BSc Computing for Games
Research Dissertation Handbook

January 27, 2020

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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:

`https://www.falmouth.ac.uk/staff-profiles/?field_department_target_id_selective=34458`

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 **40 credits**, one third of the credits for your final year.

COMP320: Research Practice

In study block 1, you have one assignment consisting of two parts: a written **research review and proposal**, with a **prototype computing 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 the state-of-the-art. Within this framework, you will formulate a research question to be addressed by your project. You will also assess the ethical issues surrounding your project, and justify your proposed research methods accordingly.

Your **prototype computing 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 artefact will allow you to "hit the ground running" in study block 2. Please pay careful attention to the requirement to demonstrate the computational statistics you intend to deploy in your project, as this forms an important part of your prototype artefact.

COMP360: Research Dissertation

In study block 2, you again have one assignment, composed of two parts: a written **dissertation**; with a **computing artefact**. Each of these builds upon 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 **computing 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. It is critically important to recognise, however, that in this project you **must** demonstrate refactoring through your use of version control and design documentation and you **must** demonstrate appropriate validation, verification, and testing of your artefact. With this being the case, please pay careful attention to how you version control, test, and improve your artefact from its prototype version to the final deliverable.

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 computing 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

many weeks to write! Absolutely, under no circumstance should you attempt to leave the write-up until the end of the project a week or two before the deadline. It is simply too herculean a task to complete with sufficient rigor in a last minute deluge!

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! Justification and evidence are needed!

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 or 2-page reflective addendum that evaluates the project. The reflective addendum is **mandatory**. 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.

- **Reflective Addendum**: Please do not forget to include an appendix of at most two pages 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, according to the same principles and similar criteria to other refective writing assignments.

- **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.

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) **Identify** a project supervisor **and agree** a topic for your research, by:
  (i) **reviewing** the academic literature **in addition to** the state-of-the-art
  (ii) **and deriving** a key question or problem from the review to motivate your work

(B) **Produce** a prototype computing 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

  Note that you *must* complete and submit Part C *before* carrying out any experimental work.

(C) **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

(D) **Incorporate** computational statistics into your prototype computing artefact, indicating how you will:
  (i) **collect, analyse, and present** data relevant to your research

(E) **Deliver** a 10-minute practice 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
  (iv) **articulate** the ethical considerations you have made
  (v) **illustrate** your approach to collecting, analysing, and presenting data

(F) **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) **justify** the methodology to be used in addressing the research question(s)
  (v) **outline** the key legal, social, ethics, and professional considerations
  (vi) **present** your data analysis approach **and** any preliminary results

(G) **Write** a final research review and proposal that will:
  (i) **address** any issues raised in Part (F)

(H) **Deliver** a 10-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) **assess** legal, social, ethical, and professional issues
  (iv) **present** any preliminary results you have obtained so far, **emphasising** your approach to data collection, analysis, and presentation

Assignment Setup

These assignments form a **research** task, consisting of **literature review**, **academic writing**, **software development** and **scientific experimentation**. For the **research proposal** with **prototype computing artefact**, there are no set GitHub repositories. You will instead use BitBucket repositories based at Falmouth University.

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

`https://gamesgit.falmouth.ac.uk/scm/fyp/dissertation.git`

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

For the **prototype computing artefact**, fork the BitBucket repository at the following URL:

`https://gamesgit.falmouth.ac.uk/scm/fyp/computing-artefact`

You are strongly encouraged to use this repository in order to demonstrate your refactoring process. Ensure that you set up the `.gitignore` file for your chosen development environment, and maintain the `readme.md` file with design documentation appropriate to your project. Select an suitable license for your work.

Part A

Part A consists of a **single formative submission** early in academic year, by a date agreed with your supervisor. This work is **individual** and will be assessed on a **threshold** basis.

To complete Part A, email your chosen supervisor and agree a topic for your proposal within the area of that supervisor's expertise. Then, email confirmation of that agreement to the module leader.

You will receive immediate and continuous **informal feedback** through timetabled weekly meetings with your supervisor.

Part B

Part B consists of a **multiple formative submissions**, set at the discretion of your project supervisor based on agreed milestones and the nature of your proposed project. This work is **individual** and will be assessed on a **threshold** basis.

