Botswana Accountancy College

Computing and Information Systems

Research and Innovation

CONTENTS

1. Introduction

The purpose of the module is to enable students to undertake independent study in a focused area of work.

The project provides students with an opportunity to:

- Work on their own initiative within a structured environment,
- Study an area of particular interest to them,
- Develop skills in researching sources of information, problem solving and communication.

Students are expected to work in groups of four to five, with guidance from *a Project Supervisor* and the *Module Leader*.

The project is a significant piece of work. Although the end product is important, assessment is not based on this alone. The manner in which the project was conducted, the research undertaken, the analysis and design of the solution, the writing up of the work and critical assessment are also considered during the assessment process.

Reading

Projects in Computing and Information Systems: A Student's Guide
Christian Dawson, Addison Wesley (2009)

Students are also expected to use other relevant information sources.

2. Project Administration

2.1 Types of Projects

The project is viewed as a piece of research in which you will investigate an area of computing at the forefront of knowledge and produce an end product that may include software (or hardware), a model, a framework, etc. At its core, your project involves an exploration of a leading-edge subject in computing. It is a research effort that allows you to delve into uncharted or under-explored territories, pushing the limits of current understanding. The result of this investigation is not merely theoretical but also tangible, culminating in the creation of an end product. This product may take the form of software, a hardware solution, a model, a new framework, or any other innovative creation that contributes to the field.

Diversity in Project Types

Considering the vast expanse of computing, the types of projects you can embark upon are diverse. They may include, but are not limited to:

- **Software Development Projects:** Involving the creation of new software applications, tools, or systems that address specific needs or gaps in the field.

- **Hardware Development Projects:** Focused on designing and building computing hardware or integrated hardware-software solutions.

- **Models and Frameworks:** Developing new models or frameworks that offer fresh perspectives or solutions to existing problems in computing.

- **Data Analysis and Business Intelligence Projects:** Leveraging data analytics, machine learning, and business intelligence to derive insights and solutions.

- **Network and Mobile Computing:** Projects that enhance or innovate in the areas of network infrastructure, mobile computing, and telecommunications.

- **ICT and Business Computing Solutions**: Developing ICT solutions that streamline business processes, enhance decision-making, or improve operational efficiency.

Whatever the type of project, you are expected to spend considerable hours per week working on your project. This time allocation includes various activities, such as attending lectures, meeting project s*upervisors*, conducting project reviews, and various other activities.

2.2 The Supervisor

Each group is allocated a *Project Supervisor*, who is supposed to provide group supervision every step of the way. Each group should agree with the *Project Supervisor* on how this time is to be spent and should arrange times and places that are mutually convenient. **The most convenient time is during the tutorial time allocated in your timetable.**

The role of your *Project Supervisor* is to guide you through the project module, to attempt to ensure that you do the right things at the right time, provide feedback on your work, point you in the right direction, and ensure that you understand the project process.

The supervisor will conduct **Project Reviews.** These reviews are milestones in the project, and you are expected to prepare for these and bring materials for the supervisor to inspect. You will be awarded a grade on the basis of these Reviews, and this grade will contribute to your overall 'monitoring' mark.

The *Project Supervisor* is **not** expected to assist with the subject matter of your project, nor is he/she expected to provide you with an explanation of what to do if you do not attend lectures, nor tell you how to fill in documentation such as the Terms of Reference or explain to you such things as what constitutes the Design Study. Your task is to arrive at consultation meetings with the correct documents, completed to the best of your ability, listen to the advice and act on it. Failure to keep in contact with your project supervisor can result in your project going horribly wrong so **stay in touch!**

2.3 Lectures

A few lecture sessions will be held at the beginning of the semester to orient students to Research and Innovation. These sessions will cover key areas of the project, such as knowing your supervisor and group members, identifying a topic of interest, accessing literature, and project management issues. Attendance at these sessions is compulsory.

During the semester, the following programme of lecture sessions will be held:

Week No	Activity	Purpose
1	Introduction Research	To provide students with a clear understanding of the module, what is entailed, and to enable them to begin the process of identifying a project topic, a client/sponsor and meeting the supervisor. What is research? The research process, classifying research, research methods: it discusses what methods may be required in order to develop the project further, including a variety of methods for obtaining data, such as questionnaires, evaluation schedules and other forms of data collection. Looks at how the results of your project might be analysed and what statistical tools are available for doing this.
2	Literature Review Project Planning and risk management	Literature survey process, literature searching, managing information, critical evaluation, writing literature review Project definition, planning, risk management
3	Project Control Project Presentations	Dealing with problems, managing time, working with supervisor, working in teams Structuring reports, referencing material and avoiding plagiarism, documenting software, oral presentation and demonstration of artefact

3. Step-By-Step through Your Project

3.1 The Six Project Phases

There are six distinct phases to the project:

1) **The Initial Phase**, in which you find out about the module, meet supervisors and negotiate a project. In this phase you will be expected to choose a group of students to work with. The maximum number of students in a group should be four. This should last no more than two weeks.
2) **The Investigation & Planning Phase**, in which you are working out what you need to do to complete the project.
3) **The Research Phase**, in which you are looking in depth at the background materials so that you can undertake your project in the light of current 'best practice. This culminates in your Literature Review and should take about three to four weeks.
4) **The Design Phase**, in which you spell out precisely what you are going to produce and how you intend to do it. This culminates in the Design Study and should take between two to three weeks.
5) **The Development Phase**, in which you actually get to do what you say you are going to do! This is the crucial phase of you project and culminates in the Product. This should take between four and five weeks.
6) **The Reporting Phase**, in which you pull together all of the details, write a Final Report. This phase (including oral presentation and demo) will take between two and three weeks.

3.2 Data Science Lifecycle

A general approach to data science projects, covering key stages from planning to deployment.

