

## LEVEL 6 ASSESSMENT SPECIFICATION

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| Student name:                   | Nathan Pascoe                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Student ID number:                                   | 256620                        |
| Programme:                      | BSc Software Engineering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                      |                               |
| Module:                         | Socket Programming and Concurrency                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                      |                               |
| Module code:                    | ACCA6028                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Contribution to Overall Module Assessment (%):       | 100%                          |
| Lecturer:                       | Andrew Green                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Internal Verifier:                                   | John Williams                 |
| Assignment Title:               | Socket programming report and implementation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Word count (or equivalent):                          | 3000<br>1000 + implementation |
| Submission deadline:            | 20/5/2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Return date of provisional marks & written feedback: | 10/6/2022                     |
| Submission method:              | <p>All written assessments, where practical and possible, must be submitted via Turnitin unless otherwise instructed by the Lecturer. (Please DO NOT put this assessment specification into Turnitin or it will match many similarities with other students' submissions.)</p> <p><b>Alternative submission method (if applicable):</b></p> <p><b>Late submission of the assessment will result in a late penalty mark.</b> Penalties for late submission: Up to one week late, maximum mark of 40%. Over one week late, 0%. Only the Extenuating Circumstances Panel may approve a change to submission dates.</p> |                                                      |                               |
| Academic honesty / referencing: | <p>Academic honesty is required. In the main body of your submission you must give credit to authors on whose research and ideas your work is based. Append to your submission a reference list that indicates the books, articles, etc. that you have used, cited or quoted in order to complete this assessment.</p>                                                                                                                                                                                                                                                                                              |                                                      |                               |

**Module Learning Outcomes  
(from module syllabus)**

- Critically appraise the major concepts, principles and practice to design web services.
- Demonstrate a comprehensive knowledge and understanding of complex client/server concepts, principles and tools to build, test, debug and critically evaluate software components in scalable, distributed applications.

## **TASK DESCRIPTION**

### **Task 1 – report (50%)**

You are to write a research-driven essay of 3000 words which explores the following topics:

- How the Transmission Control Protocol operates and endeavours to guarantee delivery of data. Refer to the three-way handshake and so-called “Two Generals’ Problem”.
- The impact of the maximum transmission unit (MTU) size on the transfer of data. You should consider associated factors such as the size of the protocol data unit (PDU), their relative positions in the OSI model and the practicalities of IP fragmentation.
- Synchronicity and asynchronicity in network protocols. Consider the sorts of applications you might use with each. Consider I/O dispatch models.
- The meaning of interoperability for networked applications and how it is best achieved.

Consider how these are relevant to us as programmers and how they may impact on our design decisions for development of networked applications.

### **Task 2 – implementation (50%)**

You are to develop a networked application using sockets, to build a networked application of your choosing. You may pick the application you wish to implement, however should be careful that:

- 1) It is of an appropriate scope. You may wish to discuss your planned implementation with your module lecturer before you start.
- 2) You are not relying too heavily on resources you yourself did not create. It is acceptable to use external sources (including those developed in class) with attribution, however you will gain very few marks for doing so and must show significant independent development.

This task is intentionally open-ended – you may make the specific decisions about the application you wish to build, how it is to be implemented, the precise features you will include and what external protocols it might support.

Finally, you should include a written report of 1000 words which explains the features and design decisions of your application, including how it adheres to best practice.

Below are three example scenarios to give you an idea of the anticipated scale of the application. You may select one of these 3 if you'd like or can pick something entirely different.

### **Example 1: Chat Application**

Construction of a chat application (e.g. [IRC](#)).

This should be an application which supports multiple simultaneous users and avoids I/O blocking through multithreading. You must successfully incorporate low-level data transport through sockets.

This should include some form of interface, but this may be a web frontend, console application, Windows form or similar. The precise features to be included are up to you, but as a starting point, it would be wise to consider how a user can:

- 1) Join the server.
- 2) Send a message.
- 3) Leave the server.

There is significant scope for extended functionality, such as setting a nickname, viewing users connected to the server, including images or emojis (though this will be interesting if your frontend is a console application), sending private messages, etc.

### **Example 2: Web Server**

Construction of a web server, e.g. [Apache](#) or [Nginx](#).

To construct a web server, you will need to investigate an existing protocol – http. You will need to consider how you can respond to the requests a http client (i.e. a web browser) might make. This should include the ability to transfer a html file as part of the body of a http response.

