CS3IP: Individual Project Mark Scheme

Introduction

Given the diversity of projects carried out for this module, the mark scheme has of necessity to be quite general in nature, and based around the learning objectives set for the module: -

LO1: Ability to specify and carry out a Computer Science project of significant scope and size independently.
LO2: Ability to integrate knowledge from a variety of sources
LO3: Ability to produce a high-quality technical report describing and evaluating the outcomes of a technical endeavour
LO4: Ability in coherent demonstration and verbal exposition of own work

A primary consideration (bound up with our British Computer Society accreditation) is that the work should demonstrate at least part of the software development lifecycle in action. For the purposes of this module, the stages in the lifecycle are Requirements, Design, Implementation, Verification and Maintenance. Whilst it is easy to apply these stages to a project that produces a 'deliverable' in the shape of a piece of software, research-based projects should address at least one stage, and identify it clearly.

It is recommended that those conducting research encapsulate a conventional research paper with a narrative that indicates how they managed their research project to meet LO1.

To this end, work will be assessed according to five aspects, which are:

- contextual investigation/background research
- project process and professionalism,
- the deliverable,
- evaluation and reflection,
- exposition

Marks for any aspect will be determined by reference to a set of descriptors that relate various characteristics that the work exhibits to applicable mark ranges. The overall mark reported by an assessor will be derived from a weighted sum of the marks for the five aspects. To allow for legitimate variation in the nature and orientation of CS3IP topics, a supervisor may (within specified limits) vary the weight attached to each aspect and should share these changes with the second assessor.

How the process works

Each student will present their work to their supervisor and a second assessor (another staff member) in a 40-minute 'closed demo'. The demo forms an integral part of the assessment process. Specifically, it enables the assessors to:
(1) assess the quality, functionality, and completeness of the deliverable (contributing to the Deliverable component);
(2) evaluate the student's ability to clearly articulate, justify, and reflect on the development and outcomes of their work (contributing to the Exposition component).

The supervisor and second assessor read and mark the student's report independently, using the five aspects, and each determine a grade. They should then share the grades they have arrived at, and in discussion reach a final mark. A starting point is to average the two grades, but if they are too disparate this may not give a meaningful result: if this happens consult the Module Tutor who will ask a third assessor to read the report to settle the dispute. In extreme cases, the Examination Board may have to become involved.

1: Project Aspects

To comply with CS3IP requirements all projects must engage with the five aspects listed above, which correspond to sections of the assessment mark scheme. Depending on the project, the relative proportions and indeed the nature of the work done that falls under each aspect will vary.

1.1: Contextual Investigation/Background Research

Work in this area answers the question: *What is the project trying to achieve, why is it important and what makes it different from other work in the area?*

Essentially the student needs to explain what the problem is that they want to solve (or question that they want to answer) with their work, what has been done in that area and why their solution is better. The nature of the project will determine what is involved here. Computing for Business students may wish to state the business case for their work, indeed anyone whose work is of potential commercial value should do so to some degree. A more research-oriented project will include a review of academic literature in the area under study. A project being completed for a client (real or imaginary) can include knowledge elicitation of the domain and from the intended user base. Both the rationale for and the broad objectives of the project need to be explained in this section of the report.

1.2: Project Process and Professionalism

Work in this area answers the question: *How did the student plan to achieve the deliverable?*

This is the student's opportunity to demonstrate their project management skills as well as show their understanding of the software lifecycle. For projects involving the creation of software, a variety of formal artefacts may be produced – for example, requirements specification, use case analysis, domain model, class diagram, sequence diagrams, storyboard, navigation structure, and test plan. Similarly, for research-based or investigative projects, the process will typically involve identification of the research question or focus of investigation, experimental/study design, research tool design, and results analysis, discussion, and, where applicable, recommendations/guidelines. Critical decision making about tools and methodologies may be explained, including both the rationale for those selected and the reasons why others were discarded.

The student's Project Diary should be a great help in writing this section, as this information should be being recorded throughout the course of the project. The actual Diary may be added as an appendix to the report.