Phases:

1. **Define objectives and requirements**
    - Establish the project's problem statement, objectives, scope, and success criteria.
    - Identify and collect data set for the project
2. **Data collection and preprocessing**
    - Prepare data for analysis. Ensure the data is clean, complete, and relevant.
3. **Exploratory data analysis**
    - Explore the data to understand distributions, relationships, and anomalies. EDA provides insights that inform the choice of models and techniques.
4. **Model building**
    - Select and apply appropriate models or algorithms to generate predictions or insights.
5. **Model validation**
    - Evaluate the performance and reliability of the model. Ensure that the model generalizes well to new data.
6. **Reporting Phase/ Communication of Results**
    - Deploy the model or communicate the findings to stakeholders

To some extent, these phases overlap at their transition points; for example it is difficult to determine at what point the Initial Phase ends and the Investigation & Planning Phase begins. The material in the rest of this section outlines the activities you will undertake during these phases.

3.3 Meeting Your Supervisor

The Initial Phase of your Project will have already started, by the time you read this document. An important part of this phase is to initiate contact with your supervisor. The meetings between you and your supervisor should be group meetings where the supervisor wishes to address the whole set of students that he/she is supervising, or they may be individual group tutorial sessions.

3.4 Choosing Your Project Topic

The first decision that you need to make is the type of project you want to undertake as a group. Once you have agreed with your supervisor on the chosen topic, you then begin to develop your **Terms of Reference** (see below).

Please Note: If the *supervisor* does not deem you suitable to research a given area, because you are judged not to possess the skills that are required to effectively investigate the topic you will ***not*** be allowed to study that topic.

You should choose a project that you feel would allow you to perform well under each component of assessment. You cannot pass by simply getting something working.

It is important that your implementation should involve something that is beyond the scope of all of the other modules you are taking. It should be technically or theoretically challenging. This could, for example, be the method of gathering and analysis of information, the design approach, the use of advanced features of software products, the generation of complex algorithms or the application of already existing skills in a new and challenging environment.

You will be expected to research the current literature that is relevant to your project, critically review and analyse it and then use what you have learned from the review in constructing the product.

3.5 Terms of Reference

The transition from the Initial phase to the Investigation and Planning Phase may be very smooth and hardly noticeable. However, an important step is for you to develop Terms of Reference (TOR) for your Project. This is a brief overall summary of what you are proposing to do in your project and why. It should include the following:

1) Title
2) Problem Statement and Background
3) Aims & Objectives
4) Skills Required
5) Outcomes & Deliverables
6) Methodology
7) Constraints & Resources
8) Evaluation
9) References
10) Project Schedule
11) Gantt Chart

The first true assessment point in the project requires you to produce a **Terms of Reference**. This aims to create a fully detailed agreement as to what you will produce, how you will produce it, and what the outcomes and/or deliverables will be.

The timescale for producing the ToR is deliberately very short; as the entire project needs to be carried out within the timescale allowed, and if too much time is spent negotiating the project at the start, you will find little time is left for the actual project itself. The objectives given in the ToR document should address the deliverables to be produced during the project, the academic worth of the project and the final product.

The **Terms of Reference** will define the work that is to be done and, if necessary, the way in which it is to be undertaken. Specifically, you will state the objectives to be achieved, particularly in the areas of product construction and academic worth, e.g. the research to be undertaken, any intermediate products that are to be developed, evaluation and selection of approaches, development of the end product, and validation of the end product. Having a well-defined statement of objectives allows you to critically assess the project outcome against the original objectives. This is an important aspect of the product demonstration and the project report. The objectives stated in your Terms of Reference become the milestones in your **Project Schedule.**

The **Project Schedule** defines what activities you will undertake, in what order and when you will do them. You are expected to be able to use software tools to be able to plan and manage the project – for example Gantt Charts, Activity diagrams etc.

There is a separate proforma for the ToR, containing guidance on how it should be completed. The project assessors will judge whether the work has been completed successfully or not by comparing the results with the requirements set out in the terms of reference and the learning outcomes.

A draft version of the ToR must be achieved and ready for discussion with your *Project Supervisor* (around week 2).

3.6 The Literature Review (LR)

After you have submitted the **Terms of Reference,** the Research Phase gets underway in earnest. Normally, a Literature Review is a critical evaluation of written material that has been published on your topic by accredited scholars and researchers. In addition, if appropriate, this Literature Review could include descriptions and evaluations of any relevant software products currently in use. It ought to convey to your reader the extent of knowledge, ideas and the relevance of products that exist for your topic. It should include a comparison of different approaches to your subject area and a critical analysis of their strengths and weaknesses.

In this module, the Literature Review has a wider brief but a very specific purpose, which is to provide the background support for the project activity which you will undertake. You could be designing new algorithms to create secure passwords, or you could be creating an e-Commerce website for a catering company. This does not matter; the brief is the same – **you should critically examine what is the current 'state of the art' in that particular field**, narrowing it down to very specific items which will assist you in producing a report or software which is at the forefront of current knowledge. That 'state of the art' consists of all that is currently available, whether this is theory, practice, convention, opinion or product; looking at a very wide range of sources including, books, journals, conference proceedings, Government/corporate reports, theses and dissertations, the Internet, Websites, available software, newspapers, magazines, television programmes etc. Here you will clearly need to take care; not all of these sources are equally valid and reliable, and when presenting evidence you need to be very cautious about the evidence used from single sources, especially if they are some of the latter ones mentioned.

Example 1: A student is undertaking a project on "Student awareness of malware". The Literature Review should consist of not only an examination of all of the 'theoretically' different types of malware currently in existence

and their dangers, but also any research done into the number and types of malware currently to be found on personal and corporate computers, with historical trends; examples of software available on the market to eliminate malware, and evaluations or gradings of these done by reviewers, together with any practical advice provided on how to eliminate malware and protect from infection. It is likely that as part of the practical work following the review, the student would wish to undertake a survey or some examination of personal computers; as part of the Literature Review a section should therefore explore how precisely other researchers have done this in the past, and critically analyse this methodology.

Example 2: A student is undertaking a project on "Designing an on-line catalogue for a furniture manufacturer". The Literature review should consist of an examination of the theory underpinning producing databases on the web and how this might be done, for example using different scripting languages: ASP, JSP, PHP etc., and different databases Access, MySQL etc. As undoubtedly the catalogue will consist of images, the student would probably need to investigate Multimedia Databases. In addition there should be an examination of what is currently the 'norm' in furniture manufacturers; what the web-presence of other manufacturers is like, an evaluation of relevant websites and an examination of the technologies on which they are based. The student will probably go on to develop a website for the manufacturer; part of the Literature review should look at web development methodologies; how this is currently being carried out and the process managed.

