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COMSM0111 Handbook

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Chapter 1

Introduction

A final-year project often represents the pinnacle of a degree programme; it offers a range of positives including freedom for deep, self-directed exploration of a specific topic. These same positives imply associated challenges, but the outcome is almost always something you as a student, and we as a Department, can be proud of. In academic terms, there are several core principles which motivate the unit:

Engagement in self-directed, independent work Responsibility for every aspect of the project is *yours*. There are of course, numerous sources of support and advice, but *you* should take ownership and therefore drive the organisation and delivery.

In-depth investigation with a research-oriented challenge One can argue different points of view, but our expectation is that an MEng project should involve a clear, significant and ideally research-oriented challenge to achieve a high mark.

Put simply, it is possible for a project to be awarded a good mark for what might be described as development (e.g., understanding and integration of existing technologies, and implementation of a resulting system). However, our aim is to push you beyond simply producing something: it is almost always the case that a project which includes some flavour of research (e.g., understanding and critiquing research-level material, evaluating and extending the state-of-the-art by investigating novel solutions, techniques or concepts) will have a higher ceiling wrt. marks.

Demonstration of the unit Intended Learning Outcomes (ILOs) *Every* unit has a set of ILOs which guide the content, and act as a benchmark wrt. quality. We expect students who complete this unit to

- work autonomously, planning your own work and meeting deadlines, but also developing your own, novel views and ideas,
- demonstrate a broad awareness of current problems and insight at the forefront of academic and industrial thinking,
- have a comprehensive understanding of theories and techniques specific to the project topic,
- apply said theories and techniques in your own research and development,
- deal with complex issues, both systematic and creative, and make robust decisions (even in the absence of complete data),
- critically evaluate your own work and that of others, and
- communicate your work clearly through a variety of mediums, and to both expert and non-expert audiences.

By design, these align with exactly the sorts of skills required of students by future employers, whether in an academic or industrial, Computer Science or non-Computer Science context.

This document is intended to overview the unit from both student and staff perspectives; one goal of including both is to ensure transparency (esp. in relation to the assessment process), but this requires *you* both read and understand the *whole* document. In addition, note that the diversity of project topics and approaches to work mean the document tries to focus on guidelines rather than rules. In a few cases

there is no room for exceptions, the rationale for which are clearly explained. However, in most cases a good reason to do X means X is allowed: there is an implicit assumption that *you* can make a decision whether X makes sense or not, whatever X actually is.

Chapter 2

A student perspective

From a student, i.e., your, perspective the unit can be described in terms of three phases, with concrete details (e.g., deadlines) available on the unit web-page. Specifically, you will carry out

1. a specification phase, in which you first select a project topic and Supervisor, then construct a document which outlines the topic and specific work involved,
2. an execution phase, in which you actually carry out the work specified, and
3. an assessment phase, in which you deliver a thesis and various presentations to the marking panel so your work can be assessed.

2.1 Phase #1: specification

2.1.1 Selection

Our approach to managing the selection of project topics and Supervisors is, by design, quite "hands-off". The motivation for this approach is that being overly prescriptive might constrain your options: we view the creativity, diversity and ambition in MEng project topics as a significant selling point over other degree programmes. Specifically, we assume you can engage with staff members *without* being prompted to do it; there is no project "roadshow" in the same way as other units, for example. Similarly, there is no canonical "menu" of projects to select from: usually members of staff prefer to develop ideas collaboratively with interested students, rather than simply list topics.

These features mean *you* need to be *very* active in the selection process. As such, our recommended approach is as follows:

1. While in theory the topic can be more or less *anything*, in practice not all topics are suitable from an academic point of view. Carefully read this handbook, including the staff perspective in Section 3, to get an idea of

   - the overall process, and
   - various (esp. assessment) criteria

   both of which can help rate the suitability of a given idea or concrete topic.

2. It is sensible to initially focus on those topics you are good at, interested in, or which might be useful in some way; this almost always maximises the utility and quality of the resulting work. As such, think honestly about

   - which topics you were most interested in (or best at) during the units you have studied so far, or
   - which topics represent the area you want to work in longer term (i.e., during your career).

   It can also be sensible to consider which members of staff you get along with: a good working relationship between student and Supervisor is a strong indicator of success.

3. Carefully read the Departmental research web-page

   http://www.cs.bris.ac.uk/Research/

   which provides coarse research groupings for staff, and links to their personal and group web-pages; often these will list detailed areas of interest or speciality, or even concrete topics.

4. Then, once you either

   - have an idea of an area of field, however vague, or
   - have an idea for a concrete topic which a member of staff has suggested, or of your own,

   do some background research and go to *talk* with members of staff whose research interests or specialities match: they will be able to refine any ideas you have, suggest new ideas and so on.

   The key point here is to do some background research *first*. This serves two main purposes. First, there are many students and few staff; this implies that Supervisors might be selective in who they supervise, and as a result a high level of enthusiasm could be viewed as an advantage. Second, good topics almost always result from a conversation or negotiation since they merge the interests, ideas and expectations of both student *and* Supervisor; with no background, you will struggle to engage in such a conversation.