This server should be multithreaded and support an appropriate i/o dispatch model to allow the multiple simultaneous connections.

Much of the challenge with this sort of application is that you are heavily constrained by the existing protocols. Be careful to analyse them carefully in creating your implementation.

### **Example 3: Multiplayer Game**

Construction of a networked multiplayer game, implementing the frontend game of your choosing. This might be something turn-based (likely easier) or something real-time (likely harder).

Through the interoperability principles we've discussed during this module, you may create a socket server which uses a frontend that isn't necessarily using the same environment. This might be console-driven, web-based, or uses a game engine (e.g. Unity).

Build a game which has more than one player, be it a text-based adventure game, a digital form of a boardgame, a real-time strategy game or an action game. You should carefully consider the right communication protocol for such a game (e.g. TCP vs UDP) and how you structure the data which is sent and received.

# GUIDANCE FOR STUDENTS IN THE COMPLETION OF TASKS

**NOTE:** The guidance offered below is linked to the five generic assessment criteria overleaf.

## 1. Engagement with Literature Skills

Your work must be informed and supported by scholarly material that is *relevant* to and *focused* on the task(s) set; you should make use of scholarly reviews and primary sources, where appropriate (for example, refereed research articles and/or original materials appropriate to the discipline). You should provide evidence that you have accessed a wide *range* of sources, which may be academic, governmental and industrial; these sources may include academic journal articles, textbooks, current news articles, organisational documents, and websites. You should consider the *credibility* of your sources; academic journals are normally highly credible sources while websites require careful consideration/selection and should be used sparingly. Any sources you use should be current and up-to-date, mostly published within the last five years or so, though seminal/important works in the field may be older. You must provide *evidence* of your research/own reading throughout your work, using a suitable referencing system, including in-text citations in the main body of your work and a reference list at the end of your work.

### **Guidance specific to this assessment:**

**Task 1:** Breadth of evidence of suitable and authoritative reading beyond that specified in the unit materials. Correct use of Vancouver referencing.

## 2. Knowledge and Understanding Skills

At level 6, you should be able to demonstrate coherent and detailed knowledge and a systematic understanding of the subject area, at least some of which is informed by the latest research and/or advanced scholarship within the discipline. You should be aware of the uncertainty, ambiguity and limits of knowledge. Your work must demonstrate the growing extent of your knowledge and systematic understanding of concepts and underlying principles associated with the subject area. *Knowledge* relates to the facts, information and skills you have acquired through your learning. You demonstrate your *understanding* by interpreting the meaning of the facts and information (knowledge). This means that you need to select and include in your work the concepts, techniques, models, theories, etc. appropriate to the task(s) set. You should be able to explain the theories, concepts, etc. meaningfully to show your understanding. Your mark/grade will also depend upon the *extent* to which you demonstrate your knowledge and understanding; ideally each should be complete and detailed, with comprehensive coverage.

### **Guidance specific to this assessment:**

**Task 1 and 2:** Evidence of understanding of key concepts and technologies involved in this area. Evidence to be demonstrated through a comprehensive report and a suitable development project.

## 3. Cognitive and Intellectual Skills

You should be able to: critically evaluate evidence, arguments, assumptions, abstract concepts and data some of which are at the forefront of a discipline (and that may be incomplete) to devise and sustain arguments, to make judgements and/or solve problems; describe and comment upon particular aspects of current research, or equivalent advanced scholarship, in the discipline. Your work must contain evidence of logical, analytical thinking, evaluation and synthesis. For example, to examine and break information down into parts, make inferences, compile, compare and contrast information. This means not just describing what! But also justifying: Why? How? When? Who? Where? At what cost? At all times, you must provide justification for your arguments and judgements. Evidence that you have reflected upon the ideas of others within the subject area is crucial to you providing a reasoned and informed debate within your work. Furthermore, you should provide evidence that you are able to make sound judgements and convincing arguments using data and concepts. Sound, valid conclusions are necessary and must be derived from the content of your work. Where relevant, alternative solutions and recommendations may be proposed.

### **Guidance specific to this assessment:**

**Task 1:** Evidence of your ability to evaluate sources of information and form your own well-reasoned responses.

**Task 2:** Evidence of your ability to develop the concepts covered into a wholly or partly original development project.