As you can see, the Literature Review itself should be much more than a descriptive list of the material available. You should analyse this material critically and use the results of this to inform what you are about to do. This should not only influence the content and the quality of your work, but should also direct you to work in particular ways. Your review should conclude with how your work will be informed by or fit within this body of knowledge. You should also reflect upon how this research will influence the development of your product. You should avoid plagiarism by clearly referencing all sources of information using the Harvard system.

A draft version of the LR must be achieved and ready for discussion with your *Project Supervisor* during your **Project Review 1**. For those who are conducting data analysis, project should also present a cleaned data set.

3.7 The Design Brief (DB)

After you have submitted the Literature Review, you enter the Design Phase. During this time, you will need to revisit your planning and map out in detail the precise specifications for your 'product' which will be developed. This re-visitation is necessary, as you may well have discovered information which means that your initial ideas are unworkable or inappropriate. This is an opportunity to modify your original planning.

For those developing software or hardware, it will mean also considering how users will use or interact with the product, together with undertaking an analysis of the constraints. For those developing a 'pure' piece of research, it means developing research instruments (e.g. questionnaires or other measurement tools) and specifying clearly how data will be collected and analysed. Whichever approach you are taking, you will need to specify your methodology clearly and identify your Research Questions/Objectives (and if appropriate, your Research Hypotheses).

For those working on Data analysis, projects should present EDA: Summary of key findings, visualisations and identified variables for Modelling.

All of this is summarised in a short document called the Design Brief, which will include a Product Specification. This latter should be agreed with the project supervisor. A draft version of the DB must be archived ready for discussion with your *Project Supervisor* during **Project Review** 2.

3.8 Product Development/ Model Design and Building

It is likely that you will have begun the 'Development' phase well in advance of this. If you are producing a software product, for example, as part of the Design Study you will have produced templates, mock-ups and sections of code to look at the feasibility of particular items. If you are undertaking a survey-based research, you will have already constructed (and probably trialled) questionnaires or interviews.

For data analysis projects; Model Design and Building

- Select and apply appropriate models or algorithms to generate predictions or insights.
- Evaluate the performance and reliability of the model. Ensure that the model generalizes well to new data.

- **Key Activities:**
  - Choose models based on the problem type (classification, regression, clustering, etc.).
  - Train models using training datasets.
  - Tune model parameters to improve performance.
  - Validate models using appropriate metrics (accuracy, precision, recall, etc.).
  - Perform cross-validation and test model performance on unseen data.
- **Deliverables:** Trained model and validation results.

This phase is the longest of the entire module, and is a major undertaking. For some students this is where motivation begins to flag, especially if the project has not been going well thus far, or there are other pressures. The best advice is to maintain contact with your supervisor, by short, but regular, visits or emails.

At the end of this, you will probably look back to find that this was the most satisfying, if not the most challenging part of the module. In order to ensure that you keep to a sensible timescale, a demonstration of work in progress and an almost-complete file must be achieved and ready for discussion with your *Project Supervisor* during **Project Review 3**.

3.9 Reporting

At a certain stage, you must transition from the development phase to the reporting phase. Determining the right moment for this shift can be challenging for some students. Ideally, reporting should occur concurrently with development. Each group member is expected to document their work simultaneously with the development activities.

There is a lot to do, and you will not complete the documentation well if you do not allocate sufficient time to do this. The report carried more weight of the module mark, care and time should be allocated to it. By this it means that there is a balance to be struck between carrying on and finding every last bug

in a program, and leaving yourself so little time for the write-up that you fail to convey the full meaning of what you have done, or that your write-up is so poorly executed that the overall report marks are badly affected.

As part of the reporting phase, you will need to complete your Project File, and ensure that it is in a state ready to be submitted; you will need to compile a Research Report, to complete and make ready for presentation any software you have produced.

In order to ensure that you keep to a sensible timescale, a draft version of the Report and an almost-complete file must be achieved and ready for discussion with your *Project Supervisor.*

4. Project Planning and Monitoring

4.1 Project File

You should keep a project file on Teams that contains working documents suitably referenced and filed in sections with a method of recording changes to your project. All project control documentation and the project file **must** be available in at your Project Reviews.

Typical contents of the project file are given in Appendix A.

4.2 Project Planning

As part of the Terms of Reference, you are required to produce an initial project plan by identifying the tasks that have to be undertaken in order to meet the milestones given in the objectives of your terms of reference. You may have met some elements of project management in earlier modules, and you can draw on some of these experiences. In the main, though, it is for you to use this as an opportunity to find out more about project management tools and software. Enhancing your skills in this manner will lead to better grades. In the text which follows, certain items are stressed in bold; these are standard project management terms and tools which you can use to help you. If you have not met them before, you might consider researching their use on the Internet or in the Library. A Lecture session will discuss project management specifically.

Identify dependencies amongst the tasks and a logical sequence of execution and come up with a **Project Schedule** (see the suggested proforma in Appendix A). Estimate the effort required to complete each task and, taking account of the time that you have available, converting the estimated effort for each task into an elapsed time. Apply the elapsed times to the project plan and hence derive a start and end date for each task. This information would normally be summarised in the form of a **Gantt Chart**.

Design a proforma on which you can keep a **Record of Work** or **Project Log** (see the suggested proforma in Appendix A). Each time that you do some work on the project, make a note of the task on your proforma, cross-referenced to the schedule and the date and time spent. In this way, you can express your progress against the schedule using various progress metrics. For example, if your schedule allows 50 hours for a task, and you complete the task in 60 hours, then you are 20% over budget in hours on that task.

Your scheduling will be constrained by the report due date. Work backwards from this date allowing for defining the report structure and content, draft

report writing, review by *Project Supervisor* and preparation of final version. Do not underestimate the time for these activities.

It is quite acceptable for you to use a computerised project control software package. You are strongly recommended to read any project management texts that you can find. Having a project schedule allows you to monitor your progress and, if necessary, to take corrective action.