2.1.2 Specification

Once you have a project topic and a member of staff who has agreed to act as your Supervisor, the next step is to translate this into a short project specification consisting of three parts:

1. The first part should, at a high-level, motivate the project by exploring questions such as

   - what the central problem is,
   - what the market is for (i.e., who cares about) a solution,
   - what the impact of a solution could be,
   - what solutions are possible, and
   - which direction within the possible options you intend to talk.

   If appropriate, explain any progress you have made so far (e.g., background reading, prototype implementation).

2. The second part should outline the project aims and objectives; a good way to structure this would be to list

   - a few high-level objectives (e.g., investigate X, solve Y, design Z), and
   - a more thorough set of lower-level, step-by-step aims (e.g., implement X, perform experiment Y, compute Z)

   in bullet point form. Crucially, you should evaluate why each item on your list is important, challenging etc.

3. The third and final part should outline (as far as possible) how you envisage spending your time. The idea is to estimate the tasks required, how long they will take (ideally based on some evidence rather than guesswork), and the order you will do them in; this should help to set priorities, and identify potential bottlenecks.

   For some projects, resource planning is an important part of the plan; in others it can make sense to outline concrete milestones and even specific deliverables. For most projects, at least some form of risk and contingency planning is sensible.

The development of this specification is *not* intended as a formal hurdle: it is not assessed, can be changed as and when appropriate, and in some ways cannot be wrong. Rather, the aim is to prompt, or even *force* you to start thinking about what you will do, and why and how you will do it.

2.2 Phase #2: execution

The execution phase commences with an informal interview (or progress check) with the Unit Director, details of which can be found on the unit web-page. The goals are to

1. provide feedback on your specification (e.g., an external, second opinion in addition to that of your Supervisor),
2. spot and resolve any potential problems before they impact on what you plan to do, and
3. answer any specific questions about the unit itself.

As such, the interview is not assessed but *will* result in written feedback that summarises your discussion. Whether positive or negative it is important to view this feedback as opinion rather than guaranteed fact, and accept the emphasis is on *you* to act appropriately (which may of course include disagreeing if there is good reason to do so).

Ideally you will have been working on background research and exploratory implementation, for example, from the point at which the project was conceived; once the interview is complete you can focus on working toward your stated aims and objectives. This phase is hard to give generic advice about since the actual work you do depends entirely on the project topic. However, keep in mind two points:

1. the unit duration is long relative to others, spanning both teaching blocks, and
2. there are no deadlines bar submission of deliverables that support the assessment process.

Specifically, the value of careful planning aspect of your specification, even if that plan changes, will become apparent: without such a plan, there is a danger your work will become unfocused and therefore "drift". Take note of the common pitfalls in Section 2.4.2, many of which relate to the execution phase; key examples include having regular contact with your Supervisor, and trying to work continuously throughout the project duration.

2.3 Phase #3: assessment

Throughout the following, keep in mind that

- under current Faculty rules [3, "Examination and Assessment Procedures"]
  1. the pass mark for M-level units is 50%,
  2. since the unit *must* be passed before an MEng degree is awarded, resits are possible but imply a capped mark,

  and
- you must understand and adhere to current Faculty rules [3, "Plagiarism and Intellectual Property"] relating to plagiarism.

Fundamentally, your project is assessed by a marking panel who read an associated written thesis (or dissertation); they use criteria described in Section 3.3 to mark and rank your project in what is a rigorous and well-defined process. As such, the objective is for said thesis to describe your project, and the work you have done, so you get a mark that properly reflects your achievements.

There are some good reasons for focusing on the thesis as the primary form of assessment; for example it allows us to deal with a diverse range of topics in a consistent way, and focuses on the artefact that will most likely be of long term use (e.g., within job interviews) to you. Even so, each student is required to submit three deliverables, namely

1. a thesis, in both electronic and hard-copy forms,
2. a poster, in electronic form only, and
3. any auxiliary or supporting material (e.g., source code), in electronic form only

with exact submission details available on the unit web-page. There are clear and important justifications for the additional deliverables:

- On one hand, the diversity of your projects and their operational requirements (e.g., equipment, data sets) means it is hard or even impossible for the marking panel to "use" them (e.g., to execute any software developed). On the other hand, having this material available can allow them, for example, to verify claims made in the associated thesis; this is also the case for the External Examiner.

  You should view this deliverable as satisfying the latter point: for each claim or result in your thesis, iff. some appropriate evidence exists in an electronic form, this is what you should submit.

- It may be tempting to think of the poster as an extraneous hurdle. However, there are two important aims, namely to

  1. force you to consider your strategy for verbal and written presentation (if you cannot clearly distil your contribution into a poster, you might also struggle for clarity elsewhere), and
  2. support the poster event, motivated and explained within Section 2.3.2.

The unit web-page houses a set of structural guidelines for the thesis and poster, presented using a set of LaTeX templates, referred to in the following. However, there is *no* requirement *at all* to use these templates, or indeed LaTeX: in common with the rest of the project, you are free to select and use whatever tools are most suitable.

2.3.1 Thesis

There are many guides to technical writing, e.g., [2, 1], but ultimately it is difficult to give generic advice because the process and challenge is personal to each student and specific to a given topic.