1.3: Deliverable

Work in this area answers the question: *What did the project produce*?

This refers to the actual software or research outcomes that have been produced as a result of the project work. Whilst it should be covered in the report, the work as presented at the demo is of major significance here.

For software development projects, this is the implementation of an end product, including testing and some documentation. There may be one or more prototype iterations. The aspect may include experimental application of an end product derived from the lifecycle activities.

For research-based or investigative projects, this is the analysis of results obtained from practical experimental sessions or from other investigative procedures. Typically, this will return models, recommendations, or guidelines from which clients or future researchers can benefit.

1.4: Evaluation and Reflection

Work in this area answers the question: *"How do we know if the deliverable met its goals?"*

Whilst the Project Definition Form, submitted early in the module, provides a 'jumping off point' for what the student intends to do during the course of the project, it is recognised that this may change in light of initial research. Evaluation should be based on the specification and requirements analysis for projects that produce a piece of software, assessing how well the end product meets those requirements. Research-based projects should assess how well the initial research questions or objectives have been answered by the work presented.

The Reflection component of this section allows the student to assess their performance – e.g., time management, organisation, etc. – and reflect on how they have grown as a person and as a computer science professional during the course of their project. Whilst the report should be written in formal language, using the third person, the Reflection – to accommodate its more personal nature – may be written in the first person.

This aspect embraces all activities and thought aimed at gaining a well justified summation of what the project work has achieved and what may be learned from it. Systematic, evidence-based comparison of project outcomes with objectives and broad norms of quality is fundamental. Regardless of project type, the merit of methods/approaches employed (e.g., any particular software processes and tools used, or research/investigative methods adopted) should be considered and compared with possible alternatives. Limitations of the project work achieved should be considered. Lessons learned should be outlined, along with scope for, and desirability of, further work/research. Where there is a client, wherever possible input should be obtained from the client, and an assessment made of the value that the client could derive from the project outcome.

For software development projects, the usability of an end product intended for a client, or any other form of user should be assessed.

For research-based or investigative projects, the significance of results obtained should be evaluated.

1.5: Exposition

Work in this area answers the question: *"How well was the project work presented?"*

This covers how well the student has conveyed information about and shared understanding of the project to others. The primary vehicle for doing so is the report and the student's ability to present their work orally via a well-organised presentation and demonstration as well as their competence in answering questions.

Both the organisation and structure of the report and the clarity of the language used is important. Apposite illustrations – including diagrams, screenshots, and code snippets – should be used.

Particularly in the literature review and background information sections, correct citation, quotation, and referencing should be used, and students may be penalised if this is not done. The Harvard system is preferred.

2: Grade Descriptors

The statement against the mark of 40% is intended to indicate the minimum level the work should have achieved to pass that aspect of the project.

2.1: Contextual Information/Background Research

<40%	Disordered fragmentary information, general knowledge level with little evidence of research
40%	The origins and purpose of the deliverable are coherently described. Any previous work or research that the project directly relies on is cited. Any client associated with the work is identified.
41-49%	There is evidence of an investigative element, but the outcome is presented in a purely descriptive and/or unstructured manner with little or no indication of critical thought, and/or is excessively limited in scope, having regard to the project topic.
50-59%	Related practical and/or academic work is reviewed, with some evidence of systematic and/or critical thought, with relevant references cited. Where applicable, the business context and processes of a client are set out in sufficient depth to motivate the work in general and a range of specific objectives. For research and investigative projects, aims and objectives are clearly stated. There will be a suitable description of the motivation behind the project.
60-69%	There is substantial evidence of systematic investigation and critical thought, whether in reviewing previous work/research or in pursuing business analysis or in motivating subsequent work/research, as applicable. How the results of the contextual investigation/background research relate to and influence the development of the deliverable is clearly established.
70-79%	There is evidence of both thoroughness (e.g., in attention to detail and scope) and depth of insight into the problems raised by the development of the deliverable and the range of objectives that the development pursued.
>80%	Precursor work or research is formally cited and critically reviewed, probably with some original insights that augment the motivation for the present work/research. Business analysis (where relevant) shows a detailed understanding of a client's business and the related wider business environment, with the project work placed in the context of critical review of existing processes, preferably coupled with suggestions for process improvement or new processes. Background research analysis shows a deep understanding of the research space and the related 'bigger picture', with the proposed research placed in context and its need well justified.