4.3 Project Monitoring

As stated above, you will need to keep records of how the project is progressing, and whether you are keeping on track. This means regular updates and entries to your **Project Log**. Ideally these will be completed on a weekly basis, but in reality you may find that pressure of work means that you do not do these with this sort of regularity. The best advice here is to try to maintain the discipline of regular entries; if you fall behind, it is extremely difficult to reconstruct these at a later date, and the lack of a coherent trail of development may cause you to lose Process marks.

In all likelihood, events will occur which will divert you from your initial plan, and you will fall behind (or even get ahead of) your planned schedule as indicated on your Gantt chart. This is known as 'slippage', and you will need to deal with it. Your project logs should allow you to indicate where slippage has occurred, and how you intend dealing with it. In addition, your project log should contain critical evaluations of work that you have completed. For example, you should not just indicate that you have spent 3 hours in the library researching database theory, but give an indication of how successful this was, citing ideas and references where appropriate.

4.4 Project Reviews

The purpose of a **Project Review** is to assess group progress and its ability to manage the project. Each review takes the form of a walkthrough, involving the group and the *Project Supervisor*. The project file is inspected, along with updated terms of reference and project schedule, and any deliverables available, during the review, the contents are used as the basis of the assessment. In addition to this file inspection, each Project Review has a particular focus. A **Project Review Record** is supplied by the group and completed by the supervisor during the review; a copy is given to the group to be added to the project file.

The first review pays particular attention to the Literature Review, the second, the Design Study, and the third reviews focuses on the product Development/ Model Building .

The End of Project Deliverables

The main 'deliverables' for your project will consist of the product that you are developing for your client or sponsor, together with any agreed supplementary materials (e.g. training guides, user guides etc.). However, you need to be aware from the outset that at the end of the project you are required to submit for Assessment:

- A 2500-word Project Report +/- 10%
- Any Software or other Product you have developed
- Your Project File
- Oral Presentations

The various sections below describe what is required in more detail.

4.5 Project Report

The Project Report should describe the project activity undertaken by the group. Plan the content of the report by preparing a framework for the report before you begin writing (See Appendix C of this handbook). In this way, the report will be well structured and you will avoid omitting things. Your *Project Supervisor* will comment on your framework.

Prepare a draft report by expanding on and filling out your framework. As you write your draft, you can make adjustments to your framework as things come to mind, or if some things are not in the correct section.

The report will cover, amongst other things,

- The purpose of the work undertaken
- The objectives of the work undertaken
- The Literature Review –You may wish to improve the first draft. It should then be included within this final report
- The approach adopted, and whether or not the original objectives were achieved
- A reflection on project outcomes and the process by which you achieved them. The way that the project evolved, and the difficulties

encountered and how they were resolved, what was produced and what remains to be done.

- The appendices of the report must contain the relevant documentation for the end product(s), user guides, etc.

The project report provides the opportunity for you to critically assess the outcome of the project activity.

In general, you should be able to assess alternative methods of approach and alternative solutions to the problem and then give reasons for having selected the chosen solution and be able to explain why you rejected the others. Having completed the project, you should be able to assess the suitability of the approach and the quality of the solution and to state what the good points are and what the unsatisfactory points are. This discussion will take account of the project objectives, the original Terms of Reference and the Product Specification agreed in the Design Brief. You should be able to state what aspects of the approach or solution you would change if you were starting again and why. You should also be able to give reasons for changes to the project if it was re-oriented, rescheduled, the approach changed or the solution modified. You should be able to discuss the lessons that you have learned.

If the project does go wrong and you do not achieve all of your original objectives, but you have a good critical assessment of the project along with a significant body of work, then you may still do well. It may be that the project topic was a difficult one, that there might be little or no literature on the subject or what seemed like a worthwhile approach or a good solution turned out to be a waste of time and you had to go back to the drawing board. In these circumstances, the project might seem to you to be a disaster. This is not the case if the project is written up well since others following you will be able to avoid your pitfalls. Advice on how not to do something is as valuable as advice on how something can be achieved.

4.6 The "Product"

The first thing here is to identify clearly & precisely what is the 'end product' of your project. This will take one of two forms:

(i) Novel algorithms, coding or other pieces of software (or even hardware) that you have created either as a central part of your project, or along the way to producing something else. Included in

this would be Websites, databases, 3D Models, games, educational materials. Here the 'product' is the software (in its loosest sense)

(ii) Novel research carried out and managed by you which has examined some feature that you have identified, and on which you have collected data, analysed and evaluated it, and presented a critical report on your findings. Included in this would be the case where a group has undertaken a survey or a series of interviews, or a case study. Here the 'product' is the totality of the research – its methods, the data collected, the presentation of the data and the results of analysis.

In reality, it may be that your product will be a combination of different elements. For example, students who are producing software will undoubtedly need to evaluate this with users; in order to carry out this small scale evaluation they will need to design a methodology, collect and analyse data etc. A group undertaking a large scale survey will need to use a computer package such as SPSS to analyse the data; this might involve coding or other novel uses of the software.

The development of this 'product' appears to be a formidable task; however, it is only one component of the assessment. The development of your product should form a significant section in your Project Report. Along with a description of the process it should reflect upon difficulties encountered and whether or not the original Project Objectives have been achieved. It should refer back to your Literature Review and be used to confirm a line of reasoning, support other established research ideas or, conversely, disprove them.

4.7 The Project File

By the end of the project your Project File will be an extremely bulky affair, as it will contain all your working documents suitably referenced and filed in sections. You should be aware that 15% of the marks on this module is given over to Monitoring; the file and contribution during to the discussion with your supervisor is a major component in this mark, as it demonstrates how you have managed the project. If the file is higgledy-piggledy, with no clear demarcation between sections with missing items, you can be sure that you will get poor process marks, regardless of how well you think you have managed the project. Conversely, this is where students who have had 'disasters' in terms of software development (software will not run; programs crash), can make up marks, by demonstrating that they managed the process

well, and did everything that they could reasonably be expected to have done in order to get the programs to work.