What follows is an attempt to guide the structure, content and presentation of your thesis. The best policy is to read and absorb this, make alterations where it makes sense to, and get regular input from your Supervisor and any third-party proof readers you can engage: if your thesis can be read and understood by one of your peers, then you can be reasonably confident a marker can do the same.

Structure and content

To provide at least some guidance and points of reference, the unit web-page houses a range of specimen theses. In addition, the structural guidelines provided outline a thesis in terms of the following sections

- some compulsory (e.g., contents, executive summary, supporting technologies) and optional (e.g., notation) preliminaries, often called front matter,
- a contextual background, which explains and motivates the underlying problem or challenge involved,
- a technical background, which gives enough background on related work that the reader can understand what you have done,
- a overview of project execution, which details the work you carried out, and
- a critical evaluation, which presents and analyses any results and comparison.

There is *no* requirement *at all* to replicate this structure exactly (bar any compulsory sections): you are free to amend it to suit the requirements of your topic. For example, projects with an emphasis on implementation might sensibly include a section on system design or architecture. In addition, keep in mind some general points:

- The marking panel are not necessarily experts in your topic: the clarity and quality of your presentation is therefore at least as important as the technical challenge or quality of your work. Put another way, if the reader cannot understand your contribution it does not matter how good it is: they will be unable to comprehend the level of quality or the associated value.

- Clear citations to relevant research and results are a hallmark of good technical writing: they provide credit to the original author (which is a pre-requisite where their material has been reproduced), allow the reader to find extra information where required, and also demonstrate your understanding of the topic.

  You should make an effort to find, read and cite the *original* sources of such material, for example focusing on research papers rather than web-based alternatives (e.g., Wikipedia).

Preparation and printing

Whether or not you use the template provided, there are some preparation and printing guidelines you *must* adhere to as diligently as possible:

- The text should be single (or at most 1.5) line spaced, using a 10 point serif font (e.g., Times, Times New Roman, Garamond or similar).

- Pages should be numbered consecutively; the preferred position for page numbers is the bottom centre of each page. The top, bottom and side margins should be at least 2 cm.

- Anything you can refer to, including floating content, should be captioned and numbered relative to the section they are typeset within. For example,

  - the second definition within section 1.4 would be captioned "Definition 1.4.2",
  - the third diagram, image or graph within section 2 would be captioned "Figure 2.3",
  - the first table of numeric data within section 3.2 would be captioned "Table 3.2.1",
  - the forth machine readable input or output within section 4.7.1 would be captioned "Listing 4.7.1.4", and
  - the only algorithm within section 5 would be captioned "Algorithm 5.1".

- The preferred form of citations is numerical (i.e., [1] rather, for example, than author-date or author-title), referring to a complete bibliography at the end of the thesis (but before any appendices). When referring to a particular part of a book or long paper, it is helpful to indicate the specific sections or pages (e.g., [Section 7, 1] meaning section 7 of reference 1).

- When limited use of direct quotations is appropriate, they must be clearly delineated using quote marks *and* an associated citation to the original text.

- For the electronic submission, PDF is the only acceptable format; for example OpenOffice and Word documents are not acceptable.

- The hard-copy should be laser printed on A4 size white paper: make every effort to print on *both* sides of the paper. The thesis must be bound using one of two options, either

  - a spiral or comb binding, or
  - a cloth binding.

It is important to understand there are sensible rationale for each of the above. For example, the requirements are designed to

- minimise problems during the print and binding process,

- ensure markers have space to write notes and can refer consistently to specific features where appropriate, and

- allow us to archive your work as well as support external examination and accreditation processes.

2.3.2 Presentations

Viva presentation

To support the marking process you will be expected to give a verbal presentation to the marking panel. Each student is allocated a slot, whose format is

1. part presentation, wherein you explain project content (with support of slides for example),
2. part demonstration, wherein you exhibit project outputs (e.g., software or results),
3. part viva voce (or oral) examination, wherein you defend your work based on questions posed by the marking panel (during or after the presentation and demonstration).

Each allocated slot is relatively short in duration; this is by design, and intended to focus the presentation at a high-level rather than on technical detail (which the thesis will inevitably contain). As such, an ideal presentation might cover aspects such as motivation for the project topic, an overview of the central problems and/or solutions, where the technically challenging or novel areas of work are, what the major contributions and achievements are, and so on.

Specific organisational details can be found on the unit web-page; keep in mind some general points:

- In the same way as with your thesis, remember that the marking panel are not necessarily experts in your topic; in addition, there is no requirement for them to have read the thesis before the presentation (some markers deliberately prefer *not* to do this).
- By default, the only equipment available will be

  1. a standard, network-connected Linux based workstation from the MVB-2.11, CS lab,
  2. Audio-Visual (AV) equipment capably of projecting the workstation output onto a screen, and
  3. a whiteboard (or equivalent).

