

BSc Computing for Games Research Dissertation Handbook

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Chapter 1

Introduction

You are required to deliver a major **research project** as part of your degree; either in the form of **empirical research** relating to computing for games, or **practice-based research** related to game development. Individually, you explore a field that interests you, and for which there is a clearly identified need.

The strongest projects constitute original research, making a contribution to knowledge in their field; the very strongest projects in the past have been submitted and accepted for publication in international scientific conferences. This is not a requirement, but a bar to aim for.

Selecting a project

Your **project supervisor** is responsible for giving you guidance and feedback throughout your project, through regular group and individual supervision meetings.

Every potential supervisor has their own area of expertise and research interests, and has suggested several possible project titles. These are available here:

<http://bit.ly/2yrSqZn>

You may also propose your own project title within the fields of expertise of the listed supervisors. Please contact your prospective supervisor to discuss this, as they are best placed to ensure your proposal is feasible and relevant. One of the few restrictions on the project topic is that it must allow you to develop some form of **software artefact**, as this is a component of the assessment. This doesn't have to be a piece of software intended for an end user — for example it could be a software component for collecting and analysing statistics within a pre-existing software system. Your supervisor can advise on what would constitute a relevant and suitable artefact for your project.

Over the summer vacation, consider the proposed project titles and areas and decide on your preferred project. Contact your prospective supervisor to express your preference and discuss the project in more detail. **At the beginning of study block 1**, the course team will finalise the assignment of students to projects and release this to you.

Module overview

The project is split across **two** modules, each worth **20 credits**. Thus in total your dissertation project makes up **one third** of the credits for your final year.

COMP320: Research Practice

In study block 1, you have two deliverables: a written **research review and proposal**, and a **prototype software artefact**.

Your **research review and proposal** will give a comprehensive review of existing scientific literature on your chosen topic. In writing this you will become familiar with the wider context of your project and how it

relates to state-of-the-art research results. Within this framework, you will formulate a research question to be addressed by your project. You will also demonstrate awareness of the ethical issues surrounding your project.

Your **prototype software artefact** will demonstrate your familiarity with the software tools and analysis techniques that you will use for the remainder of the project. The most time-consuming aspect of many projects is data collection and analysis, especially where human participants are involved; a solid prototype software artefact will allow you to “hit the ground running” in study block 2.

COMP360: Research Dissertation

In study block 2, you again have two deliverables: a written **dissertation**, and a **software artefact**. Each of these builds on the corresponding deliverable from study block 1.

Your **dissertation** will present and discuss the results of your project. It is likely that your research review and proposal from COMP320, with changes, will constitute roughly the first half of your dissertation. You will present your results in a scientifically rigorous way, and demonstrate critical reflection on your findings and on the course of the project itself. It is no coincidence that the document style we ask you to use for your dissertation is the same style as used for scientific journals and conference proceedings published by IEEE — this is the tone and level of rigour for which you should strive.

Your **software artefact** will refine the prototype from study block 1. The nature of the software artefact will vary dramatically between projects, however your work will be assessed on the usual software engineering criteria of writing functionally coherent and maintainable code, making sophisticated use of appropriate tools and techniques.

Assessment weighting

As noted above, the project constitutes a total of 40 credits, or one third of the credits for your final year. Thus the expectation is that the project will constitute approximately **400 hours** of work (including supervision meetings and timetabled sessions as well as independent study).

In both modules, the written work is worth 70% of the marks, and the software artefact 30%. Thus it is vitally important that you allocate ample time for writing up, and do not treat it as an afterthought!

Chapter 2

Guidance on Completing your Project

Ethical Clearance

Computing professionals are expected to follow the ethical standards that have been outlined by the British Computer Society (BCS), The Chartered Institute for IT. **All** students are expected to familiarize themselves with the BCS Code of Conduct. Although scientific work at undergraduate level is unlikely to raise serious ethical concerns, there are many topics pertinent to games where Sections 1 and 2 of the Code of Conduct and the Interpretation of the BCS Code of Conduct are likely to apply. Research artefacts with the potential for practical application or future commercialisation are one example and will normally also have wider ethical implications for you to consider. As such, heed the points in Section 2 on technological procedures and standards as well as those on complying with legislation.

All students must follow Falmouth University's Research Ethics Policy. In practice, this means you need to complete the Research Ethics Approval Application Form and obtain ethical clearance **before** using the research artefact you have created to collect primary data. Even if collecting such data presents minimal to no risk. Furthermore, if your project involves human participants (e.g. for testing a game system you have developed), or presents a significant ethical risk (e.g., systems that process personal data) then you will need to have completed the full Research Ethics Approval Application Form available on LearningSpace. In these cases, you should also discuss these ethical issues in your dissertation and pay particular attention to how you addressed these issues in your research methodology.

If you did not obtain ethical approval at the proposal stage, email a revised version of the application form to the module leader and **do not** start to collect data until you have been advised to do so. Failure to follow the policy will constitute academic misconduct and will result in a failing grade. If you are unsure of the status of your application, contact the module leader.

Project Management

The final year project can be quite a daunting and intimidating prospect. Many students find it challenging because of its self-directed nature and the accompanying discipline and dedication needed to follow it through. However, do not worry! Completing the project is not only intellectually liberating and a mark of your academic independence, but will provide you with a sense of achievement and satisfaction.