To complete Part B, design and implement a computing artefact appropriate to your chosen project. Create a task board setting out the key requirements for the system, 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 as well as relevant design documentation (including relevant UML diagrams).

You will not directly submit this work. Instead, your supervisor will track your work on the BitBucket server.

You will receive immediate and continuous **informal feedback** through meetings with 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 complete Part C, download the Research Ethics Approval Application Form from the 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.

You will receive immediate **informal feedback** from your supervisor and a **decision** after the ethics committee have convened, according to the academic calendar.

Part D

Part D consists of a **multiple formative submissions**, set at the discretion of your project supervisor based on agreed milestones and the nature of your proposed project. This work is **individual** and will be assessed on a **threshold** basis.

To complete Part D, incorporate computational statistics into the repository of your prototype computing artefact. It is anticipated that you will write `R` code or `NumPy` code (or similar) to support your use of data in your project. Ensure your `readme.md` file contains any information required to build and execute your statistical tests.

If you have not yet conducted a pilot study, it is advisable to generate sample data through simulation so that you can prepare your data analysis and presentation techniques.

You will receive immediate and continuous **informal feedback** through meetings with your supervisor.

Part E

Part E 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?
(v) What are the key legal, social, ethical, and/or professional issues associated with your project?

To complete Part E, prepare a short presentation and deliver it in the scheduled session in week 11. Prepare your slides using your choice of presentation software (e.g. Beamer, reveal.js, PowerPoint).

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

Part F

Part F 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 F, use the provided LaTeX template to write a literature review and proposal. Then, attend the relevant session in week 12.

Do **not** modify the formatting of the provided template. You are advised to bear in mind the page limit and attempt to adhere to it at this stage, however you will **not** be penalised for failing to do so. Please also ensure that you include a clear link to your git repo somewhere in the document.

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

Part G

Part G 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 G, revise your document from Part E to address any issues highlighted during the peer review. Also, incorporate references to the data analysis approaches that you intend to deploy (as per Part F). 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.

Please ensure that you include a clear link to your git repo somewhere in the document.

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

You will receive **informal feedback** through a meetings with your supervisor. You will also receive **formal feedback** three weeks after the deadline.

Part H

Part H 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 H, prepare a short 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).

You will receive immediate **informal feedback** from a panel of academics. You will also receive **formal feedback** three weeks after the deadline.

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 computing artefact, ensuring that you:
  (i) **apply** a rigorous software project management approach;
  (ii) **follow** best practices in software engineering;
  (iii) **and clearly demonstrate** validation, verification, testing, and refactoring;

(B) **Conduct** the research required to answer 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 10-minute presentation that will:
  (i) **analyse and synthesise** your findings.

(D) **Write** a draft 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** appendicies in IEEE format that will:
  (i) **address** any issues raised through peer-review;
  (ii) **attach** the `R` code used to analyse the data;
  (iii) **evaluate** the outcome of the project through a reflective addendum;
  (iv) **and clearly demonstrate** the way you validated, verified, and tested your computing artefact;

(F) **Deliver** a 10-minute presentation that will:
  (i) **showcase** the final computing artefact;
  (ii) and **defend** the claims you have made in the academic dissertation.

Assignment Setup

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

Please continue to use the BitBucket repositories that you setup earlier, having forked:

```
https://gamesgit.falmouth.ac.uk/scm/fyp/dissertation.git
```

```
https://gamesgit.falmouth.ac.uk/scm/fyp/computing-artefact
```

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 adequete 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 adequete 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 10-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 including: (i) an appendix containing any `R` code used for statistical data analysis; (ii) an appendix containing up to **TWO** pages of critical reflection and self-evaluation should be incorporared; (iii) an appendix containing supplementary evidence of the way the computing artefact was validated, verified, and tested.

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 10-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.

You **must** demonstrate success at every learning outcome in order to pass.