#### **4. Practical Skills**

At level 6, you should be able to apply the methods and techniques that you have learned to review, consolidate, extend and apply your knowledge and understanding, and to initiate and carry out projects. You will deploy accurately established techniques of analysis and enquiry relevant to the discipline, and apply them in complex and unpredictable contexts, to devise and sustain arguments and/or to solve problems. You should be able to frame appropriate questions to achieve a solution - or identify a range of solutions. You should be able to demonstrate how the subject-related concepts and ideas relate to real world situations and/or a particular context. How do they work in practice? You will deploy models, methods, techniques, and/or theories, in that context or circumstances, to assess current situations, perhaps to formulate plans or solutions to solve problems, or to create artefacts, some of which may be innovative and creative. This is likely to involve, for instance, the use of real world artefacts, examples and cases, the application of a model within an organisation and/or benchmarking one theory or organisation against others based on stated criteria. You should show awareness of the limitations of concepts and theories when applied in particular contexts.

#### ***Guidance specific to this assessment:***

**Task 2:** Evidence of your ability to utilise the concepts, techniques and methods covered along with any skills already developed to create a suitably original and functional development project.

#### **5. Transferable Skills for Life and Professional Practice**

Your work must provide evidence of the qualities and transferable skills necessary for graduate-level employment requiring the exercise of initiative and personal responsibility and decision-making in complex and unpredictable circumstances. This includes demonstrating: the learning ability for professional development to advance existing skills and acquire new competences of a professional nature that will enable you to assume significant responsibility within organisations; that you can initiate and complete tasks and procedures, whether individually and/or collaboratively; that you can use appropriate media to effectively communicate information, arguments and analysis in a variety of forms to specialist and non-specialist audiences; fluency of expression; clarity and effectiveness in presentation and organisation. Work should be coherent and well-structured in presentation and organisation.

#### ***Guidance specific to this assessment:***

**Task 1:** Evidence of your ability to produce a well-formed and well-presented report which progresses logically and draws appropriate conclusions.

**Task 2:** A well-presented development project with use of consistent naming conventions, coding style, indentation and fully commented source code.

# STUDENT FEEDBACK FORM

This section details the *extent* to which the assessment criteria are demonstrated by you, which in turn determines your mark. The marks available for each category of skill are shown. Lecturers will use the space provided to comment on the achievement of the task(s), including those areas in which you have performed well and areas that would benefit from development/improvement.

## Task 1:

| Generic Assessment Criteria                                                                                                                                                                                                                                                                                                                            | Marks available | Marks awarded |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|
| <b>1. Engagement with Literature Skills</b>                                                                                                                                                                                                                                                                                                            |                 |               |
| A small range of authoritative sources have been cited. Some of these are getting a little old although the technologies which they have been cited to support have changed little since their writing. There is evidence of inclusion of academic works. Correct use has been made of the Vancouver system.                                           | 20              | 11.8          |
| <b>2. Knowledge and Understanding Skills</b>                                                                                                                                                                                                                                                                                                           |                 |               |
| The concepts discussed in the report are a good demonstration of understanding the topics outlined in the brief. Each of the required topics has been addressed and a reasonable demonstration of understanding is presented in each case. Reasonable use is made of sources to support points made.                                                   | 30              | 18.6          |
| <b>3. Cognitive and Intellectual Skills</b>                                                                                                                                                                                                                                                                                                            |                 |               |
| The report fails to tie together the concepts discussed in any more than a very superficial way. The import of IP fragmentation is not fully explored, the relationship between MTU and PDU is not explored, the 2 general problem is simply described as a problem which is not applied to reliability of network connections as it should have been. | 30              | 15.6          |
| <b>4. Practical Application Skills</b>                                                                                                                                                                                                                                                                                                                 |                 |               |
| Not required.                                                                                                                                                                                                                                                                                                                                          | 0               | 0             |
| <b>5. Transferable Skills for Life and Professional Practice</b>                                                                                                                                                                                                                                                                                       |                 |               |
| The report does not meet the minimum word count although it is close. The report is logically ordered. The standard of communication presented makes reading the text dense and awkward. Accurate use is made of the Vancouver system.                                                                                                                 | 20              | 11            |

|                                                                                                                                                                                                            |                                                        |  |                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|--|-----------------------|
| <b>Assessment Mark</b> (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed. ) | <b>Late Submission Penalties (tick if appropriate)</b> |  | <b>57-4 =<br/>53%</b> |
|                                                                                                                                                                                                            | Up to 1 week late (40% Max)                            |  |                       |
|                                                                                                                                                                                                            | Over 1 week late (0%)                                  |  |                       |

