that effect or ask them to complete Part III of the University form ‘Certification of Student Ill Health’ copies of which are available at local GP surgeries and the Student Support Office. You should hand this certificate to your Programme Director or the Student Support Office as appropriate at the earliest opportunity.

If your condition is not sufficiently serious to cause you to seek medical help, then the University will not require you to supply a doctor’s medical certificate unless you are absent from the University due to illness for more than 7 days. You must however contact the Student Support Office as soon as possible and self-certify your illness (that is complete and sign the ‘Certification of Student Ill Health’ form to state that you have been ill) as soon as you are able to attend school. You should do this if your illness means you are absent from the University for any period up to 7 days (see 1. below) or if you are able to attend the University but your illness is affecting your studies (see 2. and 3. below).

The following sub-paragraphs explain what you should do if your illness affects your attendance at compulsory classes or if you consider that your performance in your studies/examinations has been impaired.
1. If you are unwell and feel unable to attend the University to take a compulsory class, assessment or examination then you must seek advice by contacting the Student Support Office immediately, in person, through a friend or family member, by telephone or by email. This is to ensure that you understand the implications of being absent and the consequences for your academic progress, which might be quite serious. You must do this as soon as possible so that all options can be considered and certainly no later than the day of your compulsory class, assessment or examination. If you do not do this then you will normally be considered to have been absent from the class without good reason, or to have taken the assessment or examination in which case you will be given a mark of zero. You must also complete and hand in a ‘Certification of Student Ill Health’ form on your return.

2. You may be unwell but able to proceed with an assessment or examination and yet feel that your performance will have been impaired. If you wish this to be taken into account as an extenuating circumstance, you must inform the Student Support Office about this on the day of the assessment or examination and hand in to the Student Support Office a completed ‘Certification of Student Ill Health’ form. If you leave this until later it will not normally be possible to take your illness into account when assessing your performance.

3. If, as a consequence of your illness, you wish to seek an extension to a deadline for submitting assessed coursework, you must complete a ‘Certification of Student Ill Health’ form and discuss it with the Programme Director. The application for extension must be made before the deadline and not retrospectively.

4. You may be receiving occasional and ongoing medical attention which affects your studies. If so, you should obtain a letter from your physician which should be given to the Student Support Office before the relevant examination period if you wish your condition to be taken into account as an extenuating circumstance.

Special Circumstances Committee  Evidence of illness during the course or examinations is considered by the School’s Postgraduate Special Circumstances Committee, which makes recommendations to the course examiners. It is therefore particularly important that any periods of ill health are properly documented, and that such documentation is deposited with the Postgraduate Office at the time of the illness.

If you wish the Special Circumstances Committee to consider your case you must complete a Special Circumstances form, which is available from the Student Support Office or as a doc file from the web.

Notes
- Certification of Student Ill Health forms are available in the Student Support Office, all schools and halls of residence.
- Your school will give you guidance on the effect of any absence from your studies or if you consider your illness has affected your studies. If you have repeated episodes of ill health which is affecting your studies, your school may refer you to the Student Health Centre.
- If you are found to have been deceitful or dishonest in completing the Certification of Student Ill Health form you could be liable to disciplinary action under the University’s General Regulation XX: Conduct and Discipline of Students.
- The use of the ‘Certification of Student Ill Health’ forms by GPs as described above has been agreed by the Manchester Local Medical Committee. A GP may make a charge for completing the form.

13.2 Student Representation and Feedback

The School and University take seriously both the issues of student representation and that of quality control of the course. Student representatives are elected and will have the opportunity to bring issues to relevant members of staff, and see that they are dealt with satisfactorily. The Programme Director has overall responsibility for the running of the course, and regular meetings of all students with the Programme Director will be arranged. At other times, the Programme Director is available for any
issue to be raised. If a student is not satisfied with the way an issue is dealt with, then the Head of School may be approached, or the complaints procedure invoked.