Typical contents of the project file might be some of the following:

- **Terms of Reference**
- **Project planning and monitoring documentation**
- Project Log
- Background information
- **Documentation for & results of Project Reviews**
- Specimens of documents collected during investigation.
- Records of interviews, meetings etc.
- Evidence of skill development
- **Designs for the Project**
- Examples of Research Instruments
- Notes to the file
- Raw data; preliminary analysis
- Draft product documentation
- Research findings
- Investigations undertaken to explore ideas.
- Product testing & Evaluation
- **Annotated bibliography**

The items in **bold** form an essential core of the file and are required. Other items should be included only if they are relevant.

4.8 The Presentation

This part of the assessment allows you to demonstrate the command that you have over the subject matter of the project. You are expected to prepare and drive a **Presentation**. The presentation should be structured with an introduction, exposition and conclusion.

Explain enough about your project for the audience to understand the points that you are about to make, then critically assess those aspects of your project which you think are important, e.g. the technically challenging aspects, the design approach, how well the objectives have been achieved, major changes to the original objectives, things that you have done well, things that you would have done differently with hindsight, objectives that you have failed to

achieve and why, the final state of the project and what further work is required, etc. You should also spend a little time reflecting on the journey: what have you learnt from this process over and above the content of the project?

You will only have a total of 15 minutes available. Allow time for questions and discussions. Inspect the venue in advance. You should ensure, in advance, that any facilities that you require for the demonstration (especially any software you require is installed) are available at the venue and that they are working satisfactorily.

4.9 Submission Details & Deadlines

Full details of actual deadlines are given in the Timetable, available as a separate document. What follows here is a summary of what you are required to submit at approximate times.

The Terms of Reference

This should be submitted to *MS Teams* within the first weeks of the semester. It is a requirement that you obtain a passing grade for this. Any ToR which fails, means that you must take time out to resubmit before you can move on to the next phase.

A Draft Literature Review

This should be submitted to *your supervisor*. It will be reviewed and you will be given an opportunity to revisit and improve your LR, when you submit your Final Report.

The Design Brief

This should be submitted to your supervisor as part of Project Review 2.

The Project Report, Product and Project File

Your **Project Report** must be:

See appendix C for guidance on formatting and content.

If you have produced a **Software Product**, then this should be produced separately shared on gitlab/github. The link should be provided in your report.

*The Project Final Report and any software produced remain the property of Botswana Accountancy College and are **not returned**. They may be made available for future reference by other students. If a copy is required for personal use, it should be made **prior** to submitting the report.*

The **Project File** consists of the sectioned file that you have used throughout the project for planning and documenting progress. It **must include your ToR, Your Project Management, including Progress Logs, the Design Brief, Four Project Reviews** (conducted with the Supervisor) and a **Bibliography**. It may well contain all research carried out, as well as other materials.

Please note that in addition to the deadlines above, The Project Reviews occur at specific points in the semester.

5. Assessment

5.1 Assessment Components

There are five elements of assessment, for which you will receive separate grades, according to the following criteria:

Element	Criterion
Terms of Reference **10%**	The extent to which you have been able to negotiate a project which is appropriate to the needs of a client, to set detailed and appropriate targets, and to plan towards the meeting of those targets, and to document the process.
Product **20%**	The quality of the deliverables in relation to the requirements of the client/sponsor, the technical and/or intellectual demands required, the 'look and feel' of the end-product, and the quality, range and appropriateness of supporting materials.
Monitoring **15%**	The extent to which you have managed the entire process, using the resources available, making effective use of meetings, monitoring and evaluating your own work, and documenting the process effectively.
Final Report **40%**	The extent to which you have been able to select a relevant and appropriate topic, to research it effectively using a wide range of sources, to critically analyse the material produced and to report on the outcomes using high levels of academic writing skills. The extent to which expected outcomes are met, whether design approach proposed has been followed, etc.
Presentation and Demonstration **15%**	Scope and coverage of work; depth and penetration of analysis and evaluation; use of material; empirical (including evidence, examples, statistics, etc); conceptual and comparative; demonstration of skills and methods; relevance and validity of conclusions; pertinence and incisiveness of views expressed;

	individuality and creativity. Clarity and conciseness of communication; fluency and consistency of style; visual quality and legibility; appropriateness in selection of modes of presentation (written, graphic statistical, etc). Includes correct referencing style and extent of reference sources

Please note immediately that there is not a one-to-one correspondence between the elements for submission and the assessment criteria. This is deliberate, and means that **you cannot omit any one of the items for submission without seriously compromising your overall grade**. What follows below is an attempt to describe the relationship between the items for submission and the assessment criteria.

The grade that you get for the **Terms of Reference** will be 'banked', and that grade will carry over towards the final marking.

The Grade for the **Final Report** weighs 40 %.

The grade for **Process** is derived from a number of sources. During the semester, you will receive grades for the Project Reviews that you undertake with your supervisor.

The **Product** grade will be based mainly on the quality of the end-product you have produced, mainly, but not entirely, in relation to your stated objectives and your Terms of Reference. Where this is a piece of software, consideration will also be taken of the supporting evidence found in the Project Report and the Project File, such as the technical specifications, the user guide, the design, testing and evaluation as well as the fitness-for-purpose of the product. Where the project is a piece of research with no identifiable software or hardware product, the grade will be based on the quality of the research undertaken: the research design and implementation, together with the analysis and interpretation of results. The presentation will be a strong element here, and you should use it as an opportunity to present the results of your project to their best effect.

6. Some Advice

Do not think that you have plenty of time for the project. Although the submission date for the project report may seem a long way off, when you allow for the literature review deadline, Easter, the unplanned unavailability of IT resources, software that does not do what it is supposed to do, birthdays, other domestic demands on time, and planning and writing the report, you will find that you do not have as long as you think between the terms of reference and the end of product construction.

It is very difficult to recover slippage on the schedule. You should allocate approximately considerable hours each week to the project. Do not sacrifice this to other modules or activities.

Try and act on any advice given to you by the supervisor at the weekly sessions.

It is up to you as a group, to drive the project, if you do not take the necessary actions, no one will generally come looking for you. So, if you do not inform the *supervisor* of your project choice, you will not be allocated one, or if you do not arrange to meet your *Project Supervisor*, they will not be able to offer you any guidance.