## Task 2:

| Generic Assessment Criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Marks available | Marks awarded |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|
| <b>1. Engagement with Literature Skills</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |
| Not required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0               | 0             |
| <b>2. Knowledge and Understanding Skills</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |               |
| The report is very brief (358 words rather than 1000) and states choice of technology base as well as details of the application flow for this project. Details of design concerning the network communication aspects of the project are not discussed. As a result, the project is not able to communicate well your level of skills or understanding regarding the implementation of client/server projects. The video demonstrates that you do have some understanding of how the code you have produced functions.                                                                                                                                                                                                                                             | 10              | 5.1           |
| <b>3. Cognitive and Intellectual Skills</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |
| You have discussed why the project is presented as it is in your demonstration video. The discussion of where the project does not consider further aspects such as security is some indication of your ability to synthesise an argument from what has been produced. The issue here is that with this project design and build, most of the thinking has been already done for you.                                                                                                                                                                                                                                                                                                                                                                               | 10              | 4.5           |
| <b>4. Practical Application Skills</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |               |
| This project is a Websocket-based chat room. It is quite similar to the codebase of a lot of the Websocket tutorial projects which can be found online. Using Websockets for this project was not advised as this socket implementation presents an API which masks many of the intricacies of network programming. The close use of source projects and the choice of environment have served to limit the degree to which this project is able to demonstrate your understanding of network programming concepts. You have initialised sockets which are then read from and written to. In this you have met the broad requirements of the project. The project demonstrates that you are able to respond to the brief and implement a client/server application. | 70              | 36.4          |
| <b>5. Transferable Skills for Life and Professional Practice</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |               |
| A very short report. The report does not address areas which would have helped you demonstrate your ability to design and understand network applications. The demonstration video helps with this somewhat. A correct use is made of the Vancouver system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 10              | 4.2           |

|                                                                                                                                                                                                            |                                                        |  |                      |
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| <b>Assessment Mark</b> (Assessment marks are subject to ratification at the Exam Board. These comments and marks are to give feedback on module work and are for guidance only until they are confirmed. ) | <b>Late Submission Penalties (tick if appropriate)</b> |  | <b>50-4<br/>=46%</b> |
|                                                                                                                                                                                                            | Up to 1 week late (40% Max)                            |  |                      |
|                                                                                                                                                                                                            | Over 1 week late (0%)                                  |  |                      |

## GENERIC ASSESSMENT CRITERIA

### Level 6

In accordance with the Framework for Higher Education Qualifications, at the end of Level 6 students should have coherent and detailed knowledge and a systematic understanding of their subject area, at least some of which is informed by the latest research and/or advanced scholarship within the discipline. They will be able to accurately deploy established techniques of analysis and enquiry within a discipline, using their conceptual understanding to devise and sustain arguments and/or to solve problems. They should be aware of the uncertainty, ambiguity and limits of knowledge. They should be able to critically evaluate evidence, arguments, assumptions, abstract concepts and data (that may be incomplete), to make judgements, and to frame appropriate questions to achieve a solution - or identify a range of solutions. They will apply the methods and techniques that they have learned to review, consolidate, extend and apply their knowledge and understanding, and to initiate and carry out projects. They will have the ability to manage their own learning, and to make use of scholarly reviews and primary sources (for example, refereed research articles and/or original materials appropriate to the discipline). They will demonstrate the qualities and transferable skills necessary for employment requiring: the exercise of initiative and personal responsibility; decision-making in complex and unpredictable contexts; the learning ability needed to undertake appropriate further training of a professional or equivalent nature.