All course units have course evaluation questionnaires. Students are encouraged to complete these for they are part of the quality assessment. They are processed by the School, they are read by the course unit lecturers and their appraisers, the Programme Director, the external examiners, and others who are concerned with the course quality. Other quality controls are maintained by the Postgraduate Syllabus Overview Committee (which maintains industrial relevance as well as quality), the Faculty, the government Engineering and Physical Science Research Council, and the accreditation bodies.

13.3 Guidance to Students on Plagiarism and Other Forms of Academic Malpractice

As a student, you are expected to cooperate in the learning process throughout your programme of study by completing assignments of various kinds that are the product of your own study or research. For most students this does not present a problem, but occasionally, whether unwittingly or otherwise, a student may commit what is known as plagiarism or some other form of academic malpractice when carrying out an assignment. This may come about because students have been used to different conventions in their prior educational experience or through general ignorance of what is expected of them.

This guidance is designed to help you understand what we regard as academic malpractice and hence to help you to avoid committing it. You should read it carefully, because academic malpractice is regarded as a serious offence and students found to have committed it will be penalized. At the very least a mark of only 30% would be awarded for the piece of work in question, but it could be worse; you could be awarded zero (with or without loss of credits), fail the whole unit, be demoted to a lower class of degree, or be excluded from the programme.

Academic malpractice includes plagiarism, collusion, fabrication or falsification of results and anything else intended by those committing it to achieve credit that they do not properly deserve. In addition to the advice that follows, your School will give you advice on how to avoid academic malpractice in the context of your discipline. It will also design assessments so as to help you avoid the temptation to commit academic malpractice. Finally, you should take note that work you submit may be screened electronically to check against other material on the web and in other submitted work.

You should read the following guidelines carefully and direct any questions to your Programme Director or to the Student Services Centre.

Plagiarism

Plagiarism is a serious academic offence and the disciplinary consequences are severe.

Plagiarism is presenting the ideas, work or words of other people without proper, clear and unambiguous acknowledgement. It also includes 'self-plagiarism' (which occurs where, for example, you submit work that you have presented for assessment on a previous occasion), and the submission of material from 'essay banks' (even if the authors of such material appear to be giving you permission to use it in this way). Obviously, the most blatant example of plagiarism would be to copy another student's work. Hence it is essential to make clear in your assignments the distinction between: (a) the ideas and work of other people that you may have quite legitimately exploited and developed, and (b) the ideas or material that you have personally contributed.

To assist you, here are a few important do's and don'ts:

1. Do get lots of background information on subjects you are writing about to help you form your own view of the subject. The information could be from electronic journals, technical reports, unpublished dissertations, etc. Make a note of the source of every piece of information at the time you record it, even if it is just one sentence.

2. Don't construct a piece of work by cutting and pasting or copying material written by other people, or by you for any other purpose, into something you are submitting as your own work. Sometimes you may need to quote someone else's exact form of words in order to analyse
or criticize them, in which case the quotation must be enclosed in quotation marks to show that it is a direct quote, and it must have the source properly acknowledged at that point. Any omissions from a quotation must be indicated by an ellipsis (…) and any additions for clarity must be enclosed in square brackets, e.g. “[These] results suggest that the hypothesis is correct.” It may also be appropriate to reproduce a diagram from someone else’s work, but again the source must be explicitly and fully acknowledged there. However, constructing large chunks of documents from a string of quotes, even if they are acknowledged, is another form of plagiarism.

3. Do attribute all ideas to their original authors. Written ‘ideas’ are the product that authors produce. You would not appreciate it if other people passed off your ideas as their own, and that is what plagiarism rules are intended to prevent. A good rule of thumb is that each idea or statement that you write should be attributed to a source unless it is your personal idea or it is common knowledge. (If you are unsure if something is common knowledge, ask other students: if they don’t know what you are talking about, then it is not common knowledge.)

As you can see, it is most important that you understand what is expected of you when you prepare and produce assignments and that you always observe proper academic conventions for referencing and acknowledgement, whether working by yourself or as part of a team. In practice, there are a number of acceptable styles of referencing depending, for example, on the particular discipline you are studying, so if you are not certain what is appropriate, ask your tutor or the course unit coordinator for advice! This should ensure that you do not lay yourself open to a charge of plagiarism inadvertently, or through ignorance of what is expected. It is also important to remember that you do not absolve yourself from a charge of plagiarism simply by including a reference to a source in a bibliography that you have included with your assignment; you should always be scrupulous about indicating precisely where and to what extent you have made use of such a source.

