Guidelines for the final year project in the Software Engineering Programme of the Bachelor of Engineering

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These guidelines are based in part on the guidelines for the final year project in the Bachelor of Engineering (Electrical and Electronic) [1].

All students in the Bachelor of Engineering course must complete the final year project. It is important to note that to qualify for Honours in the Software Engineering programme, a student must have demonstrated the achievement of the research project outcomes detailed in the Outcomes section below.

A final year project with research outcomes is characterised by the:

- statement of an hypothesis related to research in the discipline of software engineering.
- definition of an experiment or set of experiments to test the hypothesis.
- collection and critical analysis of relevant information and data.
- evaluation and analysis of results and the statement of appropriate conclusions.
- clear communication of the project to professional colleagues.

The Nature of Research for the Final Year Project

All students are strongly encouraged to take Scientific Communication 405 or have at least familiarised themselves with the lecture material and notes on the website. The unit is aimed at providing students with the practical skills necessary for carrying out research in the area of computer science and software engineering and writing a thesis.

One of the challenges of the final year project is to ensure that it contains an adequate research component in order for it to qualify for Honours. Given that the desired outcomes for an Honours level final year project involve the demonstration of

research capability, it is imagined that the project will involve at a minimum, research of an analytical or comparative kind (see below).

The unit Scientific Communications 405 covers the nature of research in some detail. Quoted below is a summary of the different types of research:

- **Descriptive**

  Descriptive research asks the following questions: What is there? What do we see? Such research often takes places at the early stages of our understanding of a system. This might be common in areas such as human-computer interaction, for example, where we observe how humans and machines interact before we hypothesize models for that behaviour or new systems for the computers.

  Note that even though descriptive research is an important element of the scientific process, it is not envisaged that an entire final year project would be based on descriptive research alone. Rather, descriptive research may be an initial step which is taken before carrying out comparative or analytical research.

- **Comparative**

  Comparative research asks the following questions: How does one system compare with another in terms of the functional specifications we are given? Are our findings general? Comparative research takes place when we are asking how general a finding is. Is this algorithm specific to my particular problem, or will it solve a class of problems?

- **Analytical**

  Analytical research asks the following questions: How does it work? What is the mechanism? Analytical research takes place when we know enough about the system to start formulating hypotheses about how the system works, how the parts are interconnected, and what the causal relationships might be. A typical analytical approach would be to devise two or more alternative hypotheses about how a system works, to devise a hybrid approach to solving a problem, or to develop an entirely new theory that provides a solution to the problem. Ideally, analytical research is tested by devising a set of experiments to distinguish successful approaches from the others. Examples of this in software engineering may be to find a new measure to calculate code complexity or new metrics for process maturity.

In addition, when conducting experiments as part of a research project, the student should also seek to answer the following questions:

1. Why were the particular experiments chosen?
2. What was done, and how?
3. What were the results? and
4. What do the results mean?

If the project is concerned with a new method, then 3. and 4. are replaced by

3. What are the advantages of the method? and
4. How well does it work?

(Information quoted above taken from the Scientific Communication 405 web site: http://undergraduate.csse.uwa.edu.au/units/233.405/)

Where a software application is constructed as part of the experimental methodology, the student should have demonstrated sound Software Engineering practices in its construction (see outcome 4). It is important to note however that the construction of a software application as the sole basis for the final year project is not sufficient to qualify for Honours.

Outcomes

On completion of the final year project, the student will have demonstrated:

1 the ability to write a research based thesis to a professional standard which includes the ability to:
- 1.1 understand how to structure the document into its component parts:
  - 1.1.1 introduction, including a literature review with proper citation and referencing of bibliographic sources.
  - 1.1.2 methods.
  - 1.1.3 results.
  - 1.1.4 conclusions.
  - 1.1.5 bibliography.
  - 1.1.6 appendices.
- 1.1.write using clear grammatical and correctly spelled English.
- 1.2.effectively use document preparation tools to produce a report that can be read easily.
- 1.3.appropriately use figures and tables to aid the reader in understanding the work undertaken.
- 1.4.appropriately use appendices to present supplementary material (including source code where necessary).

2. the ability to undertake a research problem and conduct a scientific investigation of that problem which includes:
- 2.1.clear understanding and ability to state the problem being investigated.
- 2.2.an adequate exploration of the history, context and current status with regard to solving the problem.
- 2.3.the ability to design and construct a set of experiments that test the hypothesis.
- 2.4.the ability to conduct the experiments and collect data.
- 2.5.the ability to analyse and present the data collected from the experiments including the use of statistical and other methods of analysis.
- 2.6.the ability to draw conclusions from the experimental data and to be able to apply them in the context of resolving the truth of the initial hypothesis.

The student will also have demonstrated:

3. The generic research skills of:
- 3.1.the ability to work independently;
- 3.2.the ability to develop the research beyond the scope of the supervisor; and
- 3.3.critical thinking.

If the project involves the development of a software application, the student will

have also demonstrated:

4. The use of sound Software Engineering principles including the fact that they have:
   4.1. understood and implemented a software process using a clearly stated methodology.
   4.2. captured functional and technical requirements for a specific application which solves a given problem or set of problems.
   4.3. investigated alternative approaches and designs and detailed the decision process behind the chosen strategy.
   4.4. written the application following the process and using best-practices in all aspects of the development process.
   4.5. tested and verified that the application met the stated requirements.
   4.6. analysed the process and provided feedback into possible process improvements.

Bibliography

[1] EECE, General Guidelines for the final year project in the Bachelor of Engineering, School of Electrical, Electronic & Computer Engineering, 2002