2.2: Project Process and Professionalism

<40%	No clear plan. Work has been approached in a haphazard manner. Elements of the process are missing or fragmentary.
40%	In the case of software development projects, at least two software lifecycle stages towards the project objectives have been completed with some success; in the case of research/investigative projects, at least research/investigative question identification and process design have been completed with some success.

41-49%	There is work towards the design of a deliverable showing knowledge of recognised lifecycle activities drawn from at least two lifecycle stages or understanding of recognised research practice. The relationship between processes and artefacts and any theoretical material included in the report is likely to be limited and weakly evidenced.
50-59%	Work leading to the deliverable has followed recognised stages – e.g., analysis, design and implementation for software development projects and experimental/study design and application for research projects – but probably with errors or omissions in application. Relevant formal artefacts (e.g., design documents, method descriptions) have been produced, but may be flawed in execution. There is evidence that processes and artefacts have taken account of any theoretical material included in the report although these may not be highlighted clearly.
60-69%	Recognised development or research/experimental processes have been proficiently applied. Artefacts are in good style, showing consistent and effective attention to the need for quality. For research/investigative projects with an experimental element, experimental design is well reasoned and sound. There is clear evidence that processes and artefacts accurately reflect the recommendations drawn from the theoretical material included in the report.
70-79%	The development or research/experimental process shows insight and innovation. There is strong evidence of consistent attention to quality.
>80%	Work of high quality, conducted to a near-professional standard.

2.3: The Deliverable

<40%	Work is fragmentary. Software does not run or shows major flaws. Objectives have not been attained.
40%	Some major objectives of the work have been achieved, resulting in a functional or basic research/investigative deliverable or a rational and credible explanation for failure to achieve a functioning system or a research/investigative deliverable has been given.
41-49%	In the case of a software development project there is a deliverable with functionality exceeding the threshold expectation; in the case of a research/investigative project, there is a deliverable with usefulness/insight exceeding the threshold expectation.
50-59%	There is a deliverable that broadly meets the objectives of the work, though there may be (for software development projects) usability flaws, poor reliability, or gaps in functionality or (for research/investigative projects) gaps in coverage, limited analysis, poor level of recommendation.
60-69%	There is a deliverable that substantially meets the objectives of the work, with only minor flaws. For research projects, research/experimental design is well reasoned and sound.
70-79%	The deliverable shows insight and innovation. There is strong evidence of consistent attention to quality.
>80%	There is a deliverable characterised by, for software development projects, a very high standard of functionality and usability, coupled with originality, and for research/investigative projects, a very high standard of analysis. Software may be near commercial quality, research may be approaching a level worthy of publication.

2.4: Evaluation and Reflection

<40%	Little attempt at systematic review of the work. Analysis of personal performance is uncritical. Inadequate testing of any software created.
40%	The outcome of the work has been reviewed, with opinions expressed as to the successfulness of the work as a whole. Analysis of personal performance is basic.
41-49%	There is some evidence of systematic evaluation, e.g., comparison of outcome against objectives for some requirements or against research hypotheses or goals in the case of research projects. Analysis of personal performance includes suggestions for improvement
50-59%	There is, for software development projects, evidence of systematic evaluation, including comparison of outcome against objectives over a broad range of requirements, and attention to a wider range of issues, such as usability and process, as well as functionality. Client-based projects cite client views. For research/investigative projects, there is evidence of systematic evaluation such as comparison of outcomes against research objectives and/or research hypotheses, critical reflection on the research methods used, comparison of data sets, etc. Personal performance is analysed critically.
60-69%	Evaluation is systematic and conducted in a manner consistent with any theoretical discussion included in the report. Evaluation is evidence-based, e.g., includes user or client feedback obtained in a systematic manner, statistical investigation of reliability or other matters, comparison of research data sets, etc. There is evidence of reflection on project processes and outcomes, including (where applicable) the value of the outcome to a client.
70-79%	Evaluation processes show evidence of careful design. There is substantial evidence of reflection on the processes and outcomes of the work, leading to exposition of insights gained from the work.
>80%	Both evaluation of the work and personal performance has been to a high standard of rigour and thoroughness. Insights gained are substantial and show innovative thought.

