

Postgraduate MSc Project Guidelines 2014-2015

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Contents

Chapter 1

MSc Projects

1.1 Why do you do an individual project?

The British Computer Society guidelines for course accreditation state that MSc projects should reflect the ethos of advanced study and scholarship appropriate to a masters degree. In particular, projects are an opportunity for you to demonstrate

- a systematic understanding of knowledge, and a critical awareness of current problems and new insights at the forefront of your academic discipline;
- a comprehensive understanding of techniques applicable to your own research or advanced scholarship;
- originality in the application of knowledge, together with a practical understanding of how established techniques of research and enquiry are used to create and interpret knowledge in your chosen discipline;
- an ability to deal with complex issues both systematically and creatively, make sound judgements in the absence of complete data, and communicate your conclusions clearly to specialist and non-specialist audiences;
- self-direction and originality in tackling problems, and a level of autonomy in planning and implementing tasks at a professional or equivalent level;
- critical self-evaluation of the project process.

These core requirements are structured to provide you with exactly the skills that future employers expect of people with an MSc. This is true regardless of whether you go on to work for a computing-related employer, in other sectors of industry or commerce, or if you continue in academia toward a PhD.

We want our students to go out and impress future employers. In an interview we want you to be able to not only discuss your thesis but to confidently explain *why* the work has value and to answer questions that challenge the relevance of your work in a wider context. This is what employers tell us they find so attractive about Bristol graduates; the fact that they can answer such questions with passion and confidence. We have therefore designed our MSc project process to enable you to gain the necessary experience, knowledge and confidence to excel.

1.2 Why do you write an MSc thesis?

The final mark for your Individual Project is primarily based upon a written thesis that you are required to submit at the end of your course. Even if your project involved a significant amount of software, hardware, theory, or experiment, your mark will be mainly derived from the written evidence documented in your thesis. Placing the emphasis on your thesis has several advantages:

- it tests your ability to document and disseminate ideas, motivate your project and meet all your objectives;
- it treats all students – regardless of project type – on an equal basis;
- your thesis will represent your work on leaving the University (employers might not ask to see your code but may well want to read your thesis).

This does not mean your thesis should not discuss any implementation details or that we will not take into consideration any software or hardware developed for the project. Indeed you are strongly encouraged to discuss and document the design processes behind your work. But it does mean we will be marking the thought processes behind any software or hardware that you build and your understanding of what that system enables you to do in relation to previous work.

1.3 How is project work taught and assessed?

Undertaking your project and writing your thesis is likely to be the most challenging experience you will have at university; and it will involve a range of skills substantially different from those required to do well in regular taught units work. To help you get the very most out of the experience, we divide the project process into two distinct units which allow us to more easily teach and assess these skills and provide you with the most useful and timely feedback.

The two project units may be summarised as follows:

- **Research Skills unit** (20 Credit Points, 200 hours, in the 2nd semester):
This contains the taught components of the project and will give you guidance on how to conduct research, plan your project, and write scientific reports. You will submit several pieces of coursework including a substantial report called Research Review on which you will receive constructive feedback before commencing the technical work of the project itself. This unit represents about a quarter of the time you will spend on your project.
- **Individual Project unit** (60 Credit Points, 600 hours, over summer):
This is where you carry out and write up the work you have proposed in the Research Skills unit. You will undertake your project work, present a poster, and submit an MSc thesis. Although you can start your project at any time toward the latter part of the programme, you will usually begin as soon as your summer exams finish and then work on your project *full time* until the end of September.

The Research Skills unit runs in the 2nd semester, before your exams. The Individual Project unit runs over summer, after your exams. Formally, progression to the Individual Project is dependent upon successful completion of the taught part of your degree; but you are expected to start your project while this decision is being made.

1.4 What is expected of you?

Here is an ABC check list of the type of things we will be assessing. You are expected to have demonstrated an ability to perform the following core skills:

A) Work independently on a Computer Science related project for which you have defined the objectives and rationale

In other words you are being asked to

- **Work autonomously.** Your work will be self-motivated and will progress towards a self-contained deliverable that you have defined yourself. Although you will meet regularly with your supervisor, his or her main role is to provide you with constructive feedback (and possibly some inspiration) on ideas and work that originate largely from you. You need to take responsibility and ownership of the project. While we strongly encourage

you to discuss your work and its context with as many people as possible, *in all cases reports must be based on your own work, be written in your own words, and present your own ideas about your chosen topic.*