  It will be possible to connect your own laptop to the AV equipment instead of the workstation available; other equipment is *your* responsibility, and in particular *you* must make arrangements with the Unit Director to accommodate it (e.g., if you need to transport it, or leave it at the venue overnight).
- Opportunity will be provided to test your materials (e.g., slides, internal or external equipment for the demonstration) before the slot itself; typically this will be the day before. Beyond this, *you* are responsible checking the materials: you should not assume there will be time to do this within the slot itself.

  In particular, make sure your materials are easily accessible via a USB stick, download using a web-browser, or on the Departmental file system (preferable all three) so you can start as quickly as possible.
- The demonstration should compliment the presentation and give the marking panel confidence that your ideas and implementation work as described; some students prefer to include the demonstration within the presentation itself, others leave it until the end and as a vehicle to prompt questions.

  Note that for some topics (particularly theory-based), traditional demonstrations may be inappropriate; *you* should consider how use the time for an alternative but similarly useful purpose.
- As long as there is a clearly motivated reason, it is permissible to present a pre-recorded demonstration (i.e., a video) rather than a live one. Examples might include demonstrations that require a prohibitively long time to complete, require equipment that cannot be transported, or need to be performed in a particular environment (e.g., outdoors).

Poster presentation

Feedback from previous cohorts suggests they were unhappy with the closed nature of the viva presentations: they felt seeing the work produced by their peers useful and interesting (cf. COMS30400). As such, a second, informal presentation occurs after the vivas which is based on the poster produced by each student. There are two aims:

1. allow markers to ask less formal follow-up questions after the more formal setting of the viva presentation, and, crucially,
2. act as a positive conclusion to the unit, year and your degree as a whole, celebrating the achievement your project represents.

The latter aspect in particular is only viable if everyone engages: the aim is to invite the entire Department (staff and students), as well as external parties, to see your work. To this end, one can imagine you using the event to showcase your work and skills to potential employers. The format is simple, with concrete details available on the unit web-page; in essence,

- we organise some food and drink, print and display your posters in the MVB somewhere, then
- you attend, eat, drink and discuss your work with anyone who is interested; typically this means spending some time with your poster to talk to people, and some time investigating the work of your peers.

Note that whether or not you use the template provided, PDF is the only acceptable format for the electronic submission of your poster.

2.4 Hints, tips and common pitfalls

2.4.1 Frequently Asked Questions (FAQs)

"How do I align my project topic with COMSM0306?" The COMSM0306 or "business plan" unit complements COMSM0111: in a sense, the former focuses on where and how to apply the outcomes of the latter. Although COMSM0306 involves developing a business plan, it is vital to realise the unit ILOs wider than this, and certainly transferable. For example, being able to

- understand product life cycles and value development costs,
- develop and manage Intellectual Property (IP),
- identify and understand markets, and
- explain concepts and market unique selling points

is just as applicable to a project within an *existing* company (e.g., trying to motivate your manager to allocate resources to your project) as starting a *new* company.

History suggests the best approach is to first identify a project topic suitable for COMSM0111, i.e., one with a clear challenge: it is almost *always* the case that the associated challenge and "added value" can be leveraged to write a business plan, whether it represents novelty (e.g., some technology that does not exist) or pure difficulty (e.g., some technology that cannot be easily reproduced). Although there are clearly counter-examples, taking the opposite approach is not always as easy: with no context, finding a good business idea for COMSM0306 can be hard, and can also make it harder to satisfy the COMSM0111 criteria in Section 3.3.

"What happens if I can't find a project topic and/or Supervisor?" The Faculty rules [3, "Examination and Assessment Procedures"] stipulate a final-year project must be passed before the associated degree can be awarded; this implies the project is not optional. Failure to find a project topic and/or Supervisor already means some of the ILOs have not been met, but this is not terminal. Although we try hard to make *you* manage the selection process, a "disaster recovery" option is for the Unit Director to select a project topic and Supervisor for you. This will try to take your interests in and experience into account, but ultimately you should aim to avoid it at all costs: it means you will potentially have to work on a topic which is far from ideal wrt. both metrics.

"What if I want to do a project related to X, but there is no suitable Supervisor?!" The Department, like any, has research specialities; members of staff tend to align with these, even in a rough sense. As such, it can be the case that no member of staff is an ideal Supervisor for a given topic. It is perfectly possible to still opt for such a topic, but two issues are important:

1. It is less likely you will get ideas relating to a concrete topic from staff members, hence there is more emphasis on you having your own idea.
2. You *must* have an academic Supervisor from within the Department. Since there will be limited expertise within the Department, supervision will inevitably be at a higher level (e.g., with less guarantees about help wrt. technical detail).

If you are unsure which, if any, staff member is the best match for a given topic, the Unit Director can offer advice.

"Can I select an external (e.g., industry, other Department) project topic?" The Department as a whole has a wide, varied range of connections to industry and beyond. On one hand, related project topics represent a fantastic opportunity, and will typically provide clear motivation: if an expert external contact thinks the topic is important, this is evidence enough of the value! On the other hand, there are two key rules to keep in mind:

- Even if your external contact remains more prominent from a day-to-day perspective, you *must* have an academic Supervisor from within the Department. In part, this will ensure you focus on satisfying the academic requirements of the project as a first-class goal.
- Since the external contact (and any associated resources) potentially have other commitments, there is a danger that they are not as available as you (or they) expect. As such, you *must* engage in a careful approach to planning to manage and mitigate this problem.