So far, plagiarism has been described as using the words or work of someone else (without proper attribution), but it could also include a close paraphrase of their words, or a minimally adapted version of a computer program, a diagram, a graph, an illustration, etc taken from a variety of sources without proper acknowledgement. These could be lectures, printed material, the Internet or other electronic/AV sources.

Remember: no matter what pressure you may be under to complete an assignment, you should never succumb to the temptation to take a ‘short cut’ and use someone else’s material inappropriately. No amount of mitigating circumstances will get you off the hook, and if you persuade other students to let you copy their work, they risk being disciplined as well (see below).

Collusion

Collusion is any agreement to hide someone else’s individual input to collaborative work with the intention of securing a mark higher than either you or another student might deserve. Where proved, it will be subject to penalties similar to those for plagiarism. Similarly, it is also collusion to allow someone to copy your work when you know that they intend to submit it as though it were their own and that will lay both you and the other student open to a charge of academic malpractice.

On the other hand, collaboration is a perfectly legitimate academic activity in which students are required to work in groups as part of their programme of research or in the preparation of projects and similar assignments. If you are asked to carry out such group work and to collaborate in specified activities, it will always be made clear how your individual input to the joint work is to be assessed and graded. Sometimes, for example, all members of a team may receive the same mark for a joint piece of work, whereas on other occasions team members will receive individual marks that reflect their individual input. If it is not clear on what basis your work is to be assessed, to avoid any risk of unwitting collusion you should always ask for clarification before submitting any assignment.

Fabrication or Falsification of Results

For many students, a major part of their studies involves laboratory or other forms of practical work, and they often find themselves undertaking such activity without close academic supervision. If you are in this situation, you are expected to behave in a responsible manner, as in other aspects of
your academic life, and to show proper integrity in the reporting of results or other data. Hence you should ensure that you always document clearly and fully any research programme or survey that you undertake, whether working by yourself or as part of a group. Results or data that you or your group submit must be capable of verification, so that those assessing the work can follow the processes by which you obtained them. Under no circumstances should you seek to present results or data that were not properly obtained and documented as part of your practical learning experience. Otherwise, you lay yourself open to the charge of fabrication or falsification of results.

Finally

If you commit any form of academic malpractice, teaching staff will not be able to assess your individual abilities objectively or accurately. Any short-term gain you might have hoped to achieve will be cancelled out by the loss of proper feedback you might have received, and in the long run such behaviour is likely to damage your overall intellectual development, to say nothing of your self-esteem. The disciplinary consequences for you can be severe. You are the one who loses.

13.4 Complaints Procedure

The University has a formal Complaints Procedure. Copies of the procedure and form can be found on the University’s policies webpage38 under ‘Student Complaints Procedure’.

In essence, most complaints can be dealt with quickly and informally. Complaints should be made promptly, orally or in writing, to an appropriate member of staff, such as your Programme Director or tutor. If your complaint is of a general nature it might be best to mention it to your student representative so that he/she can raise it at the relevant school committee. If you are dissatisfied with the response, you should put the complaint in writing to the Head of School, or, if the complaint relates to actions taken by the Head of School, you should write to the Dean of the Faculty concerned. The Head/Dean concerned will investigate the matter and come back to you, normally within 10 working days. If, having pursued the matter informally, you are still dissatisfied you should refer the matter formally and in writing to the University’s Registrar and Secretary. You should consult the Complaints Procedure for advice on how a formal complaint should be carried out. If you need help using the procedure or guidance on where to refer your complaint, you can seek advice from any of the following: The Central Academic Advisory Service, the appropriate Faculty or School Secretary, the office of Student Support and Services, or the Students’ Union Advice Centre (Students’ Union, tel. 275 2930).