- **Work on a project related to your chosen MSc specialty.** Advanced students will receive an MSc in a specific subject and future employers will expect that the subject of your MSc project is related to your degree title or theme. Of course, your work may be influenced by or reference other areas of Computer Science (or indeed other academic areas such as the physical or biological sciences). Your project should build upon what you have learnt in your degree, but *you are expected to go beyond the taught components of your course and demonstrate your own original thoughts and contribution.*
- **Have defined objectives and rationale.** A project must be a well defined unit of work. You must define what the goals of your project are, and what it achieves. More importantly you need to explain why these goals and achievements are worthy and important. In other words *it is not just enough to explain **what** you have done, you also need to describe **why**.*
- **Work to strict deadlines.** Efficient time management is a skill that all employers will be looking for. Moreover, in order for the MSc project cycle to run smoothly, the effective coordination of nearly all staff and students is required. For this reason *everyone involved must adhere to project-related deadlines which are strictly non-negotiable.*

B) Apply knowledge about an area to a specific problem, which may be engineering, analytical, academic or applied in nature

You are being asked to absorb information (from course materials, resources, experiences and the literature) and then **do something with it** by applying it to a particular research problem. In other words you are being asked to **add value** to the prior information you have gleaned. There are many ways you can add value:

- by conducting experiments which have not been done before;
- by implementing something which has not been done before;
- by designing a novel architecture to solve a problem;
- by applying theory to a practical environment;
- by developing new theory;
- by analytically comparing different approaches to solving a problem;

- by conducting a detailed critique of a particular technique or technology;
- by assessing standardization work;
- by producing a comprehensive overview of a new area for which no such literature exists.

The above list is not intended to be exhaustive – good projects add value in many different ways. But your thesis should demonstrate clearly in which way you have added value to existing work in the area.

C) Produce a well-structured report, including introduction, motivation, analysis, and appropriate references to existing work

We are not directly marking how many hours you put in, or how much stress you put yourself under. In the long run all we mark (and all that any future employer will likely see) is your thesis. The final mark will be a combination of both the content of your thesis, and your ability to write a thesis.

You will be given guidance and training in writing a thesis, and indeed one quarter of the way through the project you will write a Research Review and receive feedback. Your thesis and Research Review must exhibit the following traits:

- **Be well structured** – it needs to be organised in a logical way that is chosen to effectively communicate the information you wish to convey. To some extent, this will depend on the details of your particular project.
- **Be driven by a clear and well-defined motivation**
- **Contain analysis.** Whatever you do you must include a critical analysis of the subject. You should demonstrate how the topics in the report relate to one another.
- **Adopt appropriate techniques and technology.** Whatever you do must be done with the most appropriate methodology. Applying numerical experiments in an area where theoretical models are more appropriate may reduce your marks, and vice-versa.
- **Contain relevant references to existing works.** You must demonstrate that you understand how your project fits into the wider context of the subject area.
- **Be creative** – we adopt Sir Ken Robinson’s definition of creativity as “*The process of having original ideas that have value.*”

Students should take note of the fact that their MSc thesis is a public document which bears the University's name. All publications endorsed by the University must be of an appropriate standard. To allow sub-standard work to be published would stain the reputation of the University and cannot be permitted. Therefore you will only pass your project and receive your degree if your thesis meets the minimum requirements.

1.5 What is expected of us?

All members of the academic staff are expected to participate in the supervision and marking of MSc projects. Staff make considerable efforts to ensure students are given useful feedback throughout the project cycle. This feedback is designed to flag up potential problems that might lead to the failure of a project further down the line and to point out areas that could be improved to achieve a higher mark. Both the Research Skills and Individual Project units are designed to give guidance to students all the way from initial project planning right through to submission of the final thesis. In this way we aim to make the project experience as effective and rewarding for students and staff as possible.

To ensure the quality, transparency, and efficiency of our MSc project processes we follow strict guidelines based upon the activity of various marking panels, examination boards, and external assessors which meet at predetermined times (often just once or twice a year). Due to the large number of people involved, the success of this process requires that all project related deadlines stated in these guidelines must be strictly respected. Staff are advised to warn students that project submission deadlines cannot normally be extended. Even in cases of serious mitigating circumstances (as formally determined by a relevant committee) no decision can be reached regarding late projects until the next panel meeting or examination board, which may be up to half a year later.

The project cycle begins just before Christmas with all staff proposing a list of about 5 topics they would be keen to supervise. Each of these topics is just an outline idea which an interested student could develop into a viable project proposal to be supervised by that member of staff. The resulting proposals (developed by the student with the help of the supervisor) will form part of the coursework on the Research Skills unit and will be assessed. Feedback from the proposal will be used (again by the student but with the help of the supervisor) to prepare a more detailed document, the Research Review, which will be marked by at least two members of staff.

