CVEN4101 Projects and People

In 2013, this course will focus on problem solving.

Course Coordinator: Professor D. G. Carmichael

Topics

1. Systems Methodology
2. Models and Modelling
3. Some Common System Models
4. Fundamental Configurations Relating to Systems
5. The Synthesis Configuration
6. The Investigation Configuration
7. Systematic General Problem Solving
8. Creativity
9. General Problem Solving with Groups
10. Decision Making with Multiple Objectives
11. Optimization
12. Decision Approaches and Tools

Course Textbook

The textbook, on which the lectures and tutorials will be based, is:

David G. Carmichael, *Problem Solving for Engineers*, CRC Press, Taylor and Francis, London, ISBN 9781466570610, Cat: K16494.

See UNSW Bookshop.

Tutorials

Tutorials will be based on the exercises given in the course textbook. Students will not be told directly the answers to these exercises, but rather will be helped in finding the answers for themselves. This is seen as a necessary transition step to becoming an independently thinking engineer, and leaving behind the high school spoon-feeding mentality of question-answer style thinking.

Overview

Problem solving (implying decision making) is carried out every day by everyone. However, few people stop and think of the processes involved and whether they could improve their problem solving or decision making skills.

This course argues that the most rational way to develop a framework for problem solving is via a systems studies viewpoint.

Accordingly, the course firstly outlines **systems methodology**, **modelling** and the various **systems configurations of analysis, synthesis and investigation**. A systematic process is then outlined for problem solving. Problem solving and decision making are shown to lie within a systems synthesis configuration. Various forms of decision making are explored.

What is a problem and what is a solution?

In broad terms, a **problem** might be described as:

being in a state different to that desired

An alternative state to that existing is sought or wished for. A difference exists between what could or should happen, and what is actually happening.

In broad terms, a **solution** might be described as:

that which transfers the existing state to some other state.

There are degrees of goodness of solutions. Later, mention is given as to **how solutions might be ranked**. Later, mention is also given on **constraints**, which restrict the choice of solutions.

In broad terms, a **state** is:

an indicator of behaviour or performance

Examples include the balance of a bank account, the health of a person, and the position and velocity of an aircraft.

The above definitions of a problem and solution are satisfactory for introductory or lay purposes but need tightening up for engineering purposes, and are refined later in the course. More correctly, the state should be thought of and expressed as a variable that can take different values. Then a **problem** exists when:

the current values of the state variables are different to that desired

and the **solution**:

changes the values of the state variables

The state variables remain the same from problem definition till after a solution is implemented. The only thing that changes is the values taken by these state variables.

Some examples might help clarify the intent of the meanings of problem, solution and state.

Example 1. Problem: Bank account balance (state) is low, or a higher balance (state) is desired. Possible solutions: Invest the money at a higher interest rate; deposit more money; etc.

Example 2. Problem: A person is unwell (state), or a better health (state) is desired. Possible solutions: Take medicine; undertake exercise and a special diet; move to a sunnier climate; etc.

Example 3. Problem: Person at location A (state), or desires to be at location B (state). Possible solutions: Drive vehicle; catch public transport; walk; etc.

Example 4. Problem: Person is hungry (state), or desires not to be hungry (state). Solution: Anything that removes the hunger, or transfers the person from being hungry to not being hungry.

These views on a problem and a solution are quite different to the majority of the literature and peoples' beliefs. Hopefully by the end of this course, you will be persuaded to this style of thinking. The meaning of the term 'state' is central to understanding. Pay particular notice of it.

The approach presented in this course has developed out of existing systems engineering, systems studies and systems theory thinking.

Dictionary definitions and lay usages of the term 'problem' are rejected here as being unsuitable for developing a systematic framework for problem solving. You will also need to reject such definitions and usages. Typically, dictionaries talk of problems as 'being something difficult, doubtful or hard to understand, there being degrees of severity of problems, and a problem being a matter requiring a solution'.

Consistent with this, you will also need to banish from your thoughts the use of the term 'problem' as encountered in textbooks and classrooms, meaning a contrived (for learning or entertainment purposes) 'exercise', 'question' or 'puzzle', where a 'solution' is sought by the text author or class teacher.

Aim. The intent of the course is to present a rational and systematic approach to problem solving and decision making. The approach is intended to be non-discipline specific.

The aims of the course are to understand problem solving and to contribute to thinking on problem solving. The level of thinking that goes into problem solving in much of the literature is very superficial and cookbook in nature. To counter this, the course adopts a systems view to provide a rigorous framework. Rigor in the usage of terminology is also stressed. For technical terms, dictionary definitions and lay usage are rejected.