It will also constitute an key indicator—a symbol—of your competence to potential employers. It gives you something you can showcase in interview and discuss in considerable depth and with enthusiasm. Successful completion of such a project demands a mastery of core employability skills including: initiative; problem solving; communication, both written and spoken; self-regulated learning; as well as planning and management. Though the stretching of your ability in these areas to limits you never thought possible will likely be rather uncomfortable, you feel better for it when you graduate.

A pitfall that many students fall into, however, is time management. Minimise your procrastination and try to chip away at your work a little every day! Although your milestones will vary depending on the nature of your project, ideally the research artefact should be near its completion towards then end of January, permitting you to collect and analyse data across February and March ahead of the interim presentation. Then, in the later half of the study block focuses on interpreting and contextualising your discoveries and writing them up as an academic dissertation. Do not underestimate this process! Your dissertation will take

weeks to write!

It is, therefore, critically important that you consider **project management** again at this stage. Consider the system development life-cycle that is appropriate to your project. Ensure you use appropriate project management tools including critical path analysis, Gantt charts, and burn-down charts to keep track of your progress. Also, do not underestimate the importance of the **validation and verification** aspect of the research artefact. You must ensure sufficient time is made to enact quality assurance practices that will defend the integrity of your research by showing that your research project was appropriately managed and your research artefact was constructed through the sound application of software engineering practices.

Explicitly outline your management approach and transparently evidence how you actually tested your software!

If you encounter any issues with respect to your time management, please consult your supervisor who can provide you with advice. They are there to support you, so take advantage of their experience. Also, ensure that you take advantage of the support services offered by the Academic Skills Team (ASK): <http://ask.fxplus.ac.uk>

Preparing the Manuscript

The final manuscript should be prepared following the formal IEEE Transactions template with referencing in IEEE style. The manuscript should contain 12-pages of academic content (excluding figures, tables, the reference section, or any additional material) and a 1-page addendum that evaluates the project. This means there should be 12-pages of content. You should discuss the structure with your supervisor.

- **Front Matter:** The first page should display your name, the title of the project, the abstract, and a copyright notice. Please do not include your supervisor as a co-author (see acknowledgements). Leverage `thank{}` to make a statement of originality together with any intellectual property rights agreements that you have made. The statement of originality should be worded similarly to: 'This dissertation is submitted as a requirement for the degree of Bachelor of Science at Falmouth University. It presents work conducted exclusively by the author except where indicated in the text. The report may be freely copied and distributed provided the source is acknowledged.'
- **Introduction:** This section should make clear the motivation for the project. The aims of the project should at least be stated in the first paragraph, but preferably in the first sentence. Ensure to include a road-map which explains the structure of the manuscript.
- **Body:** The content and structure of the body of your work will vary greatly depending on the nature of the project. You should not have a section called body. Instead, this should be broken down into any number of appropriate sections. For example: literature review; requirements analysis and specification; design of the research artefact; implementation; research methodology; method of evaluating the research artefact (including how you validated and verified the integrity of your artefact); and findings. For empirical research, ensure that you include clearly identifiable sections that highlight: research questions; hypotheses; study design; results; data analysis; and a discussion that interprets and contextualises your discoveries. Consult your supervisor to develop an appropriate structure for your work.
- **Professional Considerations:** Do not neglect the need to acknowledge the ethical and/or professional issues raised by your work. This is an opportunity to refer to the Codes of Conduct published by the BCS and other professional bodies. Ensure that you also acknowledge any provisions that you incorporated into your methodology on ethical grounds.
- **Conclusion:** Make clear your discoveries and the key take-away points your research. Highlight any important results. If your discoveries contribute to discourse in your field of study then ensure you have explicitly stated what these contributions are and how they do so. Also, ensure that you make clear the implications of your work and if you have derived any recommendations from your results, then explicitly state these also.
- **Acknowledgements:** It is important to declare those who supported your research: your supervisor(s); other students if part of a related project; and any other person or organisation that has helped you at all.
- **References:** There is no room for error. IEEE-style references with 100% accuracy is required. Zero

tolerance. Sources should be cited in the body of your report where appropriate. This includes web pages, which historically have been cited incorrectly by many students.

- **Appendices:** you should include your project logs and any additional relevant system or test data as appendices. You may also include any technical material which you estimate as too detailed for the main body of the report. You should make sure that any technical material is appropriately annotated and consistently presented. The source code of your project (including documentation) must be submitted electronically and should not be included in the Appendix. Also, any material that does not fit in the report's Appendix that you nevertheless deem important can be included in the electronic submission. Note, however, that it will be left to the markers' discretion whether they wish to look at such extra material in the electronic submission.
- **Reflective Addendum:** Please do not forget to include an appendix in which you evaluate your final year project. This is your opportunity to reflect on what went well and what went wrong. No project will have been executed to perfection. So long as you identify and acknowledge mistakes, showing that you learned from them, you can mitigate any of the issues. Also you should consider, in hindsight, what you would do differently to avoid such issues in the future. It is important to be critical in these self-reflections. It is **not** a description or a diary. It must be both **analytical and evaluative**. These will be assessed on a holistic basis than your CPD reports, according to the same principles and similar criteria.

Chapter 3

Assignment Structure for COMP320

Introduction

You are required to deliver a major **research project** as part of your degree; either in the form of **empirical research** relating to computing for games, or **practice-based research** related to game development. Individually, you explore a field that interests you, and for which there is a clearly identified need. This module forms the first part of this project and provides the opportunity to conduct a literature review, as well as to collect and analyse data using appropriate methods and statistics.