Supervisors and students should meet to discuss the feedback from the research review and revise the project plan accordingly. Subsequently, supervisors and students should continue meet over summer to discuss the progress of project

and the write up of the MSc thesis. All MSc theses will also be marked by at least two members of staff. In addition, all theses will be individually discussed and collectively ranked by at least one marking panel consisting of about one quarter of the academic staff. Before they can be released, all project marks must be approved by an examination board consisting of all academic staff.

1.6 Where to seek further guidance

Further details and related information can be found on the relevant unit pages: which are COMSM2202 (for Research Skills), COMSM3100 (for Advanced MSc Projects) and COMSM3201 (for Conversion MSc Projects). If you are in any way confused by the information in this document or the associated unit pages you should first consult your Project Supervisor. If this turns out to be unfruitful, or you do not yet have a project supervisor, then you should consult the Unit Director for MSc Projects (Oliver Ray). For all issues related to Research Skills, please contact the Director of that unit (Kirsten Cater). Administrative issues can be addressed to the Graduate School Office (MVB 2.19). If you are still confused you should contact your Programme Directors (Oliver Ray or Simon Hollis), your Senior Tutor (Steve Gregory) or the Head of Department (Andrew Calway).

Chapter 2

Selecting a Topic

The diverse nature of Computer Science allows for many different styles of project. Our Department treats all such styles as mixtures of just three basic types. These types and some common styles which combine them in different ways are outlined below (and will be further explained in one of the Research Skills lectures).

2.1 Three basic types of project

All MSc projects are required to make some sort of novel contribution to the area of Computer Science. The three basic types of project correspond to three broad ways in which a project can add value.

- **Type I:** Software or hardware development. These are projects which build something *new*, utilizing some *concepts* from Computer Science. The key words are *new* and *concepts*; developing something which has already been done, or which is relatively trivial using standard applications will not allow you to get an MSc. The added value in these projects will mainly come from the design and evaluation work needed.
- **Type II:** Investigatory. In these projects you are asked to work on some research problem, possibly coming up with new results or new techniques. Usually the research problem is motivated by some real world issue. Sometimes such projects involve practical experimental analysis (via programs), sometimes they are more about designing or investigating a solution (via pen-and-paper). The added value in these projects will come from the analysis work you need to do in both in defining the requirements, developing solutions and evaluating your solution.
- **Type III:** Theoretical. These projects are mainly about developing models or theories which explain some concept or idea in Computer Science. Such

projects are harder to validate, in the sense of showing success criteria for your work, since theories take many decades to establish and validate. Often such theses are more mathematical in nature than others. The added value in these types of projects will come from the mathematical, logical, or other, analysis you provide in your thesis, which is over and above that found in the existing literature.

2.2 Some common styles of project

Many MSc projects fit neatly into one of the above categories, but some may involve a combination of any two or all three. The following list illustrates some of the common styles of project that we find in the Department (but is in no way exhaustive). When you specify your project, we will ask you to estimate what percentage of each type it is likely to involve.

Empirical Science

Much of Computer Science is about developing new algorithms for problems, or applying existing algorithms in novel situations. As such it very much resembles standard empirical science in that one can test whether Method A is better than Method B, by collecting data and analysing the performance. In Computer Science such projects would normally involve programming, or possibly hardware development work. Hence such projects are often *Type II* projects, in that they are essentially investigatory in nature, but they involve a component of *Type I* projects, i.e. they usually require a reasonable amount of implementation.

Note: your final mark is primarily determined by the contents of the thesis and not your code. So it is important in such projects that you do not treat the code itself as the end-product, you should consider what the system allows you to do, and how that may be demonstrated and evaluated. These are the most common type of project in our Department.

Engineering

Many computer systems are inherently complex. Suppose you want to solve a real-world problem, to do so you may need to glue various high level technologies together in a thought experiment. Example projects could be to design a banking payment system for adoption in Africa, where the computing system of choice is a 2G mobile phone (access to conventional PC networks or modern 3G services are limited). Alternatively you may want to compare existing solutions

in a particular domain – for example different on-line banking interfaces. These are all subjective and qualitative comparisons where there may be no correct solution. Such projects we refer to as *Type II* projects, but unlike empirical science style projects they are unlikely to involve significant development work. As such evaluation is a key problem, and should be well thought-out at the planning stage. Engineering a system typically leads to the discovery of challenges that would not have been obvious without actually going through the engineering process. The process, however, is very different from the empirical process in the scientific method: in the scientific method, one must have a clearly identified problem with a potential solution that can be objectively evaluated. In engineering one encounters problems only in the process, and mostly these problems are highly contextual and subjective. Several solutions are optimal depending again on the context (showing that a solution does not work is only partially helpful – typically you want to present a complete solution). As such, Engineering style projects are harder to define as to what constitutes a correct solution, indeed one may not exist. It is often impossible to even produce a prototype for demonstration, as the architecture is too complex. However, a good thesis will argue why the proposed solution satisfies the requirements.