"I need to buy an X, will the Department pay for this?" The unit itself holds no budget to support resources beyond those in the Department already; if you need equipment, software, licenses or data, for example, it is your Supervisor who should help to arrange this.

"I have some specific IT needs, who should I contact?" As a result of the School and Faculty organisation, IT services are centralised rather than managed within the Department. As such, requests for resource or support should go through the IT service desk, i.e.,

`http://servicedesk.bristol.ac.uk/`

Your Supervisor should help to arrange this, with the work typically carried out by one of the subject-specific IT support staff.

"Should I include an Appendix for X in my thesis?" The best way to think of an appendix is as content that could be of use, but it not crucial to understanding the thesis. In line with most research conferences, the marking panel is not obliged to read appendices; as such, it makes sense to populate one with content *only* if it is not important enough to include in the main body.

A common question of this type regards source code. Since there is a separate deliverable capturing source code, printing it out as an appendix is not a good idea: it seems quite unlikely someone would read it! On the other hand, it *can* be sensible to include short source code fragments when discussing some aspect of your implementation. For example, if there was a particular challenge or subtle feature worth discussing, making reference to the source code in question (much like you would a diagram, or algorithm) can help a reader understand your explanation.

"Can I bring along my demonstration to the poster presentation?" Yes this is a great idea. Unless the demonstration is portable (e.g., can simply be executed on a laptop you bring on the day), check with the Unit Director first to make any arrangements in the same was as for the viva presentation.

2.4.2 Common pitfalls

Over or under ambition in project topic or execution plan A ideal project is usually a careful balance between

1. less ambitious goals relating to clear and achievable topics, and

2. more ambitious goals relating to challenging, scientifically interesting and potentially novel topics.

Put another way, the former represents guaranteed outcomes with a lower marks ceiling and the latter represents less guaranteed, more risky outcomes with a higher marks ceiling. Too little of the former can represent over ambition: too much risk can be problematic if the goals are not fully achieved. Too little of the latter can represent under ambition: too much incremental development can limit the potential for marks.

Spreading your effort too thinly Although carefully compromise is clearly required, and it is hard to generalise, focus on a limited set of goals is a strong indicator for how successful you will be. Put another way, fewer (resp. many), goals that are more (resp. less) complete and of a higher (resp. lower) level of quality will typically lead to a higher (resp. lower) mark.

Poor planning wrt. time Time management is a challenging task in many situations; this is magnified within the context of your project by

- the long overall duration,
- the volume of work required on this unit, and
- the volume and timing of work for other units.

Beyond planning carefully, an often ignored aspect of this challenge is the dedication of enough time to write your thesis. On one hand, this task is often necessarily left until close to the deadline: some aspects are hard or impossible to write until you have done the associated work. On the other hand, this strategy will inevitably compress the amount of available time *and* clash with other deadlines. Especially since the thesis carries a high weight wrt. assessment, it can make sense to

- write incrementally throughout the project duration (esp. for sections such as the technical background), and
- compromise carefully between doing more work and the writing associated with completed work: the value of that extra work is moot, even destructive, if the work *overall* is not presented clearly.

Poor planning wt. contingency A serious approach to project management includes some form of risk assessment, coupled with thought about contingency. There is no need to necessarily do this formally, but it *does* make sense to plan for events that could have a major impact on the project. Some examples which occur more often than you might expect include

- failure of non-existence of, or delays/limits wrt. access to required equipment,
- assumption that some data-set is available,
- needing to perform an evaluation involving long-running computation but not securing the resource or allocating enough time to do so, or
- needing to perform an evaluation involving test subjects, but failing to find enough of them.

Imagine the equipment in the first case is a sensor required to capture data that is then processed in some way; one might plan to allow simulation of the processing step using synthetic data as a contingency.

Lack of contact with Supervisor The Unit Director will *always* give a second opinion on your work and answer questions about the organisational aspects of the unit, but for topic-specific advice your Supervisor should remain your first point of contact for the entire duration.

History suggests that regular meetings with with your Supervisor are a strong indicator for how successful you will be. Such meetings to not have to be lengthy (a 5 minute progress check in which you say "I am working on X but have not finished it" is fine), but can be crucial in guiding and checking your work and overall direction.

Lack of continuous work If a deadline is in the distant future, procrastination is easily justifiable; history, however, suggests students who work continuously throughout the year, rather than in a more compressed period at the end, are more successful. This is partly to do with basic workload balancing, but also gives more time to *think* about problems and solutions and investigate (potentially unsuitable) alternatives.

Lack of reprodicibity wrt. thoughts or results Two key issues are important, but often only obvious in hindsight:

1. Writing a clear description of your work demands you consider the reader, who may not have a background in the topic. You potentially started with the same background, but by the time you write the thesis, this perspective is often lost: you will inevitably understand things much better! As such, a good approach is to develop a set of working notes that act as a skeleton; in certain Departments, this is formalised by forcing students to submit an additional laboratory notebook.
2. It can be useful to reproduce a set of results from earlier in your work for your thesis, or perform an experiment again to check something. Doing so may imply using an old version of any software or hardware developed; maintaining access to this (e.g., using a version control system) can be important.