Project Reviews, meetings with your *Project Supervisor* and the product demonstration will take place by arrangement as in your Project Schedule. You are expected to attend these activities at the agreed time. You will be informed of the arrangements for the final presentation nearer the time.

7. References

- www.soc.napier.ac.uk/~cs10/CO42019/project_handbook.doc
- hopelive.hope.ac.uk/imc/level_H/R&DProject/**R&D_Handbook_06_07**.DOC

8. APPENDIX A - Project Management

8.1 Framework for the Terms of Reference

This TOR should be used in the first two weeks to develop the central ideas for the project. This should not be more than 3 pages.

Research and Innovation **Terms of Reference**	
Name of Student_1:	**ID Number_1:**
Name of Student_2:	**ID Number_2:**
Name of Student_3:	**ID Number_3:**
Name of Student_4:	**ID Number_4:**
Supervisor:	
Title	*Offer an overall title for the project.*
Problem Statement and Background	*Outline in detail the problem statement your project is addressing. Discuss any background literature considerations relating to your project. citation will be attract extra marks.*
Aim & Objectives/	*State the overall aim of the project (What are you trying to do? What does the sponsor or client wish you to produce or find out?)* *State specific objectives of the work, or milestones along the way, in terms of the major tasks needing to be undertaken.*
Requirements	*Outline in detail the core requirements of your project. These should form the success factors to your project*
Resources and Skills Required	*Specify the software, hardware, books etc to be used* *Specify the range of skills which will be required in order to ensure that the project outcomes are met.*
Outcomes and Deliverables	*Specify as clearly as possible what the final outcomes will be, and the elements that will be produced along the way (for example questionnaires, user guides, training manuals etc.)*

Methodology	*Describe how this project will be carried out i.e. what data will be collected, what experimental work or developmental work will be undertaken and what analysis will be carried out. In particular you must describe how the knowledge outcomes of this project will be evaluated/ tested to ensure claims made are sound.*
Limitations & Constraints	*Define the boundaries of the work. (For reasons of policy, the Project Sponsor or Client may specify the approach to be adopted, the people who must be approached, the organisations involved etc.)*
Evaluation	*Outline in detail how you will evaluate the success of your project. Indicate how you will test your project and success factors addressing the problem stated above.*
References	
Project Schedule	*A plan for the project*
Gantt chart	

8.2 Project Schedule Proforma

The following proforma is offered to help plan the project schedule. When using this, the Project Tasks should be fairly broad (e.g. Research Literature), but should then be broken down into specific Task Deliverables, (e.g. Obtain 20-30 Relevant Articles; Summarise these as Notes; Produce Bibliography; Create Outline Plan; Create Draft Review.)

Student Names:					
Project Title:					
Supervisor:					
Project Task		**Effort (hours)**	**Planned Start Date**	**Planned End Date**	**Specific Task Objectives Or Deliverables**
No	**Description**				

8.3 Monitoring & Evaluation

Below is a suggested Project Log, such as would be filled in on a regular basis. This assumes that you have created a Project Schedule such as the one above, and have clearly identified a set of Specific Task Objectives or Deliverables (e.g. obtain 20-30 Relevant Articles; summarise these as Notes; Produce Bibliography; Create Outline Plan; Create Draft Review, when undertaking the Literature Review). In a particular week, you may be only attempting one or two of these as a specific task objective. You should allocate this a predicted amount of time.

At the end of the week you should review progress, and say how long you actually spent on the task and what the outcome was. (e.g. For 'Obtain 20-30 Relevant Articles', a student may note:

"Found 35 separate Internet references. However, only around 15 of these seemed to be absolutely relevant and up-to-date. Most of the 15 are from serious academic sources and will probably be regarded as reliable. This means that more work is needed on this task; and additional 1 hour will be spent looking at IEEE Journal sources next week. This will not mean a redrawing of the Gantt chart"

Student Names:	
Project Title:	
Supervisor:	

Task Objectives		**Predicted**	**Actual**	**Task Outcome**
Date	**Description**	**(hours)**	**(hours)**	**Evaluation & Consequences**

9. APPENDIX B – Formal Project Reviews

The Formal Project Reviews are important milestones in the project; normally they form punctuation marks at the end of particular stages. They are also important mechanisms for supervisors to gain a good understanding of your progress, and how you are managing the process. They are assessed, and while the grade you obtain is only of 'advisory' status, this grade will have a large influence on your overall process mark, some 25% of the module marks. You should therefore take these reviews seriously, and ensure that you are prepared to undertake them at the right time.

9.1 Project Review 1

The purpose of Project Review 1 is to ensure that your project group has a manageable project of the right size and challenge, and to ensure that there is a coherent plan which will take the group through to a successful conclusion. The first review pays particular attention to the Literature Review. This will be assessed against principal objectives (i) – (v) below.

Objectives

By the time of the first review, your group will have

(i) *Established a framework for the project and its management, documenting this clearly by use of a well-organised project file.*

(ii) *Produced a draft plan of the Literature Review, and a draft bibliography, together with a sample of 400-500 words (about a page of A4) of material from anywhere in the review for tutor comment and advice.*

(iii) *A cleaned data set*

Materials Required for the Review

You should arrive at the Review with the following materials:

A Project File(digital), with clearly-labelled sections. The contents of the file are up to you, but if you have read the relevant sections of this handbook carefully, there is clear advice on what is essential, and what is supplementary.

Your draft **Literature Review and methodology.** This document should be complete, coherent and well-written. It should have been agreed by all parties, and should form a coherent, consistent, working document.

Finally, you will need a **Project Review Record**, with the top part completed, and with a list of brief points which you would like the tutor to examine.

9.2 Project Review 2

The purpose of Project Review 2 is twofold: (a) to ensure that the project is progressing effectively, and that project documentation is providing effective monitoring, and (b) to ensure that your group has a coherent and well-structured plan the second, the Design Study, and is able to write it effectively.

Objectives

By the time of the second review, your project group will have

(i) Established a framework for the project and its management, and used this effectively to keep records of progress

(ii) Monitored and evaluated progress so far, amending schedules as required.