Theory and Algorithms

There are at least two types of project which fall into this category. In the first you would focus on developing or studying models. These models take the form of definitions or theories which you could investigate for a new area, or an area in which the definitions and existing theories are currently underdeveloped. Those interested in cryptography may, for example, consider the types of definitions for encryption and signature scheme met in your course. Having done this, an in depth analysis of their consequences when applied to algorithms, protocols or systems may be suitable. In such a project you need to argue why the definitions you use make sense and why your theories fit the area you are trying to model. In the second type of project you would work on analysing or developing novel algorithms with better provable performance than is currently known. This could involve simply presenting an algorithm with a better space or time complexity or alternatively investigating existing algorithms where certain aspects, be they empirical or theoretical, are not yet clear. A well engineered implementation of a state of the art algorithm whose performance in practice is not yet known is also a legitimate project that would straddle several areas of interest.

Product Development

Suppose you have an idea for a **new** product or service which involves some **significant** Computer Science component which can differentiate it from competitors, then this would be a valid project. At first sight this just looks like an implementation project, but the real innovation and added value is in the fact it is a new product with a significant Computer Science innovation. Hence these are the main example of a *Type I* project. New products can be designed by combining technologies in new ways, so you don't need to create completely new Computer Science research. You just need to combine things in a novel way. Again, *new* is the key word, but if the elements you combine are sufficiently deep and complex then your mark will also be better (and your product more innovative). Combining a web server and a database is not new, and it combines known standard technologies. You should not think that such a project will allow you to opt out of demonstrating scientific understanding – indeed complex concepts and recent academic publications in the area become more important in this context.

Computing and Society

A major barrier to technological deployment normally comes from business, societal or human factors. To investigate how technology impacts on society and the marketplace and to develop new understandings is a very complex task. Such projects owe more to techniques in the social sciences than the physical sciences. Indeed these topics are close to what product and systems analysts may do in companies. These are examples of *Type II* projects. Such projects are often difficult to complete successfully as they often require access to data, people or skills which are not easily available. Such projects are usually only worth considering if there is a strong industrial partner to provide data and to guide you.

Review and Survey

In many areas, especially new research areas, many publications exist with no order. A valid contribution is therefore to bring order to chaos and present a coherent literature review of the area. Such projects often lead to PhD research, or assist future MSc students by forming a basis. As such these are projects of the *Type III* variant, but in areas in which the Computer Science is not yet advanced enough to enable students to make a theoretical contribution of their own. Such projects can be (incorrectly) thought of as simply reading papers and summarising them. However, they are not to be considered a soft option. To excel at such projects you need to fully understand complicated technical literature and then distil this literature down in a way which brings new insight to a problem or area.

In some sense these projects are akin to an extended Research Review – but at a much deeper level. Such projects inherently carry a risk – you may be tempted to simply produce a summary as opposed to introducing some new intellectual content, analysis and critical review. On the other hand when done correctly such projects can achieve very high marks and produce thesis of long standing value to the community with high impact. It is not uncommon for such a thesis to receive a large number of citations when it is placed on-line; as others around the world make use of the synthesis of a specific topic completed by a student. Producing a summary may involve re-casting existing works into a coherent form, comparing published results, discussing and exploring inconsistencies, spotting trends, and so on.

2.3 Advice on choosing a topic

Before embarking upon the time-consuming technical work of your project, a great deal of planning is needed to ensure you have a viable proposal. Experience shows that the success of your project depends as much on this preparation as it does on the work itself. It is absolutely vital that you do not attempt to solve a problem that is too difficult (as you will fail to meet your objectives) or is too easy (as you will fail to make a sufficient contribution). Your supervisor will use their experience to help you specify a project at the right level of difficulty. This means there should be sufficient opportunities for a strong student to achieve a very high mark but there should also be sufficient safeguards for a weak student to at least attain a bare pass.

To maximise the chances of success, we split the process of specifying your project into several stages and give you advice, guidance, and feedback along the way. The first stage is to pick a topic or idea about which you and your supervisor believe can be turned into a viable project proposal that you can carry out. To make this easier, we ask staff to pre-compile a short list of topics they would like to supervise. The next stage is to refine the initial topic or idea into a more detailed project proposal. You will do this as part of your coursework for the Research Skills unit (where you will receive further guidance about this process). By the end of the Research Skills unit, you will have submitted a Research Review and a Workplan. These will be assessed by two members of staff who will provide you with feedback on your proposal. If your plan is deemed viable (and you pass your taught courses) you will then be allowed to proceed with the project work.