Chapter 3

A staff perspective

The overarching aims are to

1. follow the assessment process in Section 3.1 and marking criteria in Section 3.3 so as to ensure as much transparency as possible,
2. produce a robust mark for and ranking of projects, with clear indications wrt. classification boundaries,
3. ensure a level of fairness and consistency wrt. marks both across a given cohort and in reference to history, and
4. minimise bias caused by over- or under-enthusiastic supervisors and/or markers.

3.1 The Assessment Process

A marking panel, whose overall size depends on the number of projects, is drawn from members of staff in the Department. Each project is assessed directly by a *minimum* of two assigned markers from the panel, and indirectly by the whole panel. Neither marker of a project will be the associated Supervisor, and the specific assignment of markers will aim (where possible) to include one topic-specific expert and one non-expert; this is an approach intended to balance scientific rigour with external perspective.

Although minor deviations are possible (e.g., due to deadline extensions or mitigating circumstances), the following order or events describes the intended process:

1. The assigned markers for a given project will inspect associated deliverables closely, the thesis in particular, and attend the relevant presentations. The marking criteria in Section 3.3 allow each of them to independently arrive at an initial mark, supported by some written justification.
2. The Supervisors of projects are asked to provide an assessment which the marking panel can later use to guide decisions where appropriate. This assessment is limited to factual statements only, and excludes mitigating circumstances which are considered via a separate Departmental panel.
3. The marking panel as a whole meets together in one session chaired by the Unit Director; the goal is to produce a set of final marks and overall ranking. Some fundamental principles are adhered to during the meeting, namely
   - every project is discussed, typically starting with projects whose initial marks are most disparate,
   - marks are never arrived at via averaging, but rather through discussion of merits and failings wrt. the marking criteria, and
   - the marking panel as a whole is responsible for arriving at the final marks and ranking (for example, the thesis for every project will be available to the whole panel to allow discussion and comparison).

   More specifically, the meeting consists of three distinct phases:

(a) Based on initial marks provided by the assigned markers, and discussion within the whole panel which may amend them, a preliminary mark is agreed for each project; these imply a preliminary ranking.

(b) The projects are considered pair- or group-wise in order to further amend the marks with the aim of agreeing on a final ranking; this process should attempt to retain the ranking made by individual markers, and consider degree classification boundaries.

(c) The final marks are agreed, and the marking panel as a whole produce some written justification for their decision; this helps to form feedback to the student, and includes both positive and negative aspects.

Note that if the Supervisor of a project is a member of the marking panel, they are prevented from engaging in the associated discussion.

4. The final marks produced by the marking panel are ratified by the Departmental exam board before being released.

5. The final marks and assessment process itself, in common with all units within the Department, are checked by the External Examiner, a role usually filled by a senior member of staff from another University (who is changed periodically). To check and calibrate quality and ensure fairness, the External Examiner can request to inspect any thesis or associated work (usually opting for a representative sample), or viva students to check whether our assessment matches their own.

As an aside, note that the process has clear parallels with peer review process in most research conferences, and funding review schemes such as that of EPSRC; these typically rely on collective opinion and discussion rather than the absolute opinion of one reviewer.

3.2 Plagiarism checks

Checking for plagiarism is a difficult challenge, esp. when a marker is unfamiliar with the associated topic. As such, a centralised and consistent approach is applied; the goal is to ensure as fair an outcome to the assessment process as possible:

- The marking panel marks each project as normal, i.e., assuming there is no issue with plagiarism, but noting specific concerns when and if applicable.
- As early as possible after their electronic submission, the Unit Director uses the TurnItIn system

  http://submit.ac.uk

  to check all theses, then, later, collates any specific concerns identified by the marking panel.
- Any cases which warrant further investigation and/or penalty are passed to and managed by a separate Departmental panel.

3.3 Assessment criteria

From both the student and staff perspectives, it is important to have a clear set of criteria to which the assessment process can refer. Such criteria are notoriously hard to construct: the diversity of project topics inevitable produces exceptions to seemingly perfect, codified criteria for example. In an attempt to combat this problem Figure 3.1 through Figure 3.3 outline indicative characteristics that projects within the associated marks range might exhibit. It is important to view these strictly as indicators *not* absolute guarantees. In particular,

1. at least some of the assessment process is, necessarily, based on opinion by individual markers drawn from their understanding of the work, and

2. it is common for a project to exhibit characteristics relating to a high mark in one category and a lower mark in others.