The Complaints Procedure does not cover the following:
1. disciplinary issues (for which a separate procedure exists)
2. matters where other separate procedures apply, e.g. harassment, academic appeals relating to examinations or assessments, appeals against exclusion on academic grounds, or against refusal to be issued with a Certificate of Satisfactory Work and Attendance, or Complaints about the Students’ Union.

Information on these separate procedures can be obtained from the University’s policies webpage.

14 Programme Learning Outcomes

Knowledge and Understanding

A Knowledge and Understanding of

- A1) advanced applications of computing in the medical area
- A2) leading-edge technologies in one or more of: Health Informatics, Medical Imaging, Medical data analysis, Computational Processing in Medicine
- A3) basic supporting knowledge in biomedicine

38http://www.manchester.ac.uk/policies

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Teaching/learning methods

Each advanced course unit utilises methods appropriate to the subject matter. Small group lectures, supervised laboratory work, mini-projects (group and individual) and independent preparatory learning are the main vehicles for dissemination of knowledge and understanding during the first half of the programme. During the second half of the programme students undertake a programme of supervised individual research, leading to a dissertation.

Assessment

Course Units are assessed by a mixture of written examinations, computer-based practical work, seminars and assessed essays and reports. The research project includes an oral presentation of the research, and examination of the dissertation by two internal examiners and an external examiner.

Skills and other attributes

B Intellectual (thinking) skills - able to

- B1) develop original ideas in a research context;
- B2) use methodologies for development of computational systems in a medical setting;
- B3) perform problem solving in healthcare and industrial environments;
- B4) develop mathematical models of data and its applications in healthcare

Teaching and learning methods

B1) is mainly demonstrated during the research project. The intellectual ability B2) is learned through small group teaching and practical lab exercises designed to put theoretical knowledge into practice. B3) and B4) are mainly demonstrated during the research project, mini-projects and problem-based learning in teams.

Assessment

B1) and B3) are developed and assessed during the research project through presentation of a seminar and examination of the dissertation. B3) and B4) are also assessed by reports from mini-projects (individual and group). B2) is assessed through laboratory exercises, either marked on-line or by written report.

C Practical skills - able to

- C1) develop applications to satisfy given requirements;
- C2) organise and pursue a scientific or industrial research project;
- C3) use, manipulate and create large computational systems;
- C4) perform independent information acquisition and management;
- C5) analyse medical data

Teaching and learning methods

C1) and C3) are demonstrated in practical lab exercises and mini-projects, as well as during the research project. The practical skill C4) is demonstrated in the preliminary preparation for each course unit while both C2) and C4) are demonstrated during the research project.

Assessment

C1) and C3) are assessed through laboratory exercises, either marked on-line or by written report. C2) and C4) are developed and assessed during the research project through presentation of a seminar and examination of the dissertation. In addition, C4) and C5) are assessed by a report or marked presentation in some course units.
D Transferable skills - able to

- D1) work effectively as a team member;
- D2) prepare and present seminars to a professional standard;
- D3) write theses and reports to a professional standard;
- D4) perform independent and efficient time management;

Teaching and learning methods

Team practical projects are used to demonstrate D1) in a number of course units. D2) is demonstrated during the research project seminar and also within a number of course units. D3) is demonstrated through lab practical and mini-project reports and the research project dissertation. D4) is demonstrated by the ability to meet a number of deadlines throughout the year, and to effectively carry out a research project on time.

Assessment

D1) is assessed through reports and marked presentations. D2) is assessed by two internal examiners during the research project seminar, who provide feedback on presentation skills. D3) is assessed by the research project dissertation which is examined by two internal examiners and an external examiner. D4) is assessed by course unit teachers and the exams office, who must ensure projects and dissertations are submitted on time. The research project internal examiners assess progress of the project at the project seminar.
A Why study Computer Science at the University of Manchester?

We believe that the University of Manchester is the ideal institution for a Masters degree in Computer Science. This is exemplified by:

One of the best Schools of Computer Science in the UK. The School of Computer Science is a leading research department with world-class research groups across a broad range of Computer Science. It was awarded a 5* rating, the highest grade, in the Research Assessment Exercise of 2001.