When choosing a project it is important to bear in mind that you will be primarily marked on the Computer Science component of your work. Any commercial motivations and/or anticipated contributions to other disciplines will only gain you marks if they are clearly grounded in some relevant aspect of Computer Science.

When selecting an initial topic or idea, it may help to consider the following:

- You should pick a topic which interests **you**. This is by far the best way to ensure you stay motivated throughout the project. Asking yourself which topics you found of most interest in the taught component of the course so far, or in your previous degree, is often a good place to start.
- Where possible you should make best use of your existing knowledge and experience as a starting point. This way you play to your strengths and avoid steep learning curves of grasping new programming languages or technology.
- Beyond an academic qualification, your MSc is designed to provide you with the best opportunity to advance toward your chosen career path. Your target profession, sector or academic institution may play a role in your project selection.
- As a Department we have close links with industrial partners and we encourage collaborative projects. For some projects an external supervisor may well play a key role BUT an internal academic must act as the primary supervisor.
- You should select a relevant topic of timely interest. This does not prevent you from re-investigating older concepts, but you should re-target them for utility in contemporary Computer Science.
- You should try and work with a supervisor that you respect and can get along with on a personal level.

When thinking of a project you might also consider the following questions:

- Why should **you** do it – rather than someone else? What specific skills or experience do you have that complement the task?
- Why is this topic of interest to the Computer Science community? After all this is an MSc in a Computer Science department.
- How might your project benefit academia beyond Computer Science? Perhaps there is an application of your project that could aid research in another subject?
- Is there potential for your project to impact wider society beyond academia?

It is important to understand that, during the course of a project, we do expect some natural deviation from the original proposal. Indeed if you could plan a project in perfect detail at the outset then there would be little need to do the project at all. At the outset we only ask you to select an outline topic which will need a great deal of further refinement and fleshing out in the Research Review. But this can only be done in conjunction with a deeper reading of the relevant literature. Further modifications to the Workplan will most likely be required as the actual work progresses. At that stage, however, we would expect any deviations to be relatively minor and require that any significant departures only be attempted after being discussed with your supervisor.

Note: due to the generalist nature of the conversion MSc, we normally expect MS50 students to do projects with a significant amount of software development. Any MS50 students who are interested in selecting a project which is less than 70% Type-I must seek approval from the MS50 Course Director.

2.4 The selection process

By the end of the second week of the second semester (week 14) you will need to have been allocated a topic and project supervisor. Further details will be given as part of the Research Skills unit, whose first few lectures will explain this process in more detail. In our Department, the process is supported by an online system in SAFE which

- helps students to find and register their interest in suitable project ideas,
- helps staff to see interested students, arrange interviews, and allocate students to projects,
- helps the Department maintain the quality of supervision by balancing staff loads.

In brief, staff are asked to propose a list of topics in their area of expertise that a student could develop into an MSc project. Students are then asked to look at this list and meet potential supervisors to discuss the proposals in more detail. Staff will then allocate projects to the most suitable students on the basis of these face-to-face interviews.

1. During the January exams academic staff will upload an initial set of project proposals into the project system. In some projects the main contact may be a Research Associate (RA) or doctoral student (PhD) but there will always be an academic member of staff acting as mentor for the supervision.

Ideally, research groups will meet to brainstorm and propose ideas for the coming session.

2. Each proposal will have a title and an abstract which specifies the nature of the work and includes any prerequisites or supervisor expectations. Project descriptions will clearly indicate the Type of project (Section ??) and the relevant area to which the work relates. Some staff may propose projects at this stage with the intention of allowing students to adapt them to their own particular interests. In addition, some projects of a more general nature (not directly related to a specific research group) may also be included for which any staff member could be a supervisor.
3. The list of proposals will be made available to MSc students so they may begin considering their choice of project.
4. After their exams, students should arrange to meet the supervisors of any projects that interest them in order to try and secure the project or tailor it in some way that better suits them. Some students may even want to propose a brand new idea of their own. Please not that students will only be assigned a particular topic if the relevant member of staff actively agrees to supervise them. Therefore, it is essential that you arrange to meet appropriate staff members to discuss project ideas in more detail and explain to them why you think you will do a good job.
5. In week 13 we will begin a formal process whereby any unallocated students will need to shortlist between 3 and 5 projects, using the online system, and staff will be asked to allocate shortlisted projects (providing they have not already taken on too many projects).
6. This process may be repeated until, by the end of week 14, all students will have persuaded a supervisor to accept them on a project and to have entered this selection into the online system.

We will aim to avoid significant load imbalances that could affect quality of supervision. Therefore you should approach your preferred supervisors as early as possible. You should also bear in mind there may be strong competition for popular project topics and supervisors are more likely to select students they think are well suited to the project and with whom they are likely to get along with on a personal level.