These assignments are formed of several parts:

- (A) **Complete** an Application for Research Ethics Approval form, which will:
 - (i) **briefly propose** the research to be undertaken in your project
 - (ii) **outline** any potential ethical issues around your proposed work, particularly with respect to research involving human subjects

Note that you *must* complete and submit Part A before carrying out any experimental work.
- (B) **Deliver** an 8-minute presentation that will:
 - (i) **explain** the context of your project
 - (ii) **identify** and **discuss** the scientific literature relevant to your project
 - (iii) **propose** one or more research questions for your project
- (C) **Write** a draft research review and proposal that will:
 - (i) **identify** and **analyse** the scientific literature relevant to your project
 - (ii) **propose** one or more research questions for your project
 - (iii) **justify** your choice of research question(s) and how they will contribute to the state of knowledge
 - (iv) **outline** and **justify** the methodology to be used in addressing the research question(s)
 - (v) **present** any preliminary results you have obtained so far
- (D) **Write** a final research review and proposal that will:
 - (i) **address** any issues raised in Part (C)
- (E) **Produce** a prototype research artefact that will:
 - (i) **facilitate** the collection of empirical data for your project
 - (ii) **demonstrate** the technical feasibility of your proposed artefact
 - (iii) **provide** a basis for further development and experimentation in the second study block
- (F) **Deliver** a 15-minute presentation that will:
 - (i) **summarise** the context and research question(s) of your project
 - (ii) **outline** and **justify** the methodology to be used in addressing the research question(s)
 - (iii) **present** any preliminary results you have obtained so far

Assignment Setup

These assignments form a **research task**, consisting of **academic reading**, **academic writing**, **software development** and **scientific experimentation**.

For the **prototype research artefact**, there is no set GitHub repository. However you are strongly encouraged to create one. Ensure that you set up the `.gitignore` file for your chosen development environment, and maintain the `readme.md` file.

For the **research review and proposal**, fork the GitHub repository at the following URL:

<https://github.com/Falmouth-Games-Academy/comp320-proposal>

Use the existing LaTeX template, which is based on the IEEE Transactions style, to write your literature review and proposal.

Part A

Part A consists of a **single formative submission**. This work is **individual** and will be assessed on a **threshold** basis.

To complete Part A, download the Research Ethics Approval Application Form from the COMP320 area on LearningSpace. Complete the form in consultation with your project supervisor. Note that you will need to write a (brief) research proposal for this form.

Print and sign the form, and hand it to your supervisor for approval.

Important: carrying out **any** experimental work without first completing Part A is a breach of Falmouth University's Research Ethics Policy. This will be treated as a case of academic misconduct, and penalised accordingly.

Part B

Part B consists of a **single formative submission**. This work is **individual** and will be assessed on a **threshold** basis. To pass, answer the following questions:

- (i) What is the context of your project? How does it fit into the research field of computing for games?
- (ii) What are the key results from the literature upon which your project will be built?
- (iii) What is the current state of knowledge in the field? What are the open questions and challenges?
- (iv) What is (are) the key research question(s) that you will seek to answer in your project?

To complete Part B, prepare a short (8-minute) presentation and deliver it in the scheduled session in week 7. Prepare your slides using your choice of presentation software (e.g. Beamer, reveal.js, PowerPoint).

Part C

Part C consists of a **single formative submission**, however your project supervisor may also set additional **formative submissions** at their discretion. This work is **individual** and will be assessed on a **threshold** basis.

To complete Part C, use the provided LaTeX template to write a literature review and proposal. Do **not** modify the formatting of the provided template. You are advised to bear in mind the page limit specified for Part D and attempt to adhere to it at this stage, however you will **not** be penalised for failing to do so.

Push your document to GitHub and open a pull request in advance of the scheduled peer review session.

You will receive immediate **informal feedback** from tutor and peers.

Part D

Part D consists of a **single summative submission**, however your project supervisor may also set additional **formative submissions** at their discretion. This work is **individual** and will be assessed on a **holistic** basis, according to the descriptors set out at the end of this document.

To complete Part D, revise your document from Part C to address any issues highlighted during the peer review. Your document must not exceed **six pages** of text, excluding figures, tables, references and appendices. This is subject to the usual policy on word and page limits available on LearningSpace.

Upload your final .pdf file to the LearningSpace. Note that LearningSpace will only accept a single .pdf file.

You will receive immediate and continuous **informal feedback** through meetings with your supervisor. You will also receive **formal feedback** three weeks after the formative deadline.

Part E

Part E consists of a **single summative submission**, however your project supervisor may also set additional **formative submissions** at their discretion. This work is **individual** and will be assessed on a **threshold** basis.

To complete Part E, design and implement a piece of research software appropriate to your chosen project. Create a Trello board setting out the key requirements for the software, and identifying which requirements will be tackled this study block and which are stretch goals to be left until later. Check the source code into a version control repository regularly. Ensure your `readme.md` file contains any information required to build and run the artefact, if appropriate.

Upload a `.zip` file containing your source code, associated assets, and screenshots of your Trello board to the LearningSpace. Note that LearningSpace will only accept a single `.zip` file.