| Level 6                                                                                                          | FAIL                                                                                                                                                                                                 | MARGINAL FAIL                                                                                                                                                                                                                                         | SATISFACTORY<br>(3 <sup>rd</sup> / Pass)                                                                                                                                                        | GOOD<br>(2.2 / Pass)                                                                                                                                                                                      | VERY GOOD<br>(2.1 / Merit)                                                                                                                                                                                                           | EXCELLENT<br>(1 <sup>st</sup> / Distinction)                                                                                                               | EXCEPTIONAL<br>(1 <sup>st</sup> / Distinction)                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Category                                                                                                         | 0-29%                                                                                                                                                                                                | 30-39%                                                                                                                                                                                                                                                | 40-49%                                                                                                                                                                                          | 50-59%                                                                                                                                                                                                    | 60-69%                                                                                                                                                                                                                               | 70-84%                                                                                                                                                     | 85-100%                                                                                                                                                                                     |
| <b>Engagement with literature</b><br>(including reading, referencing, academic conventions and academic honesty) | Little or no evidence of reading and/or reliance on inappropriate sources. Views and findings mostly unsupported and non-authoritative. Referencing conventions used incoherently or largely absent. | Poor engagement with essential reading. No evidence of wider reading. Reliance on inappropriate sources, and/or indiscriminate use of sources. Heavily reliant on information gained through class contact. Inconsistent and weak use of referencing. | Engagement with a limited range of mostly relevant and credible sources. Some omissions and minor errors. Referencing conventions evident though not always applied accurately or consistently. | Engagement with an appropriate range of research-informed literature, including sources retrieved independently. Some over-reliance on texts. Referencing may show minor inaccuracies or inconsistencies. | Engagement with a wide range of research-informed literature, including sources retrieved independently. Selection of relevant and credible sources. Very good use of referencing, with no/very few inaccuracies or inconsistencies. | Engagement with an extensive range of relevant and credible literature, informed by the latest research. Consistently accurate application of referencing. | Exceptional engagement with an extensive range of relevant and credible literature, informed by the latest research. High-level referencing skills consistently and professionally applied. |
| <b>Knowledge and understanding</b><br>(Coherent and detailed)                                                    | Major gaps in knowledge and systematic understanding of the subject                                                                                                                                  | Gaps in knowledge, with only superficial systematic understanding.                                                                                                                                                                                    | Limited knowledge and systematic understanding of the relevant                                                                                                                                  | Knowledge is reasonably detailed, accurate with a good systematic                                                                                                                                         | Knowledge is reasonably extensive coherent and detailed.                                                                                                                                                                             | Excellent coherent and detailed knowledge and systematic                                                                                                   | Exceptionally coherent and detailed knowledge and systematic                                                                                                                                |

| Level 6                                                                                                                                                                                                                          | FAIL                                                                                                                                                                                                                                            | MARGINAL FAIL                                                                                                                                                                                                                                                                           | SATISFACTORY<br>(3 <sup>rd</sup> / Pass)                                                                                                                                                                                                                                                  | GOOD<br>(2.2 / Pass)                                                                                                                                                                                                                                                                                                                                               | VERY GOOD<br>(2.1 / Merit)                                                                                                                                                                                                                                                                      | EXCELLENT<br>(1 <sup>st</sup> / Distinction)                                                                                                                                                                                                                                                                                                    | EXCEPTIONAL<br>(1 <sup>st</sup> / Distinction)                                                                                                                                                                                                                                                                                                              |
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| Category                                                                                                                                                                                                                         | 0-29%                                                                                                                                                                                                                                           | 30-39%                                                                                                                                                                                                                                                                                  | 40-49%                                                                                                                                                                                                                                                                                    | 50-59%                                                                                                                                                                                                                                                                                                                                                             | 60-69%                                                                                                                                                                                                                                                                                          | 70-84%                                                                                                                                                                                                                                                                                                                                          | 85-100%                                                                                                                                                                                                                                                                                                                                                     |
| knowledge and systematic understanding of the subject area, at least some of which is informed by the latest research and/or advanced scholarship within the discipline.)                                                        | matter. Substantial inaccuracies. No awareness of knowledge of the latest research and/or advanced scholarship within the discipline.                                                                                                           | Some significant inaccuracies and/or irrelevant material. No awareness of knowledge of the latest research and/or advanced scholarship within the discipline.                                                                                                                           | concepts and principles within the subject area which to some limited extent, is informed by current research and scholarship.                                                                                                                                                            | understanding of the field of study and to some extent, current research and scholarship.                                                                                                                                                                                                                                                                          | Exhibits very good understanding of the breadth and depth of established views, and the work is, at least in part, well-informed by current research and scholarship.                                                                                                                           | understanding of the principles and theories of current research and scholarship. Clear awareness of challenges to established views and the limitations of the knowledge base.                                                                                                                                                                 | understanding of the principles and theories of the subject, well-informed by current research and scholarship. A critical, sophisticated and nuanced awareness of the ambiguities and limitations of knowledge.                                                                                                                                            |
| <b>Cognitive and intellectual skills</b><br>(Conceptual and critical thinking, analysis, synthesis and evaluation of research, assumptions, abstract concepts and data (that may be incomplete); logic, argument and judgement.) | Wholly or almost wholly descriptive work. Little or no analysis, synthesis or evaluation. Failure to develop arguments, leading to illogical or invalid judgements. Unsubstantiated generalisations, made without use of any credible evidence. | Largely descriptive work, with superficial use of critical evaluation. Weak development of arguments and judgements. Information accepted uncritically, uses generalised statements made with scant evidence and unsubstantiated opinions. Ideas sometimes illogical and contradictory. | Limited attempt at critical thinking, analysis, synthesis and evaluation, tending towards description. Some evidence to support emerging arguments and judgements but these may be underdeveloped or with a little inconsistency / mis-interpretation. Asserts rather than argues a case. | Some critical thinking, analysis, synthesis and evaluation. Can analyse new and/or abstract concepts and data without guidance. An emerging awareness of different stances and ability to use evidence (that may be incomplete) to support the argument. Mostly valid arguments and logical judgements. Some tendency to assert/state opinion rather than argue on | Sound critical thinking, analysis, synthesis and evaluation demonstrating critical thinking. Ability to devise and sustain persuasive arguments, and to review the reliability, validity and significance of evidence (that may be incomplete) to make mostly appropriate and valid judgements. | Excellent critical thinking, analysis, synthesis and evaluation. Ability to investigate contradictory or incomplete information and make strong, persuasive, arguments and sophisticated judgements. Some evidence of independent thought and ability to 'see beyond the question', suggesting a grasp of the broader field and wider concepts. | Exceptional critical thinking, analysis, synthesis and evaluation based on judiciously selected evidence. Ability to investigate contradictory or incomplete information and make strong, persuasive, arguments and sophisticated, nuanced, judgements. Evidence of independent thought and ability to 'see beyond the question', suggesting an outstanding |