2.5 Proposing your own idea

We expect the vast majority of project ideas will be selected straight from the list provided by staff. A few will most likely be derived from the list of ideas proposed by staff but refined to meet the specific needs of a particular student. In some cases we allow students to propose their own project idea by finding a member of staff who is willing to champion their idea and supervise the resulting project.

All proposals must be entered into the system by a member of staff. This is because staff have the experience and knowledge to identify topics with the potential to lead to successful MSc projects. Even though all project ideas (whether originally proposed by staff or students) will have to be developed (by the student) in much more detail during the Research Skills unit, staff approval is required at the outset to ensure a viable project can be developed.

- If you have an idea of your own then you need to find a member of staff with similar interests who is prepared to champion that idea for you.
- If that member of staff agrees, he or she will have to enter a new proposal into the system on your behalf or adapt an existing one to suit your own requirements.
- Due to the extra work involved in proposing your own project topic, you are advised to discuss your idea with potential supervisors as early as possible.

2.6 Industrial Collaborations

We allow and even encourage projects to be carried out in conjunction with industrial collaborators. This can look very good on your CV, can help give the project a strong motivation, and can help build links with employers. But careful consideration must be given the risks and restrictions imposed by a partner. For this reason a partner can be designated as an external supervisor, but the main supervisor for your project must ALWAYS be a member of staff.

If you have partner in mind you must find a member of staff to champion your idea and enter it into the system. Tension can often develop at the end of a collaborative project when you need to spend time writing up, for example, but the partner prefer to have more features added to a prototype. Also are there restrictions on the hardware, software, or data when it comes to demonstrating your project to the markers?

The bottom line is you need to be absolutely clear what the collaborator is providing and what they are expecting. You need to risk manage to the extent that you can still pass your project if the company goes bankrupt!

Chapter 3

The Research Skills unit

This unit runs during the Spring semester, prior to the actual project. It is designed to introduce the fundamental skills that you will need to embark on your project. In order to identify and understand prior work, a key phase in any project is background research. The most important outcome of this unit will involve the creation of a comprehensive literature review. The reading and background research you conduct during this time will form the basis of your thesis by establishing a project history and placing your work in context of previous research and methodologies. This process, of reading, distillation and writing will help you to formulate and understand the aims and objectives of your project in more depth than the initial project proposal created by your supervisor – **before** you embark on the *real* scientific research in the summer.

The unit assumes that you have chosen a project topic and supervisor by *Week 14*, since the project topic will guide your background study and submitted work. During the Spring semester you will need to spend roughly 200 hours of study on the unit, representing a third of your total workload throughout the semester. During most of this time you will work independently, finding and reading relevant literature and writing your Research Review and project plan. In addition you will spend about 10% of the allotted time to liaise regularly with your project supervisor and attend about 10 hours of lectures. These lectures will help you to

- understand basic project styles and methods, and find a project suitable for you;
- prepare a project synopsis;
- find research literature relevant to your project;
- read and summarise relevant research papers;
- improve your technical writing skills;

- choose the right evaluation method for your research results; and
- prepare a realistic and convincing Workplan for your Summer project.

The remainder of this chapter is intended to provide a brief introduction and overview of the Research Skills unit. Further details (regarding submission deadlines, weights and specific requirements for each piece of work, etc.) will be made available on the unit's homepage.

3.1 Submitted work

During the course of the Research Skills unit you need to submit **four** pieces of work, the marks of which will together determine your overall mark for the unit.

The Synopsis

The first deliverable is a project synopsis which is written in your own words and states the project's aim and objectives, expected outcomes, and added value.

The Literature List

The second piece of work is a list of about ten research papers you plan to include in your Research Review, each with a very short summary pointing out the relationship to your project.

The Research Review

The Research Review's main purpose is to give a comprehensive literature review centred around your project, and to explain how the reviewed literature relates to your own project. The material in the Research Review may be re-used as part of your final dissertation, and this should be borne in mind when creating it. The Research Review will also require you to consider the contributions and evaluation of your proposed work.

The literature review must be extensive (at least twenty pages) and of a suitable quality of source material. You need to concentrate on primary sources rather than secondary ones such as Wikipedia (this will be further discussed in the lectures). With each reference you cite you need to argue in the review as to why it is relevant to your project. Thus a general overview of a subject is not sufficient to obtain high marks, it needs to be focused. The literature review should read as a survey paper; effectively it should be a stand-alone piece of work which could be given to another student to learn about your specific topic.

The Workplan

The Workplan should include the following sections:

a one-page executive summary that describes what your final thesis will be about.