You will receive immediate and continuous **informal feedback** through meetings with your supervisor. You will also receive **formal feedback** three weeks after the formative deadline.

Part F

Part F consists of a **single formative submission**. This work is **individual** and will be assessed on a **threshold** basis. To pass, answer the following questions:

- (i) What is (are) the key research question(s) that you will seek to answer in your project?
- (ii) How will answering these questions contribute to the state of knowledge in the field of your project?
- (iii) What methodology will you use to seek answers to these questions? Justify your methodology.
- (iv) What preliminary results have you obtained?

To complete Part F, prepare a short (15-minute) presentation and deliver it in the scheduled session in week 13. Prepare your slides using your choice of presentation software (e.g. Beamer, reveal.js, PowerPoint).

FAQ

- **What is the deadline for this assignment?**

Falmouth University policy states that deadlines must only be specified on the MyFalmouth system.

- **What should I do to seek help?**

You can email your tutor for informal clarifications. For informal feedback, make a pull request on GitHub.

- **Is this a mistake?**

If you have discovered an issue with the brief itself, the source files are available at:

<https://github.com/Falmouth-Games-Academy/bsc-assignment-briefs>.

Please make a pull request and comment accordingly.

Chapter 4

Assignment Structure for COMP360

Introduction

These assignments form the second part of your **major research project**; whether **empirical research** relating to computing for games, or **practice-based research** in game development. It is your opportunity to collect and analyse primary data and prepare a manuscript to disseminate your findings.

Together, they are formed of several parts:

- (A) **Complete** your research artefact, ensuring that you:
 - (i) **apply** a rigorous software project management approach;
 - (ii) and **follow** best practices in software engineering.
- (B) **Collect** data relating to your research question, ensuring that you:
 - (i) **apply** a rigorous research method;
 - (ii) **leverage** your research artefact appropriately;
 - (iii) and **conform** with all ethical requirements.
- (C) **Deliver** a 20-minute presentation that will:
 - (i) **analyse and synthesise** your findings.
- (D) **Write** a 12-page academic dissertation in IEEE format that will:
 - (i) **identify** and **review** the scientific literature relevant to your project;
 - (ii) **outline and justify** one or more research questions;
 - (iii) **outline and justify** the methodology that was applied in addressing the research question(s);
 - (iv) **analyse** data you have obtained;
 - (v) as well as **interpret and discuss** your findings.
- (E) **Prepare** the final dissertation **and** addendum in IEEE format that will:
 - (i) **address** any issues raised through peer-review;
 - (ii) **and evaluate** the outcome of the project.
- (F) **Deliver** a 20-minute presentation that will:
 - (i) **showcase** the final research artefact;
 - (ii) and **defend** the claims made in the academic dissertation.

Assignment Setup

These assignments form a **research task**, consisting of **academic reading**, **academic writing**, **software development**, and **scientific experimentation**.

For the **prototype research artefact**, there is no set GitHub repository. However you are strongly encouraged to create one. Ensure that you set up the `.gitignore` file for your chosen development environment, and maintain the `readme.md` file.

For the **research dissertation**, continue using the GitHub repository at the following URL:

<https://github.com/Falmouth-Games-Academy/comp320-comp360-dissertation>

Use the existing LaTeX template, which is based on the IEEE Transactions style, to write your dissertation.

Part A

Part A consists of a **single summative submission**. However, your supervisor may set additional **formative submissions** at their discretion. This work is **individual** and will be assessed on a **holistic** basis, according to the descriptors set out at the end of this document.

To complete Part A, implement your research artefact and show it to your research supervisor in a timetabled meeting. As the requirements for the research artefact will vary by project, consult with your supervisor to verify whether or not the artefact is adequate for the desired purpose.

You will receive immediate **informal feedback** from your supervisor.

Then, upload a .zip file containing the final version of your source code and any assets/dependencies to the LearningSpace. Note that LearningSpace will only accept a single .zip file.

You will receive **formal feedback** three weeks after the summative deadline.

Part B

Part B consists of a **single formative submission**. This work is **individual** and will be assessed on a **threshold** basis.

To complete Part B, collect data and codify it into a digital dataset. Show this to your research supervisor in a timetabled meeting. As the research questions and methods will vary, consult with your supervisor to verify whether or not the data is adequate for the desired purpose.

You will receive immediate **informal feedback** from your supervisor.

Important: Carrying out **any** data collection or experimental work without first securing ethical approval is a breach of Falmouth University's Research Ethics Policy. This will be treated as a case of academic misconduct, and penalised accordingly.

Part C

Part C consists of a **single formative submission**. This work is **individual** and will be assessed on a **threshold** basis. To pass, answer the following questions:

- (i) What is (are) the key research question(s) that you will seek to answer in your project?
- (ii) How will answering these questions contribute to the state of knowledge in the field of your project?
- (iii) Why have you applied particular methods in seeking answers to these questions?
- (iv) What results have you obtained?
- (v) How have you analysed and interpreted these results?
- (vi) What are you likely to conclude on the basis of this research?
- (vii) What are the potential implications of your discoveries?

To complete Part C, prepare a 20-minute presentation and deliver it in the scheduled session. Prepare your slide-deck using your choice of presentation software (e.g. Beamer, reveal.js, PowerPoint). You may extend your existing slides from COMP320, but must incorporate new material and new findings.

You will receive immediate **informal feedback** from your tutors.