(iii) The main focus of the review is The Design Study. For this you are required to bring a copy of the Design Study, together with a Product Specification, which has been agreed by the client or sponsor. The supervisor will keep this and return it to you with comments.

Materials Required for the Review

You should arrive at the Review with the following materials:

A Project File, with clearly-labelled sections. At this stage, this should no longer be just an empty file, but should be a working document.

In particular, you should have up-to-date **Project Logs**, and these should clearly demonstrate the work you have been doing. The comments in these logs should be evaluative, rather than merely descriptive, and there should be signs that planning has been amended as a result of any slippages.

The main focus of the review is **Design Study**.

Finally, you will need a **Project Review Record**, with the top part completed, and with a list of brief points which you would like the tutor to examine.

9.3 Project Review 3

The purpose of Project Review 3 is twofold: (a) to ensure that the project is progressing effectively and that project documentation is providing effective monitoring and (b) to ensure that the project's product Development/Analysis is progressing effectively.

Objectives

By the time of the third review, the student will have

(i) Established a framework for the project and its management, and used this effectively to keep records of progress

(ii) Monitored and evaluated progress so far, amending schedules as required.

(iii) Produced a proof od product development for the project, which shows exactly what is be developed. In case of Data Analysis out clearly and precisely what will be produced or researched, and which has been agreed with the sponsor or client.

(iv) Produce EDA report

Materials Required for the Review

You should arrive at the Review with the following materials:

A Project File, with clearly-labelled sections. At this stage, this should no longer be just an empty file, but should be a working document, with substantial sections, one of which should be concerning the Literature Review.

In particular, you should have up-to-date **Project Logs**, and these should clearly demonstrate the work you have been doing. The comments in these logs should be evaluative, rather than merely descriptive, and there should be signs that planning has been amended as a result of slippages.

The main focus of the review is **The Design Study**. For this you are required to bring a copy of the Design Study, together with a Product Specification, which has been agreed. The supervisor will keep this and return it to you with comments.

Finally, you will need a **Project Review Record**, with the top part completed, and with a list of brief points which you would like the tutor to examine.

9.4 Project Review 4 (Not Assessed/graded)

The purpose of Project Review 4 is (a) to ensure that the project has been completed successfully, and that project documentation has been provided with effective monitoring, and (b) to ensure that your group has a clear understanding of the requirements for submission, and has a clear plan for what will be produced.

Objectives

By the time of the final review, the student will have

(i) Utilised the framework to manage the project, keeping records of progress, including some critical evaluation of work produced, and ensuring that the project file is a coherent and understandable document.

(ii) Produced the project deliverables, and informally demonstrated these to the supervisor, offering some evaluation.

(iii) Thought through a plan as to how the material will be submitted, and be prepared to discuss this with the supervisor.

Materials Required for the Review

You should arrive at the Review with the following materials:

A Project File, with clearly-labelled sections. At this stage, this should be a near-complete document, and is quite extensive. You may wish to use the opportunity to ask the supervisor for advice on how to present particular sections of the file.

In particular, you should have up-to-date **Project Logs**, and these should clearly demonstrate the work you have been doing. The comments in these logs should be evaluative, rather than merely descriptive, and there should be signs that planning has been amended as a result of slippages. This monitoring should also contain some critical evaluation of the work that has been done.

The first main focus of the review is **The Project Deliverables**. For this you are required to bring a copy of any Software produced, or the final results of your Research. You should Walkthrough these deliverables with the supervisor, demonstrating exactly what you have produced.

The second main focus of the review is the **Reporting**. At the very least you need to have a coherent plan as to what you will be submitting in terms of the Project File, and have mapped out the sections of your Final Report. You should also have an outline plan for your oral presentation.

Finally, you will need a **Project Review Record**, with the top part completed, and with a list of brief points which you would like the tutor to examine.

9.5 Preparing for the Reviews

You should read carefully the advice for each of the reviews above, including the purpose of the review and what the objectives are. The objectives state what you need to have completed beforehand; they are also the criteria on which you will be assessed. Clearly you need to take particular notice of the sections headed 'Materials Required for the Review', as if you arrive without these materials, then at the very least, your grades will be affected, and in the worst case, your supervisor may decide that you are not ready for the review and cancel it. As a general principle, you should always bring your project file to the review. Ensure that it is up-to date and that you have completed all the work in readiness for the review.

Update the relevant review form from this section of the handbook, and fill in the first section. You should also write a list of points which you would like your supervisor to address. When you attend the review you should appear on time, and thoroughly prepared. Time is short and there will be a lot of ground to cover.

At the end of the review, the supervisor will write a list of points for you to consider, and also award a grade on the basis of the quality of your preparation and your engagement with the tasks.

If you fail to attend a review without just cause, or if a supervisor cancels a review because you have arrived without the correct materials, then you will score zero for the review. However, these reviews are part of the group support on this module, and so supervisors may decide to conduct a review out of sequence, or one which might have been cancelled.

9.6 Project Review Proformas

Included in the rest of this section are four proformas, one for each Project Review. You should copy each one of these, fill it out and present it to your supervisor at the start of the Project Review. He/she will then be able to make suitable comments on your work, and give you an overall advisory grade.

Research and Innovation
Project Review Record Sheet

Student Name_1:	
Student Name_2:	
Student Name_3:	
Student Name_4:	
Project Title:	
Project Supervisor:	
Review Date:	

OBJECTIVES:

By the start of this review you should have:

1.

2.

3.

4.

REVIEW TOPICS:

Please write here a brief list of points you wish to cover:

ADVICE:

APPENDIX C - Project Report

9.7 Report Writing

In preparation for report writing, you should plan the report by producing a report framework. The framework gives the main headings of the report and notes on the contents of each section. Failure to plan the report will result in a series of disconnected sections with no structure. As you write the report ideas will come to mind which belong in sections other than the one you are writing, these can be noted in the framework for subsequent inclusion.

The report is first produced as a draft followed sometimes by other drafts and then by the final version. The framework and draft should be reviewed by your Project Supervisor. The production of the framework, the draft(s) and the final version of the report should appear in your project schedule. You should include in the report the reaction of the Project Sponsor, or any other quality assurance agents, experimental participants, to the products that you have developed.