A very wide spectrum of research activities. The research extends from engineering research including novel and distributed architectures, new technologies for processors and storage; through system development and design methodologies, to formal and mathematical methods. The School has a large artificial intelligence group; it also has large research groups in advanced databases, in computer-aided design, in virtual reality systems and in mobile computing. As well as computer science research, there are many interdisciplinary research activities, including medical informatics (jointly with the Medical School and local hospitals), bioinformatics (jointly with the School of Biological Science), business and industrial applications (jointly with the Manchester Federal School of Management), imaging science (jointly with the Manchester Visualization Centre and the Imaging Science and Biomedical Engineering Department (ISBE)). This is but a selection of the wide range of our research and teaching activities.

Strong Industrial links. These include an industrial liaison and teaching unit (PEVE), an industrial exploitation centre (Manchester Informatics), a University Enterprise Centre, and strong links between the staff and external companies.

Excellent computing facilities. There is a large network of modern PCs and workstations. There are excellent facilities used by students during their research projects including:

- The largest Supercomputing Centre in Europe with many massively parallel machines and a supermassive storage facility. The Computer Services for Academic Research (CSAR) service provides high performance computing facilities to scientists and engineers from the academic community across the UK. The service is based on the Silicon Graphics Cray T3E-1200E, SGI Origin 2000 and Fujitsu VPP300 systems.
- The Manchester Visualization Centre with an Immersive Environment Theatre.
- A range of Virtual Reality Laboratories.
- A Robotics Centre with a range of mobile robots and facilities for creating and programming them.
- The Manchester Centre for Mesoscience and Nanotechnology with extensive cleanroom facilities.

39http://www.cs.manchester.ac.uk/Research_subweb
40http://www.cs.man.ac.uk/peve
41http://www.ManchesterInformatics.co.uk/
42http://www.cs.manchester.ac.uk/
43http://www.swe.man.ac.uk/nve/
44http://alg.cs.man.ac.uk/
45http://www.cs.man.ac.uk/robotics
46http://www.cs.manchester.ac.uk/nanotechnology
A large and thriving Postgraduate School. In the Postgraduate School, students take both research degrees and taught masters programmes across a wide range of computer science.

A wide range of taught Masters programmes. These include the MSc in Advanced Computer Science, Masters in Advanced Computer Science with ICT Management, Masters in Computational Science, Industrial Masters, Masters in Enterprise in Computer Science, Masters in Computational Methods and Imaging in Medicine, and Masters in Electronic Systems Integration.

All Masters course units are individually designed and not shared with the undergraduate programme.

Excellent rating by external examiners. External examiners have rated these Masters programmes highly. In December 2000 an external examiner stated: ‘Overall, coursework and dissertations are of a high standard. In particular, the dissertations tend to demonstrate the high quality of the MSc course.’

A high quality learning environment. The quality of teaching was rated as “excellent” under the most recent government review. We try to provide a supportive environment, and we care about student welfare. The School offers a Student Advice Service which is a drop-in centre available at lunchtimes for students to discuss any issues in their study or lives.

A long and distinguished history. The University of Manchester was one of the forerunners in the development of computing, with the first stored program machine being built here in 1948.

Since that time, there has always been high quality innovative research in computing at Manchester. The School developed out of these activities and was one of the earliest departments of computer science to be founded.
B The Division of Imaging Science and Biomedical Engineering

Imaging Science and Biomedical Engineering (ISBE) is a Division in the Faculty of Medicine, Nursing, Dentistry and Pharmacy. It maintains strong academic links with Computer Science and both academic and clinical links with the radiology schools in the University teaching hospitals. The academic staff currently comprises four Professors, 5.5 Senior Lecturers (including a joint appointment with Anaesthesia) and 5 Lecturers, supported by technical, secretarial and administrative, radiographic and nursing staff. There is also a full-time Research Fellow in MR Physics.