Part D

Part D consists of a **single formative submission**. However, your supervisor may set additional **formative submissions** at their discretion. This work is **individual** and will be assessed on a **threshold** basis.

To complete Part D, prepare a draft of the dissertation. This should *build upon* and *extend* your research proposal and literature review. As such, overlap with the COMP320 submission is expected. However, there should be new material. Use the provided LaTeX template and do **not** modify the formatting. Bring these to meetings with your supervisor.

You will receive immediate **informal feedback** from your supervisor.

Then, bring **two physical print-outs** of your dissertation to the timetabled peer-review session. You are advised to consider the specified page limit and attempt to adhere to it at this stage; although, you will **not** be penalised at this point for failing to do so. Also, ensure you also bring pens and highlighters.

You will receive immediate **informal feedback** from peers and *in the following week* a **meta-review** from tutors.

Part E

Part E consists of a **single summative submission**. However, your supervisor may set additional **formative submissions** at their discretion. This work is **individual** and will be assessed on a **holistic** basis, according to the descriptors set out at the end of this document.

To complete Part E, revise your manuscript to address any issues highlighted during the peer review. Your document must not exceed **twelve pages** of text, excluding figures, tables, references and appendices. This is subject to the policy on word and page limits available on the LearningSpace course page.

As an addendum to the research manuscript, an appendix containing at most one-page of critical reflection and self-evaluation should be incorporated. This should be a critical appraisal of the project, indicating the rationale for any key decisions, lessons learnt, and evaluation (with hindsight) of the process and outcome of the project.

Upload your final .pdf file to the LearningSpace. Note that LearningSpace will only accept a single .pdf file.

You will receive **formal feedback** three weeks after the formative deadline.

Part F

Part F consists of a **single formative submission**. This work is **individual** and will be assessed on a **threshold** basis. To pass, answer the following questions:

- (i) What was the purpose of your research?
- (ii) How did you approach the research?
- (iii) What did you discover?
- (iv) What are the implications of your findings?

To complete Part F, prepare a 20-minute presentation in the timetabled session after the submission deadline. Prepare your slides using your choice of presentation software (e.g. Beamer, reveal.js, PowerPoint).

You will receive immediate **informal feedback** from tutors.

FAQ

- **What is the deadline for this assignment?**
Falmouth University policy states that deadlines must only be specified on the MyFalmouth system.
- **What should I do to seek help?**
You can email your tutor for informal clarifications. For informal feedback, make a pull request on GitHub.
- **Is this a mistake?**
If you have discovered an issue with the brief itself, the source files are available at:
<https://github.com/Falmouth-Games-Academy/bsc-assignment-briefs>.
Please make a pull request and comment accordingly.

Additional Resources

- <http://www.bcs.org/category/6030>
- <http://www.bcs.org/content/ConWebDoc/39988>
- Turk, C. and Kirkman, J. (2001) Effective writing: improving scientific, technical and business communication. 2nd edition. London: Spon.
- Sides, C. (1999) How to write and present technical information. 3rd edition. Cambridge: Cambridge University Press.

Chapter 5

Marking Descriptors

Note that the assignments which constitute your dissertation project are **not** marked in a criterion-based fashion. Instead, your project supervisor will assign an overall grade by considering the following descriptors in relation to your project.

COMP320 Assignment 1 (Prototype Research Artefact — 30%)

| Criterion | Weight | Refer for Resubmission | Novice Competency | Novice Proficiency | Professional Competency | Professional Proficiency | Expert Competency |
|---------------------------------|--------|--|---|---|--|--|---|
| Ethics Approval | — | An ethics approval form has not been submitted. This is an automatic fail, regardless of other criteria. | Ethics approval has been sought and obtained. | | | | |
| Basic Competency Threshold | — | Part F is not completed or is unsatisfactory. | A satisfactory presentation is delivered for Part F. | | | | |
| Appropriateness of Requirements | — | Few requirements are distinguishable and easily measured. Requirements bear little correspondence to the proposed research. | Some requirements are distinguishable and easily measured. Requirements somewhat correspond to the proposed research. | Most requirements are distinguishable and easily measured. Requirements correspond to the proposed research. | Nearly all requirements are distinguishable and easily measured. Requirements clearly correspond to the proposed research. | All requirements are distinguishable and easily measured. Requirements clearly and comprehensively correspond to the proposed research. | All requirements are distinguishable and easily measured. Requirements clearly and comprehensively correspond to the proposed research. |
| Functional Coherence | — | Few features have been implemented, or the code fails to compile and run. Many obvious and serious bugs are detected. | Some features have been implemented. Some obvious bugs are detected. | Many features have been implemented. There is some evidence of feature creep. Few obvious bugs are detected. | Almost all features have been implemented. There is little evidence of feature creep. Some minor bugs are detected. | All features have been implemented. There is almost no evidence of feature creep. Some bugs, purely cosmetic and/or superficial in nature, are detected. | All features have been implemented. There is no evidence of feature creep. Few to no bugs are detected. |
| Sophistication | — | Little insight into the appropriate use of programming constructs is evident from the source code. The program structure is poor or non-existent. | Some insight into the appropriate use of programming constructs is evident from the source code. The program structure is adequate. | Much insight into the appropriate use of programming constructs is evident from the source code. The program structure is appropriate. | Considerable insight into the appropriate use of programming constructs is evident from the source code. The program structure is effective. There is high cohesion and low coupling. | Significant insight into the appropriate use of programming constructs is evident from the source code. The program structure is very effective. There is high cohesion and low coupling. | Extensive insight into the appropriate use of programming constructs is evident from the source code. The program structure is extremely effective. There is very high cohesion and very low coupling. |
| Maintainability | — | The code is only sporadically commented, if at all, or comments are unclear. Few identifier names are clear or inappropriate. Code formatting hinders readability. | The code is somewhat well commented. Some identifier names are descriptive and appropriate. An attempt has been made to adhere to a consistent formatting style. There is little obvious duplication of code or of literal values. | The code is reasonably well commented. Most identifier names are descriptive and appropriate. Most code adheres to a sensible formatting style. There is almost no obvious duplication of code or of literal values. | The code is reasonably well commented. Almost all identifier names are descriptive and appropriate. Almost all code adheres to a sensible formatting style. There is no obvious duplication of code or of literal values. | The code is very well commented. All identifier names are descriptive and appropriate. All code adheres to a sensible formatting style. There is no obvious duplication of code or of literal values. | The code is extremely well commented. All identifier names are descriptive and appropriate. All code adheres to a sensible formatting style. There is no duplication of code or of literal values. |