Class	Mark	Indicative Characteristics				
		Challenge and Contribution	Depth and Rigour	Innovation and Application	Analysis and Evaluation	Organisation and Communication
1st	80 to 100	topic and goals are ambitious and/or imply significant challenge, on par with work carried out by an early-stage PhD student; work often of an inter-disciplinary (e.g., both hardware and software), research-oriented nature, potentially within more than one field in CS and beyond; outstanding volume of work irrespective of goals; work represents a significant breakthrough in CS and/or is comparable to a commercial product; outcome is likely to be useful for other researchers/students (e.g., as part of an open-source dissemination)	research, execution and evaluation all with no obvious omissions, meaning a high level of breadth/depth in the work; all of the central goals have been achieved; intelligent, totally self-directed exploration of the topic (meaning minimal direction required from supervisor), based on well considered decisions and robust planning and/or organisation; volume and relevance of background research and citations covers all known literature	completed work represents a genuine and significant improvement on the state-of-the-art; clear application outside the unit remit, for significant benefit; novel results, concepts or designs conceived entirely by student; tools and techniques selected and applied perfectly, with clear motivation and consideration for alternatives	perfectly designed and executed evaluation (experimental or otherwise), using appropriate metrics and techniques; sometimes difficulty of evaluation adds to project challenge; fair, comprehensive comparison with suitable state-of-the-art and/or a multitude of alternative options; interesting and well reasoned conclusions, borne from effective analysis; abundant critical appraisal of results and related work; clearly defined open problems and identification of future work	clear, articulate and accurate written work, demonstrating high quality of presentation and mastery of topic; no identifiable problems with content or presentation, often of a quality suitable for publication; creative and effective use of visualisation and illustration; usually, material is self-developed and visually consistent; able to answer advanced topic-specific questions, and understand work in a wider context; usually, clear interest and passion for topic and field exhibited
	70 to 79	topic and goals are ambitious and/or imply major challenge; work often of an inter-disciplinary (e.g., both hardware and software), research-oriented nature, potentially within more than one field in CS; volume of work is more than adequate given goals, and/or above average given unit CP weight; completing or resolving problems with work would require minor effort alone; outcome could perhaps be useful for other researchers/students (e.g., as part of an open-source dissemination)	research, execution and evaluation all with only minor and/or superficial omissions, meaning a high level of breadth/depth in the work; most of the central goals have been achieved, and anything left incomplete is well explained and incidental; intelligent, largely self-directed exploration of the topic (meaning limited direction required from supervisor), based on well considered decisions and robust planning and/or organisation; volume and relevance of background research and citations covers most known literature	completed work represents a genuine improvement on the state-of-the-art, but perhaps incremental in nature; clear application outside the unit remit, for marginal benefit; novel results, concepts or designs conceived partly by student; tools and techniques selected and applied satisfactorily, with some motivation and consideration for alternatives	suitably designed and executed evaluation (experimental or otherwise), using appropriate metrics and techniques; sometimes difficulty of evaluation adds to project challenge; fair, comprehensive comparison with suitable state-of-the-art and/or some alternative options; well reasoned conclusions, borne from effective analysis; critical appraisal of results and/or related work; well defined open problems and/or identification of future work	clear, accurate written work, demonstrating high quality of presentation and thorough knowledge of topic; any problems are minor or somewhat superficial; effective use of visualisation and illustration; often, material is self-developed and visually consistent; able to answer detailed topic-specific questions, and understand work in a wider context; often, clear interest and passion for topic and field exhibited

Figure 3.1: Assessment criteria, described as a set of indicative characteristics that projects within the associated marks range might exhibit.

Class	Mark	Indicative Characteristics				
		Challenge and Contribution	Depth and Rigour	Innovation and Application	Analysis and Evaluation	Organisation and Communication
2.1	60 to 69	topic and goals imply modest challenge; work often less research-oriented, and more development focused; often limited to a single and/or narrow field or unit in CS; volume of work is adequate given goals, and/or in line with unit CP weight; completing or resolving problems with work would require minor effort and/or changes in approach; outcome likely only of use within the unit remit	one of research, execution and evaluation is lacking in some way, or has obvious omissions; often, some unexplored options, implying minor lack of breadth/depth; some of the central goals have been achieved, and anything left incomplete has modest impact; exploration of the topic somewhat narrow, often based on influence and ideas of supervisor; motivation for decisions often poorly explained; usually exhibits good planning and/or organisation; background research has minor omissions, with minor impact only	often limited but existing novelty, and may fail to produce an interesting (positive or negative) outcome wrt. state-of-the-art; often, completed work confirms or replicates existing state-of-the-art; novel results, concepts or designs conceived mainly by supervisor; the selection and application of tools and techniques is more than adequate; although improvements (e.g., better results, less effort) could have been realised with alternatives, any impact was marginal	design and execution of evaluation is often lacking in a few areas, but such problems potentially have minor implications only; sometimes, evaluation is mistaken for functional testing alone; above average comparison with state-of-the-art and/or alternative options but lacking in some, often minor ways (e.g., breadth and/or depth alone); critical appraisal of results and/or related work often limited, impacting in a minor but potentially obvious way overall; often, conclusions tend toward simple statements of fact; some open problems and topics for future work identified	written work of an above average quality, and with any problems implying only a minor overall impact; demonstrates solid knowledge of the topic; few substantive and/or presentation problems which have minor impact on overall clarity; use of visualisation and illustration is of above average quality, and largely effective in complementing text; often able to answer basic topic-specific questions without the need for prompts, but unable to extend answers to a more advanced level; clarity of explanation is above average; limited understanding of work in a wider context
2.2	50 to 59	topic and goals imply minor challenge; work often less research-oriented, and more development focused; often limited to a single and/or narrow field or unit in CS; volume of work is less than adequate given goals, and/or below average given unit CP weight; completing or resolving problems with work would require major effort and/or changes in approach; outcome likely only of use within the unit remit	one or more of research, execution and evaluation is lacking in some way, or has obvious omissions; often, several unexplored options, implying modest lack of breadth/depth; few of the central goals have been achieved, and anything left incomplete has significant impact; exploration of the topic fairly narrow, often based heavily on influence and ideas of supervisor; motivation for decisions often lacking entirely; sometimes let down by poor planning and/or organisation; background research has minor omissions, potentially with major impact	usually very limited novelty, and often fails to produce an interesting (positive or negative) outcome wrt. state-of-the-art; often, completed work confirms or replicates existing state-of-the-art or even less advanced alternative; novel results, concepts or designs conceived entirely by supervisor	design and execution of evaluation is often lacking in many areas, even fundamentally flawed, and such problems potentially have major implications; often, evaluation is mistaken for functional testing alone; below average comparison with state-of-the-art and/or alternative options and lacking in some, often major ways (e.g., breadth and/or depth and approach itself); critical appraisal of results and/or related work often limited, impacting in a major and obvious way overall; often, conclusions are simple statements of fact few open problems or topics for future work identified	written work of an below average quality, but with any problems potentially implying a major overall impact; demonstrates partial or patchy knowledge of the topic; some substantive and/or presentation problems which potentially have major impact on overall clarity; use of visualisation and illustration is of below average quality, and often ineffective in complementing text; often unable to answer basic topic-specific questions or requires significant prompts to do so, and unable to extend answers to a more advanced level; clarity of explanation is below average; limited understanding of work in a wider context