This should introduce your chosen Individual Project in your own words (NOT a reiteration of the original project proposal). It should also state in general terms whether your project is more of Type I, II or III and it should state which methodology you will adopt, explaining whether the project will involve significant amounts of programming, theoretical discussion, product engineering or experiments. Finally it should explain the main novelty and added value.

the expected timeline for your project, broken up into tasks, milestones and deliverables, indicating the relationship between the main tasks you will tackle and an estimation of how long they will take.

a risk analysis and contingency plan analysing how you would deal with unexpected situations that might affect the success of your project.

the success criteria for your project, i.e. what you think would constitute a thesis worthy of a distinction in your chosen area.

If applicable, include an appendix describing any significant progress you have made on your Individual Project. For example, while you may not have started any real implementation you might detail design decisions that have resulted from your research such as which technology or programming environment you have selected and why.

3.2 Supervision

You should see your supervisor at regular intervals, usually at least once per fortnight. Some supervisors meet with all their students at once, some meet with their students on an individual basis. If you cannot find a time to meet your supervisor then please contact the Unit Director. Experience shows that the amount of interaction between student and supervisor has a strong positive correlation with the ultimate project mark. As previously stated supervision is a two-way process – your supervisor is not expected to chase you if you regularly miss arranged sessions. You need to take the initiative.

3.3 Marking

Your Research Review and Workplan will be read in detail by at least two staff members. At least one of these will have some familiarity with your subject area, but they will **not be your supervisor**. The other marker is highly likely to come from a different research area, so your report needs to be understandable to a non-specialist – although they will be an academic Computer Scientist. Your Research Review and Workplan will be marked as to whether it satisfies the following criteria:

- You should demonstrate that you understand the aims and objectives of your Individual Project.
- You should show an ability to research and collate information.
- You should show an ability to digest and critique existing literature.
- You should clearly explain where or why your Individual Project will add value.
- You should demonstrate an ability to structure and write a comprehensive scientific report.

Markers will take into account the different success criteria implied by the different project types.

3.4 Concluding remarks

The Research Skills unit is like any other unit. You should pay the same respect to attendance at lectures, deadlines and plagiarism as you would for any other unit. Failing the unit does not necessarily mean that you cannot progress to the project. If this is your only unit failure you may be eligible for a compensated pass to proceed and you will not need to resubmit the Research Review a second time. If for ANY reason you have to resit other units and fail the Research Skills unit you will not be allowed to proceed to project and WILL have to resubmit a new version of your Research Review by 1st September. Information about resubmissions and your progress on the MSc as a whole will not be available until all exam boards have been completed.

Chapter 4

The Individual Project unit

After the summer exams you will be given feedback on your Research Review. Assuming you have passed the taught component of your degree (including the Research Skills unit) you will then be expected to work full time on your proposed project throughout the summer. During this time you should meet regularly with your supervisor. You will be required to give a poster presentation of your work and submit a final thesis.

4.1 Research Review feedback

Feedback for your Research Review will be released in the last two weeks of June. At this time you will receive written feedback and rationale for the mark for your Research Review. You should discuss this feedback with your supervisor and decide how the outcome affects your project plans. Any concerns at this stage must be voiced through your supervisor to the Unit Director. Neither you nor your supervisor are allowed to directly contact your markers or marking panel members on your behalf.

4.2 Working on your project

During the summer you are expected to work full-time on your project. As mentioned before, the 60 credit points allocated to the Individual Project unit amount to 600 hours of work. Spread over roughly 16 weeks, this corresponds to 40 hours per week. As far as possible, you should follow your Workplan and regularly meet your supervisor to verify your progress. As the work progresses, you may have to agree minor changes to your Workplan in order to meet and demonstrate your stated objectives.

Styles of supervision will vary but as a guide you are expected to meet your supervisor(s) at least once every fortnight throughout the summer, although staff can be expected to take some time off for a vacation. If staff are away for an extended period they will arrange other supervision for you. If you feel your supervision is inadequately provided then you need to contact the Unit Director or Head of Department at that point – not retrospectively.

4.3 Poster and demonstration event

In mid September there will be a poster and demonstration event organised for all MSc project students. This is a busy and exciting annual event (in the style of an academic conference poster session) where you will be able to present and discuss your work with your peers, academic staff and invited industrial partners.

- The poster session is an opportunity to discuss your work with your markers and present any results or demonstrate any software or hardware you have developed during your project.
- Creating and presenting a poster design is a useful summarisation exercise and an excellent opportunity for your markers to see an overview of the work before assessing the full dissertation.
- The timing of the event is such that you will have a number of weeks to act on any feedback you receive from your markers prior to submission of your final dissertation.