COMP320 Assignment 2 (Research Review and Proposal — 70%)

| Criterion | Weight | Refer for Resubmission | Novice Competency | Novice Proficiency | Professional Competency | Professional Proficiency | Expert Competency |
|---|--------|--|--|--|--|--|---|
| Ethics Approval | — | An ethics approval form has not been submitted. This is an automatic fail, regardless of other criteria. | Ethics approval has been sought and obtained. | | | | |
| Basic Competency Threshold | — | Parts B and C are not completed or are unsatisfactory. Referencing of sources is unsatisfactory. | A satisfactory presentation is delivered for Part B. The student participates in the peer review activity for Part C, with enough work present for a meaningful review. Sources are referenced, with no obvious errors or omissions. | | | | |
| Breadth of literature review | — | The literature review is missing or unsatisfactory. Many key sources are omitted. | The literature review falls far short of comprehensive. There are many obvious omissions. | The literature review falls short of comprehensive. There are some obvious omissions. | The literature review is somewhat comprehensive. There are few obvious omissions. | The literature review is very comprehensive. There are very few obvious omissions. | The literature review is extremely comprehensive. There are no obvious omissions. |
| Depth of insight | — | Little insight is demonstrated. Papers are summarised in the student's own words. | Some insight is demonstrated. Attempts are made at discussion beyond summary. | Much insight is demonstrated. Discussion is inferential in nature. | Considerable insight is demonstrated. Discussion is analytical in nature. | Significant insight is demonstrated. Discussion is analytical and evaluative in nature. | Extensive insight is demonstrated. Discussion is analytical and evaluative in nature. |
| Specificity, verifiability & accuracy of claims | — | Few claims have a clear source of evidence. Significant errors and/or misinterpretations. | Some claims have a clear source of evidence. Many errors and/or misinterpretations. | Many claims have a clear source of evidence. Some errors and/or misinterpretations. | Most claims have a clear source of evidence. Few errors and/or misinterpretations. | All claims have a clear source of evidence. Almost no errors and/or misinterpretations. | All claims have a clear source of evidence. No errors and/or misinterpretations. |
| Quality of research question(s) | — | Research questions are absent or not satisfactory. | Research questions show basic understanding of the field. Research questions are unambitious or unoriginal. | Research questions show strong understanding of the field. Research questions are original. | Research questions show some insight into the field. Research questions are original and ambitious. | Research questions show much insight into the field. Research questions are original, ambitious and timely. | Research questions show significant insight into the field. Research questions are at the cutting edge of the field. |
| Methodology | — | Methodology is not specified, not justified, or either of these is unsatisfactory. | The proposed methodology is somewhat plausible. The justification is not very convincing. | The proposed methodology is plausible. The justification is somewhat convincing. | The proposed methodology is sound. The justification is convincing. | The proposed methodology is very sound. The justification is very convincing. | The proposed methodology is extremely sound. The justification is extremely convincing. |

COMP360 Assignment 1 (Research Artefact — 30%)