In many situations, there is frequently no right or wrong answer. In many cases people are satisfied with a satisfactory outcome. The idea of an optimum solution may not exist. People from technical backgrounds may initially have difficulty in accepting that there is no right/wrong, black/white, on/off, yes/no answer.

Course Communications

All communications on the course are to be through the Blackboard discussion tool, or during the nominated lecture/tutorial time slots. Using the Blackboard discussion tool allows all students to see replies to any questions asked, and allows all students to join the discussions. Also use the Blackboard discussion tool to create discussion topics with others in the class.

Assessment - General

Assessment for the course comprises 4 components:

Component	**Max. Mark**	**Dates**
A1. An individually prepared report	20	Submit whenever you like, but **late penalties** apply after 5pm August 28*
A2. An individually prepared report	20	Submit whenever you like, but **late penalties** apply after 5pm September 18*
A3. An individually prepared report	20	Submit whenever you like, but **late penalties** apply after 5pm October 16*
B. Final examination	40	TBA
Total	100	

* Submit as early as possible because you don't know what might happen to you near these dates.
* After submitting, always check what you have submitted.

Satisfactory performance in all assessment components is necessary in order to achieve reasonable grades. A maximum total mark of 50% for the course may be given should a fail grade be obtained in any of the assessment components (irrespective of grades obtained in other assessment components).

The course convenor reserves the right to adjust by scaling the final marks given in each of the components where, looking at the marks given across the total student cohort, it is believed the original marking and/or assessment has been too harsh or too light.

Grading of submitted assessment

Grading of all assessment will be based on the following criteria (where relevant).

1. Instructions
(Have the submission instructions been followed?)
2. Content
(How comprehensive is the coverage of the topic – in depth, superficial or otherwise? Is it engineer level? How well does the work address the topic – Fully? Not at all? Skirts the topic? Misses the point? Gets sidetracked? Goes off on a tangent?)
3. Presentation
(How professionally or amateurishly presented is the work?)
4. Accuracy
(Is something said that is incorrect or contentious?)
5. Objectivity
(Has the work been objective in its presentation. Does it recognize the difference between rigorous objectivity and subjective opinion?)
6. Referencing
(Does the work include appropriate citations within the body of the work. Is the Reference list at the end complete in all details, such that any reader would be able to go directly to any reference?)
7. English Expression, Grammar and Spelling
(English expression, grammar and spelling (Aus) – correctly used? Does the work show that it has been proofread for English?)
8. Writing Style
(Is the work concise and to the point? Or is it verbose and uses unnecessary padding?)
9. Level of Material
(Is the level of presentation that which you would expect at engineer level? Or is it too simplistic?)

Marks for submitted assessment

0	Any form of plagiarism, no matter how minor. (The course mark will also be 0 for any form of plagiarism.) English expression, grammar and spelling are not to a standard appropriate to someone who is about to become an engineer. Report layout, diagrams, equations etc are not done to a visual standard appropriate to someone who is about to become an engineer.
1 to 10	One or more of the above criteria are badly done. If you receive such a mark, critically examine what you have written against each of the above criteria, and be honest with yourself in this examination.
11 to 19	One or more of the above criteria needs extra work.
20	All criteria are satisfied well.
Resubmit	Where a report is given a 0 to 9 mark, resubmission will be allowed, but only up to the date when the following assessment is due. Such resubmissions will only be looked at if the student's performance is satisfactory in the rest of the assessment components.

Late penalties will be applied separately to any mark given, and at the time of compiling the final marks for the course.

Assessment Details

Assessment Components A1, A2, A3

Individual Reports

You are required to write on one topic for your 'hand-in' (electronically via Blackboard) report A1, one topic for A2, and one for A3.

Late submission penalty – A deduction of 4 marks will occur for every calendar day or part calendar day late after the date and time nominated.

Submissions can occur whenever you like. It is suggested that you submit early if any troubles whatsoever (eg dog ate usb stick, computer malfunction, boss asks you to do some work for a change, power or computer failure, internet down, illness, death, away from civilisation) could be a possibility near the final submission date.

Regularly look for any announcements in Blackboard regarding the administration of the report.