COMP320 Research Proposal with Computing Prototype

Criterion	Weight	Refer for Resubmission	Basic Competency	Basic Proficiency	Novice Competency	Novice Proficiency	Professional 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.
Data Management Plan	—	There is little to no description of how to collect, analyse, and present data.	There is an adequete description of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is described with some clarity.	There is a competent explanation of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is sensible and is described clearly. Excerpts of the data analysis code are present and described accurately.	There is a very good analysis of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is well devised and has been defined with precision. Excerpts of the data analysis code are present and are well explained.	There is an excellent evaluation of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is very well devised and has been defined in a way that supports replication. A walkthrough of the data analysis code is present and is justified.	There is an outstanding description of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is likely to lead to new insights and has been defined in a way that make it easy to replicate. A walkthrough of the data analysis code is present and is justified very well.
Artefact Test Plan	—	There is no plan to validate, verify, and test the computing artefact, or it is inadequete.	There is an adequete plan to validate, verify, and test the computing artefact.	There is a competent plan to validate, verify, and test the computing artefact.	There is a very good plan to validate, verify, and test the computing artefact.	There is a excellent plan to validate, verify, and test the computing artefact.	There is a outstanding plan to validate, verify, and test the computing artefact.

Criterion	Weight	Refer for Resubmission	Basic Competency	Basic Proficiency	Novice Competency	Novice Proficiency	Professional Competency
Ethical Considerations	—	Inadequete assessment of legal, social, ethical, and professional issues. The proposed project is not ethically sound.	There is a somewhat accurate assessment of legal, social, ethical, and professional issues. The proposed project is ethically sound, but there may be several concerns to address through the approval process.	There is an accurate assessment of legal, social, ethical, and professional issues; accompanied by a somewhat sensible analysis of key concerns. The proposed project is ethically sound, but there may be a few concerns to address through the approval process.	There is an accurate assessment of legal, social, ethical, and professional issues; accompanied by a sensible analysis of key concerns. The proposed project is ethically sound, and there a little to no concerns.	There is an accurate and comprehensve assessment of legal, social, ethical, and professional issues; accompanied by a sensible discussion of prominent concerns. The proposed project is ethically sound, and there a little to no concerns.	There is an accurate and comprehensive assessment of legal, social, ethical, and professional issues; accompanied by a deeply intellectual discussion of prominent concerns. The proposed project is ethically sound, and there a little to no concerns.

COMP360 Dissertation with Computing Artefact

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 does not meet the 'adequate' descriptor.	All criteria are at least 'adequete'. Satisfactory presentations are delivered. Adequete participation in peer review exercises, with enough to enable meaningful review alongside critical and constructive comments provided to peers. Link between the dissertation and the research artefact is clear and appropriate. An appropriate number of sources are referenced. All sources are referenced appropriately, with no obvious errors or omissions. Claims critical to the conclusion are well-specified, verifiable, and accurate. BCS requirements satisfied.				
Functional Coherence	—	The computing artefact is not deployable.	Some useful and relevant features have been implemented. Some obvious bugs are detected. The computing artefact is deployable.	Many useful and relevant features have been implemented. There is some evidence of feature creep. Few obvious bugs are detected. The computing artefact is deployable.	Almost all pertinent features have been implemented. There is little evidence of feature creep. Some minor bugs are detected. The computing artefact is deployable.	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. The computing artefact is deployable.	All pertinent features have been implemented. There is no evidence of feature creep. Few to no bugs are detected. The computing artefact is deployable.
Sophistication	—	There is little evidence of insight into programming constructs.	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	—	There is little to no 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.
Refactoring	—	There is little to no evidence of refactoring.	There is some evidence of refactoring in version control. There is a README.md file describing the state of the artefact.	There is much evidence of refactoring in version control. There is supplementary documentation in the repository describing the state of the artefact and how it has been refactored with some clarity.	There is considerable evidence of refactoring in version control. There is supplementary documentation in the repository analysing the state of the artefact and how it has been refactored with considerable clarity.	There is significant evidence of refactoring in version control. There is supplementary documentation in the repository analysing the state of the artefact and the appropriateness of its refactoring. There is evidence of bug tracking, indicating the future development of the artefact.	There is extensive evidence of refactoring in version control. There is supplementary documentation in the repository critically analysing the state of the artefact and the appropriateness of its refactoring. There is evidence of bug tracking and roadmapping further development of the artefact.