| Criterion | Weight | Refer for Resubmission | Novice Competency | Novice Proficiency | Professional Competency | Professional Proficiency | Expert Competency |
|------------------------------------|--------|--|--|---|--|---|--|
| Ethics Approval & Academic Conduct | — | Ethical approval not obtained or evident lack of academic integrity. | Ethics approval has been sought and obtained. Academic conduct is acceptable. | | | | |
| Novice Competency Threshold | — | Any criterion not achieved at the novice competency. | Research artefact is relevant and satisfactory. All novice competency criteria are met. | | | | |
| Requirements | — | | Some requirements are distinguishable and easily measured. Requirements somewhat correspond to the proposed research. | Most requirements are distinguishable and easily measured. Requirements correspond to the proposed research. | Nearly all requirements are distinguishable and easily measured. Requirements clearly correspond to the proposed research. | All requirements are distinguishable and easily measured. Requirements clearly and comprehensively correspond to the proposed research. | All requirements are distinguishable and easily measured. Requirements clearly and comprehensively correspond to the proposed research. |
| Functional Coherence | — | | Some useful and relevant features have been implemented. Some obvious bugs are detected. | Many useful and relevant features have been implemented. There is some evidence of feature creep. Few obvious bugs are detected. | Almost all pertinent features have been implemented. There is little evidence of feature creep. Some minor bugs are detected. | All pertinent features have been implemented. There is almost no evidence of feature creep. Some bugs, purely cosmetic and/or superficial in nature, are detected. | All pertinent features have been implemented. There is no evidence of feature creep. Few to no bugs are detected. |
| Sophistication | — | | Some insight into the appropriate use of programming constructs is evident from the source code. The program structure is adequate. | Much insight into the appropriate use of programming constructs is evident from the source code. The program structure is appropriate. | Considerable insight into the appropriate use of programming constructs is evident from the source code. The program structure is effective. | Significant insight into the appropriate use of programming constructs is evident from the source code. The program structure is highly effective, with high cohesion and low coupling. | Extensive insight into the effective use of programming constructs is evident from the source code. The program structure is impressive, with very high cohesion and low coupling. |
| Maintainability | — | | The code is somewhat well commented. Some identifier names are descriptive and appropriate. Most code adheres to a sensible formatting style. There is little obvious duplication of code or of literal values. | The code is reasonably well commented. Most identifier names are descriptive and appropriate. Most code adheres to a sensible formatting style. There is almost no obvious duplication of code or of literal values. | The code is reasonably well commented. Almost all identifier names are descriptive and appropriate. Almost all code adheres to a sensible formatting style. There is no obvious duplication of code or of literal values. | The code is very well commented. All identifier names are descriptive and appropriate. All code adheres to a sensible formatting style. There is no obvious duplication of code or of literal values. | The code is extremely well commented. All identifier names are descriptive and appropriate. All code adheres to a sensible formatting style. There is no duplication of code or of literal values. |
| Validation & Verification | — | | Some evidence of source code validation and verification. Basic unit testing is evident. | Much evidence of source code validation and verification. Basic unit testing is evident, with much coverage. | Considerable evidence of source code validation and verification. Sophisticated unit testing is evident, with considerable coverage. Appropriate testing techniques beyond unit testing have been applied, with some effectiveness at improving integrity/quality. | Significant evidence of source code validation and verification. Sophisticated unit testing is evident, with considerable coverage. Appropriate testing techniques beyond unit testing have been applied, with much effectiveness at improving integrity/quality. | Extensive evidence of source code validation and verification. Sophisticated unit testing is evident, with significant coverage. Innovative or cutting-edge testing techniques have been applied, with considerable rigor. |

COMP360 Assignment 2 (Dissertation — 70%)

| Criterion | Weight | Refer for Resubmission | Novice Competency | Novice Proficiency | Professional Competency | Professional Proficiency | Expert Competency |
|------------------------------------|--------|--|--|---|---|--|---|
| Ethics Approval & Academic Conduct | — | Ethical approval not obtained or evident lack of academic integrity. | Ethics approval has been sought and obtained. Academic conduct is acceptable. | | | | |
| Novice Competency Threshold | — | Any criterion not achieved at the novice competency. | Satisfactory presentations are delivered. Adequate participation in peer review exercises, with enough to enable meaningful review alongside critical and constructive comments provided to peers. All novice competency criteria are met. An appropriate number of academic sources are referenced. All academic sources are referenced appropriately, with no obvious errors or omissions. All important claims are well-specified, verifiable, and accurate. | | | | |
| Abstract | — | | A general overview of the dissertation is provided. There is some structure. | A concise, but targeted summary of key points in the dissertation is provided. There is much structure. | A concise, but highly targeted outline of the purpose and key claims made in the dissertation is provided. The abstract broadly incorporates and follows the OCAR elements. | A concise, but highly targeted outline of the relevant academic discourse and potential contributions made in the dissertation is provided. The abstract incorporates and follows the OCAR elements. | A concise, but impressively highlighted gap in the literature and outline of intellectual contributions made in the dissertation to plug that gap is provided. The abstract incorporates and follows the OCAR elements. The key contribution of the dissertation is made clear in the abstract. |
| Introduction | — | | Introduction has much structure. The field of research is somewhat contextualised. | Introduction has much structure. The field of research is somewhat contextualised and motivated. | Introduction has considerable structure. The motivation for the research is somewhat justified. | Introduction has considerable structure. The motivation for the research is clearly justified. | Introduction has significant structure. The potential impact of the research is justified effectively. |
| Literature Review | — | | The literature review falls short of being comprehensive, but has some merit. Synthesis is adequate, hinting at a need for the work. | The literature review falls short of comprehensive, but has much merit. Synthesis is appropriate, highlighting a need for the work. | The literature review is somewhat comprehensive, having considerable merit. Synthesis is effective, criticising existing work to reveal a gap. | The literature review is comprehensive, having significant merit. Synthesis is effective, criticising existing work to reveal a key gap. | The literature review is comprehensive, incorporating all important seminal and contemporary works. Synthesis is highly effective, critically evaluating existing work to showcase an important gap. |
| Research Questions & Hypotheses | — | | Research questions suggest a basic understanding of concepts and principles in the field. | Research questions suggest a broad understanding of concepts and principles in the field. Research questions are original. Where relevant, hypotheses are made clear. | Research questions suggest a thorough understanding of the field as well as some insight into its discourse. Research questions are original and ambitious. Where relevant, hypotheses are made explicit, clear, and well-formed. | Research questions suggest a thorough understanding of the field as well as much insight into its discourse. Research questions are original, ambitious, and timely. Where relevant, hypotheses are made explicit, clear, and well-formed. | Research questions suggest an comprehensive understanding of the field as well as significant insight into its discourse. Research questions are at the cutting edge of the field. Where relevant, hypotheses are stated explicitly with precision. |