Poster submission and printing

- Your poster should be designed as an A1 PDF file and submitted to the online submission system well in advance of the event. You will obviously need to pay attention to the resolution of any photographic images or illustrations you include in the design.
- You will be emailed a charge code which will allow you to have your poster printed your poster at the University's Print Services. Alternatively you can have the poster printed at any local company at your own expense (e.g. if you miss the Print Services deadline).

Poster session and assessment

- You will meet each of your markers individually at an allocated time and are expected to use your poster to present your project and where appropriate provide a live demonstration of software or hardware.
- Although you will only be allocated a short time with your markers (15-20 minutes for both the presentation and demonstration) the story you tell, from your original motivation for the work through to your results and conclusions, may well form the structure of your final thesis.
- Markers will keep notes which may be referred to and taken into account when marking your final thesis.

4.4 Your MSc Thesis

As detailed at the beginning of this document, your thesis should reflect the ethos of an MSc project and should demonstrate the following:

- That you have worked independently beyond the taught components in the course.
- That you have chosen (and justified your choice) of an appropriate method of enquiry.
- That you have demonstrated original thought and creativity.
- That you have completed the task you set out to do (as specified in your Workplan); or there is a reasonable justification for your deviation.
- That you have demonstrated an ability to collate information, critique literature and show excellence in report writing.
- *The literature review you created for your Research Review should equate to only one quarter of the work represented in your final thesis (and should be improved in accordance with any feedback from your markers and/or supervisor).*

Thesis submission and binding

1. Your thesis must be submitted electronically as a **pdf** document, and TWO soft-bound copies of the dissertation (identical to your electronic submission) must be handed in to room 2.19 MVB by the deadline (in mid-September).

2. The Department is not able to bind dissertations for you, but there are several local companies that can. The front and back cover pages of your dissertation should be light blue soft card or light blue paper (card is preferable). You can get the blue card or paper from local stationery shops such as Ryman on the Triangle or Stationery World on Park Street.
3. Your thesis must start with a one page executive summary which details:
 - The aims and objectives of your project.
 - What was the type of project? Is your project a literature review, an experiment, a theoretical investigation or an engineering project.
 - Importantly this summary must detail exactly what has been implemented or completed in addition to what you presented in your Research Review
 - The summary should end with a list of five elements which you are most proud of having accomplished.
4. As well as your dissertation you should submit all of the source code written for your project, as a single compressed file (.tar.gz or .zip). Do not submit an uncompressed file because these can be garbled by the submission system. The reason for this submission is to enable your project to be assessed properly. If your project is of a more theoretical nature, source code may not need to be submitted; if in doubt ask your supervisor for advice. If there are commercial restrictions that prevent you submitting the source code, please inform your Course Director.
5. The date for submission is a hard deadline – extensions will not be granted. If for some reason you find that you are unable to spend the required time on your project then you must talk to your Course Director as soon as possible. In very exceptional circumstances it may be possible to arrange for you to complete your project within the following year. However, taking on paid employment or any other activity in place of working on your project will not be accepted as a legitimate reason for such deferrals.

Marking of MSc theses

Your thesis is marked using the department's marking panel process. Details of this are provided in our Marking Panel Guidelines Document, but essentially it means that your mark is derived and checked in a highly robust manner.

- At least two members of staff read your thesis in detail.

- Your thesis is discussed at a panel meeting of academic staff who determine a mark for your thesis.
- An external examiner, usually an eminent Professor from another institution, validates the marks.
- These validated marks are then passed to the Departmental and Faculty Exam boards which approve them.

4.5 Electronic Submissions

Electronic submissions of your poster, thesis and code should be done through SAFE using the appropriate unit pages (COMSM3100 for advanced MSc's; and COMSM3201 for conversion MSc's).

4.6 Failures and Resubmissions

Failure in your Individual Project in September will mean you do not qualify to obtain an MSc. In various circumstances one resubmission attempt is allowed (and the criteria for this are explained in the degree regulations). In all cases a resubmission is marked under the same criteria as the original submission but the pass mark may be different or the final mark may be capped.

All resubmissions **MUST** include a covering letter stating what improvements have been made and explaining how the revised thesis addresses the resubmission requirements that will be given to failed students who are allowed to resubmit. Students are explicitly required to quote and address each point made by the reviewers with reference to the relevant (sub)sections of the thesis. Any significant changes of direction or topic must be approved in advance. No resubmission will be marked without such a covering letter.

As always it is a marking panel which determines your mark and not a set of individual markers. In this way your mark is obtained by a consensus of academic opinion on your work. The resubmission deadline will normally be at the end of January. Resubmissions will then be marked and discussed at the next scheduled exam board meeting.

4.7 Further Information

For more information please visit: www.cs.bris.ac.uk/project/MSc