There are extensive facilities for imaging and image analysis research. A high speed (ATM) network links 22 Sun workstations and 12 high specification PCs to a RAID server and optical disk juke-box, providing access to high-performance computing and a massive image store from 34 'seats'. The network is linked to the new MR imaging suite (see below) and via that to the hospital Radiology School. Facilities for high-resolution film digitisation, high-quality image reproduction, and video editing are also available. The Unit has an extensive library of in-house and third party software, providing a state-of-the-art software development environment. It is also involved in a major international software standardisation initiative, acting (with EPSRC funding) as the UK hub for supporting and developing the Image Understanding Environment a sophisticated object-oriented framework for creating image understanding systems.

There are currently 2 clinical diagnostic suites, centered on magnetic resonance imaging and bone densitometry. Patient facilities, medical staff offices and clinical radiological conference rooms are situated within ISBE in the Medical School. A Neuroradiology group was established in 1993 and strengthened by the appointment in October 1993 of Professor Alan Jackson, to a chair in Neuroradiology. The activities of the group have expanded rapidly with currently 12 clinical staff, research associates, and students undertaking neuroradiological research projects.

B.1 Imaging at Manchester University

Image Analysis has been recognised as one of the main research strengths within the Faculty and represents one of the main research thrusts of ISBE. In 1995, the University identified biomedical imaging as a strategic priority and made the decision to invest significantly in the area. There were three complementary strands to the strategy: to establish state-of-the-art imaging facilities, to make new appointments strengthening the academic base in imaging science, and to focus the imaging needs of clinical and bioscience researchers through clinically oriented Research Institutes. Most of the elements of this strategy are now in place. We have created a new MR Imaging Unit, dedicated to research, and in partnership with other institutions created a Greater Manchester PET Centre at the end of 1998. The PET centre will be operational in August 1999 and will be equipped with a state-of-the-art GE Advance PET scanner. We have also been funded by MRC, under the JREI initiative, to create a biomedical image analysis laboratory with staffing for 3 years. We have appointed two new Professors of Neuroradiology (Prof. Alan Jackson) and of Imaging Science (Prof. Steve Williams) and a Lecturer in Neuroimaging and Image Analysis, and will shortly appoint a Lecturer/Senior Lecturer in Imaging Science. University Institutes of Neuroscience and Cancer Studies have been created and have contributed actively to developing a detailed imaging strategy, based on the University's existing strengths in clinical medicine and bioscience research.

B.2 Facilities

The MR Imaging Unit, located in the Medical School, is equipped with a 1.5 Tesla Philips ACS NT scanner with high-performance gradient systems (currently 17 mT/m with a rise-time of 200 ms, shortly to be upgraded to 22 mT/m with a 100 ms rise-time), providing single-shot echo-planar imaging capability. The system is linked by optic fibre network to an existing Philips scanner in the adjacent Manchester Royal Infirmary, which will be upgraded to the same gradient specification as the new scanner. The combination of 2 state-of-the-art scanners will give research access to systems on both academic and clinical sites. Philips Medical Systems have entered into a research agreement and provide a high level of manufacturer support for both research and development. The scanner
undertakes 1-2 days of clinical work each week with the remainder available for research projects. There is also a 4.7 Tesla horizontal 15 cm bore instrument, which will be upgraded as part of the appointment of the new Professor in Imaging Science, with a state-of-the-art imaging/spectroscopy console and high performance actively shielded gradients.

Imaging Science and Biomedical Engineering houses one of the leading computer vision image analysis research laboratories in the UK (the Wolfson Image Analysis Unit), which has not, in the past, been able to support routine state-of-the-art analysis of medical images. To do so requires a dedicated facility with appropriate support staff. We have recently been awarded funding from MRC, under the Joint Research Equipment Initiative, to establish such a facility. The main locus will be in the Medical School, immediately adjacent to ISBE, with an outpost in the PET Centre at the Christie Hospital, linked by optical fibre. The facility will comprise approximately 10 'seats'; and a massive image store, linked to the existing Wolfson Unit network. Funding for a full-time post-doctoral scientist to develop the facility and support users is guaranteed for the next three years. The aim is not only to ensure that all relevant commercial and public domain image analysis software is available to users, but also to exploit the potential of the leading-edge computer vision and image analysis research taking place in the Wolfson Unit.