| Criterion | Weight | Refer for Resubmission | Novice Competency | Novice Proficiency | Professional Competency | Professional Proficiency | Expert Competency |
|-------------------------|--------|------------------------|--|--|---|--|---|
| Methodology | — | | The methodology applied could plausibly lead to a somewhat meaningful claim. Methods are justified. | The methodology applied could plausibly lead to a meaningful claim. The methodology and integrity of the research are justified. | The applied methodology is scientifically rigorous, and potentially able to lead to a sound claim. The methodology and integrity of the research justified somewhat convincingly. | The applied methodology is scientifically rigorous, and quite likely to lead to a sound claim. The methodology and integrity of the research justified convincingly. | The applied methodology is extremely scientifically rigorous, perhaps a gold standard, and highly likely to lead to a sound claim. The methodology and integrity of the research are justified very convincingly. |
| Results & Analysis | — | | The results and their analysis is basic. | The results and their analysis approach sophistication. The method of analysis is appropriate to the project. | The results and their analysis are somewhat sophisticated and reflect good practice. The method of analysis is appropriate to the project. | The results and their analysis are highly sophisticated and reflect good practice. The method of analysis is suited and tailored to the project. Some care has been taken to guard against potential criticisms of the analysis and its assumptions. The analysis shows progress towards publishable quality. | The results and their analysis are very highly sophisticated and could be considered best practice. The method of analysis is not only suited and tailored to the project. Much care has been taken to guard against potential criticisms of the analysis and its assumptions. The results and analysis is of publishable quality. |
| Discussion & Conclusion | — | | Some insight into the topic is evident. Attempts are made at discussion beyond summary. | Much insight into the topic is evident. Discussion is inferential in nature. Key take-away points can be inferred from the work. | Considerable insight into the topic is evident. Discussion is analytical in nature. The limitations of the research are made clear. Key take-away points are made clear in the conclusion. | Significant insight into the topic is evident. Discussion is both analytical and evaluative in nature. The limitations of the research are made explicitly clear. Meaningful take-away points are made clear in the conclusion. There might be recommendations. | Extensive insight into the topic is evident. Discussion is both analytical and evaluative in nature. The limitations of the research have been thought through well, with their mitigation and/or acknowledgement made explicitly clear. Meaningful contributions to discourse in the field are made clear in the conclusion alongside key recommendations/impact. |
| Critical Evaluation | — | | Some relevant and critical self-appraisal. | Much relevant and critical self-appraisal. Outcomes and lessons learned are made clear, and loosely tied to goals to improve. | Considerable self-appraisal which is both relevant and critical in nature. Outcomes and lessons learned are analysed and tied to somewhat well-formed SMART objectives. | Significant self-appraisal which is both pertinent and critical in nature. Outcomes and lessons learned are analysed in much depth and clearly tied to well-formed SMART objectives. | Extensive self-appraisal which is both pertinent and critical in nature. Outcomes and lessons learned are analysed in considerable depth and tied explicitly to well-formed SMART objectives. Evaluation of the project leads to recommendations that others could leverage to improve their research. |

Appendix A

British Computer Society Requirements

An individual project is an expectation within undergraduate, integrated masters, and postgraduate masters programmes in computing. Students must be provided with written guidance on all aspects of the project, including selection, conduct, supervision, milestones, format of the report and the criteria for assessment. All projects should reflect the aims and learning outcomes which characterise the programme to which they contribute as set out in the programme specification.

It is expected that within an undergraduate programme, students will undertake a major computing project, normally in their final year and normally as an individual activity, giving them the opportunity to demonstrate:

- their ability to apply practical and analytical skills present in the programme as a whole
- innovation and/or creativity
- synthesis of information, ideas and practices to provide a quality solution together with an evaluation of that solution
- that their project meets a real need in a wider context
- the ability to self-manage a significant piece of work
- critical self-evaluation of the process

Projects must involve the production of a report which should include:

- Elucidation of the problem and the objectives of the project
- an in-depth investigation of the context and literature, and where appropriate, other similar products (this section is likely to be emphasised less for an IEng project)
- where appropriate, a clear description of the stages of the life cycle undertaken
- where appropriate, a description of how verification and validation were applied at these stages
- where appropriate, a description of the use of tools to support the development process
- a critical appraisal of the project, indicating the rationale for any design/implementation decisions, lessons learnt during the course of the project, and evaluation (with hindsight) of the project outcome and the process of its production (including a review of the plan and any deviations from it)
- a description of any research hypothesis
- in the event that the individual work is part of a group enterprise, a clear indication of the part played by the author in achieving the goals of the project and its effectiveness
- references

In the event of this major activity being undertaken as part of a group enterprise, there is a requirement that the assessment is such that the individual contribution of each student is measured against all the above learning outcomes.

For accreditation for CITP, CEng or CSci, the individual project should be worth at least 30 credit points at level 6 or above. The project must be passed without compensation. For accreditation for IEng the individual project should be worth at least 20 credit points at level 5 or above. The project must be passed without compensation.