Figure 3.2: Assessment criteria, described as a set of indicative characteristics that projects within the associated marks range might exhibit.

Class	Mark	Indicative Characteristics				
		Challenge and Contribution	Depth and Rigour	Innovation and Application	Analysis and Evaluation	Organisation and Communication
Fail	40 to 49	topic and goals are unambitious and/or imply only trivial challenge; research-oriented contribution somewhat lacking or absent, and hard to align with a particular field or unit in CS; volume of work is totally inadequate given goals, and/or out of line with unit CP weight; completing or resolving problems with work would require significant effort and/or changes in approach; outcome is not much use to anyone	significant omissions in most phases of research, execution and evaluation; one or few explored options, implying major lack of breadth/depth; most of the central goals remain incomplete; lack of exploration within the topic, sticking mainly to an obvious and/or pre-prescribed set of decisions; planning and/or organisation often inadequate or ill conceived; background research is patchy	few or no identifiably novel aspects, nor any significant value wrt. state-of-the-art; no obvious value or application outside the unit remit; lack of identifiable novel results, concepts or designs; choice of tools and techniques somewhat inappropriate and/or ill considered; merits of alternatives often not well considered	an evaluation is absent or so limited as to be without value; often comparison with state-of-the-art and/or alternative options is of marginal quality or missing; often lacking any critical appraisal of results and/or related work; usually lacking description of open problems, and any topics for future work based on aspects of incompleteness only	writing style and presentation such that understanding the work is difficult, and demonstrates limited knowledge of the topic; resulting thesis is unsuitable for public dissemination; many substantive and/or presentation problems which potentially have major impact on overall clarity; ineffective use of visualisation and illustration; often, material is externally sourced and/or visually inconsistent; unable to clearly answer many topic-specific questions, and/or unaware of wider field or context; often dispassionate about or unenthused by work, topic or field
	0 to 39	topic and goals are unambitious and/or imply no clear challenge; research-oriented contribution totally lacking or absent and hard to align with a particular field or unit in CS; difficult to align work with any significant effort; completing or resolving problems with work would be equivalent to starting again	all phases of research, execution and evaluation totally lacking; very few explored options, implying significant lack of breadth/depth; all of the central goals remain incomplete; total lack of exploration within the topic, sticking entirely to an obvious and/or pre-prescribed set of decisions planning and/or organisation often totally inadequate or ill conceived; there is little or no evidence of any background research	no identifiably novel aspects, nor any value wrt. state-of-the-art no value or application outside the unit remit; complete lack of identifiable novel results, concepts or designs; choice of tools and techniques somewhat inappropriate and/or ill considered; merits of alternatives often not considered at all	an evaluation is totally absent; usually no comparison with state-of-the-art and/or alternative options; totally lacking any critical appraisal of results and/or related work usually lacking description of open problems, and any topics for future work based on aspects of incompleteness only	writing style and presentation such that understanding the work is prohibitively difficult, and demonstrates very limited knowledge of the topic; resulting thesis is unsuitable for public dissemination; many substantive and/or presentation problems which potentially have significant impact on overall clarity; ineffective and/or confused use of visualisation and illustration; usually, material is externally sourced and/or visually inconsistent; unable to clearly answer any topic-specific questions, and/or unaware of wider field or context; usually dispassionate about or unenthused by work, topic or field

Figure 3.3: Assessment criteria, described as a set of indicative characteristics that projects within the associated marks range might exhibit.

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