2.5: Exposition

If the report is otherwise good but referencing is poor, inconsistent, or absent a penalty of up to 30% may be applied at the assessors' discretion, with 30% being no referencing at all.

<40%	The report is muddled and incoherent, showing a poor command of English. Referencing is absent or poorly done. The student may have attended the demo, but if so, presented their work poorly and failed to answer questions adequately, showing little understanding of their own work.
40%	The report provides basic meaningful communication of the content and outcome of the work, notwithstanding the presence of major defects such as poor spelling and grammar or a confusing layout. The student attended the demo and was able to answer basic questions about their work. Some attempt has been made at referencing.
41-49%	The report has an apparent structure and addresses all major areas of activity, though it may be unbalanced and is likely to exhibit many of the flaws given in the threshold descriptor. Some theoretical material may be included but is likely to show only limited relevance to practical work or research evidenced in the material provided for assessment.
50-59%	The report presents the work/research in a logical order with reasonably balanced attention given to all major areas of activity. Some of the flaws listed in the threshold descriptor are likely to be present, though with a

	lower frequency of errors. Presentation is clear with only occasional flaws. There are some useful examples and diagrams. Use is made of formal references and bibliography. Any theoretical material included is broadly relevant to practical work/research evidenced in the material provided for assessment. In the project demonstration/presentation, the student was able to explain the broad purpose of the project and some detailed aspects, and to answer questions on their work coherently.
60-69%	The report includes substantial reasoned argument as well as statement of facts. The style of writing is appropriate to formal scientific or business communication. There may be occasional English or spelling errors, but not such as to hinder clear communication. Examples and diagrams are employed as a systematic aid to effective communication. Use of formal references, bibliography and appendices is appropriate. Theoretical material included is well chosen and shows a high standard of relevance to practical work/research evidenced in the material provided for assessment. In the project oral examination, the student showed a good grasp of the work/research at overview and detail levels and was able to give reasoned answers to questions.
70-79%	The report can be described as very well written: all the expected material is expounded in a well organised manner, with repetition and irrelevance avoided. Supporting arguments show evidence of careful, systematic and/or innovative thought. The presentation of the report is of a consistently high standard.
>80%	Writing is concise (even elegant) as well as thorough and precise. There are essentially no flaws in English, typography, or presentation. Examples and diagrams are truly illuminating. Use of formal references and bibliography is meticulous.

Notes for Assessors

Having selected a particular descriptor as giving the most accurate reflection of what has been achieved for a particular aspect, the assessor should choose an appropriate numerical mark by judging where the work falls in the range covered by the descriptor. A central or "standard" rating should be recorded as a mark ending in 5. Where work is judged to lie exactly on the boundary between adjacent descriptors, the mark given should be the lower end point of the range for the higher descriptor (e.g., 60%, if the relevant ranges are 50-59% and 60-69%).

In accordance with School rules, an overall mark of 39% should not be given. Any case for a mark in the range 36-38% should be carefully reviewed to determine whether, on balance, there is in fact sufficient evidence of suitable work to justify a threshold pass mark (40%).

The 40% threshold is intended to correspond to work approximating the threshold honours standard.

For work below 40%, these general guidelines should apply:

0-19%	Fragmentary or almost wholly ineffective activity.
20-38%	Work/research that provides evidence of relevant knowledge and skills but deployed on such a limited scale or in such an ineffective manner that the threshold standard for the module has not been achieved. Report lacks any coherent structure or totally fails to address major areas of activity. Software missing, does not run or is unusable due to design flaws.