| Level 6                                                                                                                                                                                              | FAIL                                                                                                                                                                                                                                                                                                               | MARGINAL FAIL                                                                                                                                                                                                                                                                                                                                                                      | SATISFACTORY<br>(3 <sup>rd</sup> / Pass)                                                                                                                                                                                                                                                                                                                                                                                             | GOOD<br>(2.2 / Pass)                                                                                                                                                                                                                                                                                                                                                         | VERY GOOD<br>(2.1 / Merit)                                                                                                                                                                                                                                                                                         | EXCELLENT<br>(1 <sup>st</sup> / Distinction)                                                                                                                                                                                                                                                                              | EXCEPTIONAL<br>(1 <sup>st</sup> / Distinction)                                                                                                                                                                                                                                                          |
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| Category                                                                                                                                                                                             | 0-29%                                                                                                                                                                                                                                                                                                              | 30-39%                                                                                                                                                                                                                                                                                                                                                                             | 40-49%                                                                                                                                                                                                                                                                                                                                                                                                                               | 50-59%                                                                                                                                                                                                                                                                                                                                                                       | 60-69%                                                                                                                                                                                                                                                                                                             | 70-84%                                                                                                                                                                                                                                                                                                                    | 85-100%                                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                      | the basis of reason and evidence.                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                           | grasp of the broader field and wider concepts.                                                                                                                                                                                                                                                          |
| <b>Practical skills</b><br>(Apply/deploy accurately established tools and techniques; initiate and carry out projects; formulate solutions to solve problems in complex and unpredictable contexts.) | Limited or no use of methods, materials, tools and/or techniques. Little or no appreciation of the context of the application. Limited understanding of the application of theory to practice or making appropriate links between the two. Very weak problem-solving skills in complex and unpredictable contexts. | Rudimentary application of methods, materials, tools and/or techniques but without consideration and competence. Flawed appreciation of the context of the application. Weak understanding of the application of theory to practice, with only occasional evidence of making appropriate links between the two. Weak problem-solving skills in complex and unpredictable contexts. | An adequate awareness and mostly appropriate application of well-established methods, materials, tools and/or techniques. Basic appreciation of the context of the application. Theoretical knowledge and understanding applied in practice, but not always making logical links between the two. Can identify problems and propose basic solutions in complex and unpredictable contexts without fully appreciating the complexity. | A good and appropriate application of standard methods, materials, tools and/or techniques. Clear appreciation of the context of the application. Mainly consistent, accurate and logical application of theory to practice, making appropriate links between the two. Can identify problems and propose mostly appropriate solutions in complex and unpredictable contexts. | A very good application of a range of methods, materials, tools and/or techniques. Very good consideration of the context of the application, with perceptive insights. Can identify problems and propose appropriate solutions in complex and unpredictable contexts. Evidence of some innovation and creativity. | An advanced application of a range of methods, materials, tools and/or techniques. The context of the application is well considered, and insightful. Application and deployment extend beyond established conventions. Can identify complex problems and propose excellent solutions. Innovation and creativity evident. | Exceptional levels of application and deployment skills in unpredictable, practical contexts, drawing skilfully on the latest research within the discipline. Can identify complex problems and propose sophisticated solutions. Assimilation and development of cutting edge processes and techniques. |
| <b>Transferable skills for life and professional practice</b><br>(Exercise of initiative and                                                                                                         | Communication medium is inappropriate or misapplied. Work is poorly structured, disorganised                                                                                                                                                                                                                       | Communication medium is poorly designed and/or not suitable for the audience. Work is poorly presented in a                                                                                                                                                                                                                                                                        | Can communicate in a suitable medium but with some room for improvement.                                                                                                                                                                                                                                                                                                                                                             | Can communicate effectively in a suitable format, but may have minor errors.                                                                                                                                                                                                                                                                                                 | Can communicate well, confidently and consistently in a suitable format.                                                                                                                                                                                                                                           | Can communicate professionally confidently and consistently in a suitable format.                                                                                                                                                                                                                                         | Can communicate with an exceptionally high level of professionalism.                                                                                                                                                                                                                                    |