9.8 Framework for the Project Report

Report Presentation Format

Your **Project Report** must be:

- word-processed, on A4 paper
- Bound

The text should conform to the following specifications:

Headings:	**Arial Bold 16pt**
	Arial Bold 14pt
	Arial Bold 12pt
Body text:	Times new Roman 12pt
	1 ½ line spacing
Header:	Name, ID, Pathway

Footer: Page Numbers

There should be a contents page which indicates the sections. This handbook can be used as a guide for the format of the Report.

The front cover should either have the title and student names printed on the cover,

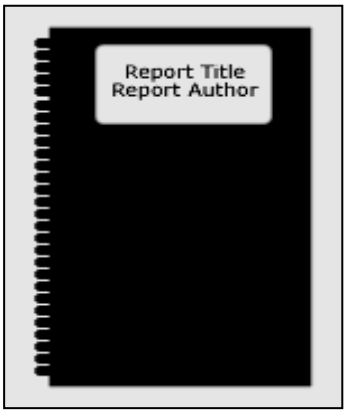

Figure 1

Any software **Products** must be submitted on github/gitlab and included in your report. The Project Report and any software produced remain the property of Botswana Accountancy College and are **not returned**. They may be made available for future reference by other students. If a copy is required for personal use, it should be made **prior** to submitting the report.

Report Contents

The report should include the following:

TITLE PAGE

- Project Title
- Author(s)
- Date (the month and year)
- Declaration. This states "The work is my (our) own, is original and has not been submitted previously in support of any qualification or course". This must be signed by the student(s).

CONTENTS

Presented in the following order and indicating starting page of each:

- list of abbreviations;
- illustrations/figures/tables and materials contained in pockets;

- individual chapters with titles;

Chapter 1 INTRODUCTION

- A brief overview of the nature of the project, what was to be attempted and the deliverables to be produced. One of the ways of doing this is to produce a list of Research Questions – these are posed as queries to be answered, either from the Literature Review or from the Practical Work.
- A guide to the remainder of the report and appendices

Chapter 2 LITERATURE REVIEW

- A critical analysis of different approaches to your subject area.
- A conclusion with how your work fits within the body of knowledge on your topic.
- Reflection upon how this research influences the development of your product.

Chapter 3 METHODOLOGIES

The next section of your report is where you describe in detail how the work was carried out, in which the work carried out is described in detail. This will be different according to the type of Project you are undertaking.

<u>Either</u>: PRODUCT DEVELOPMENT & IMPLEMENTATION

This is a description of the methods you used in order to create your software product.

- Clarify the Product Specifications (these will normally have been decided and agreed in the Design Proposals)
- The developmental approach adopted / methodology
- Resources and facilities used.
- Set backs: The problems encountered and their solutions

<u>Or</u>: RESEARCH DEVELOPMENT & IMPLEMENTATION

This is a fully justified account of the methods used to carry out the research:

- Specify the Research Questions to be answered

- Specify your methodology; what methods did you adopt & why; what research instruments did you devise; how was any sampling done?
- Implementation of the Research; problems encountered and their solutions.

Chapter 4 OUTCOMES

In this section of the report, you describe in detail what you have produced as a result of all this activity. Again, this will depend on the type of project you are undertaking:

Either: PRODUCT DEVELOPMENT & IMPLEMENTATION

This is the main section where you describe your product, and give examples of screenshots etc. The main product will be produced on disk.

- A full description and explanation of the main project deliverables.
- An exposition on how the deliverables satisfy the objectives outlined in the Product Specification.
- How it was established that the deliverables meet the objectives.
- Evaluations of the deliverables by users or other parties.
- Involvement of the project sponsor and reaction to the product.

Or: RESEARCH DEVELOPMENT & IMPLEMENTATION

This is the main section of the research where you present the data, summarise, analyse and interpret the results:

- Results, Analysis and Interpretation
- Conclusions and how these relate to expectations from the literature.
- Involvement of the project client/sponsor and their reaction to the outcomes.

Chapter 5 CONCLUSION AND RECOMMENDATIONS

A critical assessment with hindsight of the project activity.

- A brief summary of findings

- A self-assessment on the quality of deliverables, in relation to the original terms of Reference of Your Project in the NLA.
- Any recommendations for future improvements? e.g. could the findings of your research be worked on by next year's students?
- A summary of what you have learnt on this module, incorporating an evaluation of the extent to which you have met each of the Learning Outcomes, and Lessons to be learned from the process

REFERENCES

References must be presented using the **Harvard** referencing system.

- Full reference section
- Bibliography

Remember:

Cases of unattributed direct quotations or paraphrasing can constitute plagiarism and will be regarded as a serious breach of academic discipline.

Incorrect referencing can also lead to penalisation of marks

APPENDICES

Titled as **Appendix A, Appendix B** etc.

These may include any relevant material to support the report, which if presented in the main body of the report would interfere with its flow e.g.

- Terms of Reference
- Project Schedule
- Record of Work
- Raw data sets
- Design and program documentation
- Trial plan, test data and expected results.
- User Guide
- Operating instructions.

If the project contains programming (or the creation of an application) then the following should be included:

a) Annotated listings of key parts of the source code.
b) An overview of the structure of the software as created
c) A description of the strategy used for testing and evidence of that testing
d) A description of the software development
e) An analysis of the resulting software
f) Plans for future development
g) A disk(s), together with a user guide

9.9 References

What is referencing and why do it?

Referencing is a standardised method of acknowledging other individuals or groups work. We need to reference the work of others to avoid plagiarism, which is knowingly copying somebody else's work and failing to give them due credit for it, therefore implying that the work is your own.

Another reason to reference is to enable interested readers to pursue an avenue of interest by following up cited authors work.

Students must always cite the sources they have used in writing their projects. Within the text of the project the Harvard system must be used. A reference section and bibliography at the end of the project is essential and you must also reference in text. The use of work of other writers, whether in terms of direct quotation or paraphrasing must be indicated clearly using the conventions set out below.

Cases of unattributed direct quotations or paraphrasing can constitute plagiarism and will be regarded as a serious breach of academic discipline. Incorrect referencing can also lead to penalisations.