Criterion	Weight	Refer for Resubmission	Novice Competency	Novice Proficiency	Professional Competency	Professional Proficiency	Expert Competency
Abstract	—	There is no abstract, or it does not summarise the key findings.	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 does not contextualise the research and development.	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	—	Inappropriate literature review.	The literature review falls short of being comprehensive, but has some merit. Synthesis is adequete, 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	—	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.
Hypotheses	—	No hypotheses.	A set of hypotheses are implied.	Hypotheses are stated explicitly and clearly.	Hypotheses are stated explicitly and clearly, following the research question. Hypotheses are reasonably well-formed.	Hypotheses are stated explicitly and clearly, clearly decomposing the research question. Hypotheses are precise and well-formed.	Hypotheses are stated explicitly and clearly, clearly linking to the research question and the underlying literature motivating the research. Hypotheses are precise, well-formed, and related clearly to underlying statistical tests.
Computing Artefact	—	The computing artefact does not exist, or is otherwise poorly described.	The computing artefact is clearly described, and most features are distinguished from other work, and easily measured. Requirements somewhat correspond to the proposed research. The design and refactoring of the computing artefact is mentioned, with reference to relevant theories, practice, and discourse in the computing sector.	The computing artefact is clearly described with some technical detail, and nearly all features are distinguished from other work, and easily measured. Requirements correspond to the proposed research. The design and refactoring of the computing artefact is described well in technical detail, with reference to relevant theories, practice, and discourse in the computing sector.	The computing artefact is clearly described in much technical detail, and all features are distinguished from other work, and easily measured. Requirements clearly correspond to the proposed research. The design and refactoring of the computing artefact is described comprehensively, with critical reference to relevant theories, practice, and discourse in the computing sector.	The computing artefact is clearly described in considerable technical detail, and all features are distinguished from other work, and easily measured. Requirements clearly and comprehensively correspond to the proposed research. The design and refactoring of the computing artefact is analysed, with critical reference to relevant theories, practice, and discourse in the computing sector.	The computing artefact is clearly described in significant technical detail, and all features are distinguished from other work, and easily measured. Requirements clearly and comprehensively correspond to the proposed research. The design and refactoring of the computing artefact is analysed deeply, with critical reference to relevant theories, practice, and discourse in the computing sector.

Criterion	Weight	Refer for Resubmission	Novice Competency	Novice Proficiency	Professional Competency	Professional Proficiency	Expert Competency
Validation & Verification	—	There is no plan to validate, verify, and test the computing artefact, or it is inadequete. No evidence of source code validation and verification.	There is an adequete plan to validate, verify, and test the computing artefact. Some evidence of source code validation and verification. Basic unit testing is evident.	There is a competent plan to validate, verify, and test the computing artefact. Much evidence of source code validation and verification. Basic unit testing is evident, with much coverage.	There is a very good plan to validate, verify, and test the computing artefact. 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.	There is a excellent plan to validate, verify, and test the computing artefact. 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.	There is a outstanding plan to validate, verify, and test the computing artefact. 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.
Research 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.
Data Management Plan	—	There is little to no description of how to collect, analyse, and present data.	There is an adequete description of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is described with some clarity.	There is a competent explanation of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is sensible and is described clearly. Excerpts of the data analysis code are present and described accurately.	There is a very good analysis of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is well devised and has been defined with precision. Excerpts of the data analysis code are present and are well explained.	There is an excellent evaluation of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is very well devised and has been defined in a way that supports replication. A walkthrough of the data analysis code is present and is justified.	There is an outstanding description of how to collect, analyse, and present data to support the research process. The proposed use of computational statistics is likely to lead to new insights and has been defined in a way that make it easy to replicate. A walkthrough of the data analysis code is present and is justified very well.
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.

Criterion	Weight	Refer for Resubmission	Novice Competency	Novice Proficiency	Professional Competency	Professional Proficiency	Expert Competency
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 Addendum	—	Insufficient critical self-appraisal.	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 whcih is both relevant and critical in nature. Outcomes and lessons learned are analysed and tied to somewhat well-formed SMART objectives.	Significant self-appraisal whcih 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 whcih 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 recomendations that others could leverage to improve their research.
Artefact Testing Addendum	—	Insufficient evidence of testing.	Some evidence of appropriate testing of the computing artefact.	Much evidence of appropriate testing of the computing artefact.	Considerable evidence of appropriate testing of the computing artefact. Good range of different techniques used to validate, verify, and test the computing artefact.	Significant evidence of appropriate testing of the computing artefact. Very good range of different techniques used to validate, verify, and test the computing artefact.	Extensive evidence of appropriate testing of the computing artefact. Excellent range of different techniques used to validate, verify, and test the computing artefact.

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.