| Level 6                                                                                                                                                                                                                                                                   | FAIL                                                                                                                                                                                                                                                           | MARGINAL FAIL                                                                                                                                                                                                                                                                                             | SATISFACTORY<br>(3 <sup>rd</sup> / Pass)                                                                                                                                                                                                                                                                                  | GOOD<br>(2.2 / Pass)                                                                                                                                                                                                                                                                                                            | VERY GOOD<br>(2.1 / Merit)                                                                                                                                                                                                                                  | EXCELLENT<br>(1 <sup>st</sup> / Distinction)                                                                                                                                                                                                                                                                                                | EXCEPTIONAL<br>(1 <sup>st</sup> / Distinction)                                                                                                                                                                                                                              |
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| Category                                                                                                                                                                                                                                                                  | 0-29%                                                                                                                                                                                                                                                          | 30-39%                                                                                                                                                                                                                                                                                                    | 40-49%                                                                                                                                                                                                                                                                                                                    | 50-59%                                                                                                                                                                                                                                                                                                                          | 60-69%                                                                                                                                                                                                                                                      | 70-84%                                                                                                                                                                                                                                                                                                                                      | 85-100%                                                                                                                                                                                                                                                                     |
| personal responsibility; professional development; initiate and complete tasks and procedures: individually and/or collaboratively; use appropriate media to communicate effectively; fluency of expression; clarity and effectiveness in presentation and organisation.) | and/or confusingly expressed. Very weak use of language and/or very inappropriate style. Little or no evidence of autonomy (or collaboration, where relevant) in the completion of tasks. Little or no evidence of the skills required in graduate employment. | disjointed manner. It is loosely, and at times incoherently, structured, with information and ideas often poorly expressed. Weak use of language and/or inappropriate style. Weak independent initiative (or collaboration, if relevant). Limited evidence of the skills required in graduate employment. | Mostly ordered presentation and structure in which relevant ideas / concepts are reasonably expressed. Work may lack coherence in places. Can work as part of a team, but with limited involvement in group activities. Demonstrates the basic skills required in graduate employment, with some areas of minor weakness. | Mostly coherent, organised work, in a suitable structure and is for the most part clearly expressed. Can work effectively independently and/or as part of a team, with clear contribution to group activities. Demonstrates the skills required in graduate employment, with some areas of strength and some of minor weakness. | Work is coherent, fluent, well-structured and organised. Can work very well autonomously and/or as part of a team, with very good contribution to group activities. Demonstrates very good graduate employment skills, with just occasional minor weakness. | Work is coherent, very fluent and is presented professionally. Can work autonomously with initiative. Where relevant can work professionally within a team, showing leadership skills as appropriate, managing conflict and meeting obligations. Demonstrates excellent graduate employment skills and an appetite for further development. | Work is exceptionally coherent, very fluent and is presented professionally. Can work exceptionally well and professionally within a team, showing advanced leadership skills. Demonstrates exceptional graduate employment skills and an appetite for further development. |