Your report

a. Title your submission files SurnameFirstname_A1.doc, SurnameFirstname_A2.doc and SurnameFirstname_A3.doc (as appropriate) where 'Surname' and 'Firstname' are as they appear in Blackboard. Nothing else will be accepted. For example, SmithJohn_A1.doc, SmithJohn_A2.doc and SmithJohn_A3.doc. DON'T USE docx or pdf.
b. Submit as an attachment to Blackboard, not a cut and paste to Blackboard, not as an email attachment. After submitting, check that you have submitted the correct file.
c. Use sensible margins.
d. Use 12 point Times, single line spacing.
e. Length – maximum 2 pages (including appendices, figures and tables).
f. Do not repeat the wording of the assignment. Do not give a table of contents.
g. No cover page. Nothing in headers or footers. Use the first two lines of your submission for: Course name, report topic, your name (as it appears in Blackboard), and your student number (all 12 point type).
h. Proofread for spelling and grammar.
i. Use third person (not first or second person).
j. Citations within the report are as Author (year) or (Author, year). (Not square brackets with numbers; not superscripted numbers.) An alphabetical list of References at the end is complete with all authors, authors' initials, year, title, and (for a journal) journal name, volume, issue, pages; (for a book or report)

publisher and place of publication; (for the internet) full web address. A Bibliography is a list of works that are related to the topic and ones you looked at, but didn't cite directly. So both a list of References and a Bibliography could be expected.

k. Material (text, figures, tables) copied from elsewhere, and not acknowledged, is referred to as plagiarism and represents academic misconduct for which students can fail a course and can have their enrolment cancelled. Any text from another source needs inverted commas around it, together with a citation of Author (year) and the page number of the quote. Any figure or table from another source needs a citation in the figure/table caption. Then give full referencing under 'References' at the end.
l. Use subheadings and give a structured flow. Bullet points are acceptable within the report, but not as the total report.
m. Do not extract or paraphrase material from the lecture notes. Just reference the material's location in the lecture notes.
n. Make your contribution terse, concise and to the point. Don't pad or be verbose. Don't pad with pretty pictures or university logo.
o. Focus your contribution directly on the topic and exclude peripheral information.
p. Do not use footnotes.

Disciplines reported on

For each of the Topics A1, A2 and A3 below, you are to select a different discipline for each, from the many disciplines (structures, geotech, water, waste, construction, transport, management, ...) that you have studied in your degree so far.

The submissions for Topics A1, A2 and A3 cannot be from the same discipline. That is, the discipline chosen for A1 has to be different to that chosen for A2, which has to be different to that chosen for A3, which has to be different to that chosen for A1. If you repeat the same discipline, it is an automatic 0 mark.

Plain English

The content of your submissions might be (but doesn't have to be) from very esoteric and specialist areas of civil and environmental engineering. You need to be able to describe what is happening in plain English, such that a person not from the chosen discipline can understand what you have written. That is, translate any specialist language and terminology to plain English.

Topic A1 – Synthesis Configuration

Write your report as an MSWord.doc document right from the first word. Do not write as docx and then later convert to doc, because any equations and symbols will be lost.

You are to go back over the courses that you have done previously towards your degree. From any of the many disciplines (structures, geotech, water, waste, construction, transport, management, …) that you have studied, describe something that fits a synthesis configuration. You choose the 'something'.

Use plain English. Assume that the reader is not a specialist in the 'something' that you have chosen. You are not writing a novel or essay – you are writing a concise technical report, and so don't pad with unnecessary 'Once upon a time' and 'They lived happily ever after'.

Page 1:

Give the following:

- **Discipline.** Name the discipline area. (1 line)
- **Situation.** What within this discipline are you looking at? (2 lines)

Then give information on the following. If you are using mathematics, also describe the symbols etc in words.

- **Controls.**
- **States.**
- **Outputs.**
- **Model.**
- **Objective(s).**
- **Constraints.**

Page 2:

Then:

- **Characterise the model.** Suggest why such a model is being used for your situation as opposed to some other model type.
- **Describe (in words) how the synthesis might be approached/attacked.** That is, how you take the information in the preceding dot points and do something with it.
- **Outcomes of the synthesis.**
- **Example applications in real-life engineering** (of what you have just described).

Page 3:

Nothing else but a **reference list**, correct with all details.

Topic A2 – investigation Configuration

Write your report as an MSWord.doc document right from the first word. Do not write as docx and then later convert to doc, because any equations and symbols will be lost.

Choose a different discipline to A1.

You are to go back over the courses that you have done previously towards your degree. From any of the many disciplines (structures, geotech, water, waste, construction, transport, management, …) that you have studied, describe something that fits an investigation configuration. You choose the 'something'.

Use plain English. Assume that the reader is not a specialist in the 'something' that you have chosen. You are not writing a novel or essay – you are writing a concise technical report, and so don't pad with unnecessary 'Once upon a time' and 'They lived happily ever after'.

Page 1:

Give the following:

- **Discipline.** Name the discipline area. (1 line)
- **Situation.** What within this discipline are you looking at? (2 lines)

Then give information on the following. If you are using mathematics, also describe the symbols etc in words.

- **Inputs.**
- **States.**
- **Outputs.**
- **Model.**

Page 2:

Then:

- **Characterise the model.** Suggest why such a model is being used for your situation as opposed to some other model type.
- **Characterise the input-output data** that are used in the investigation
- **Describe (in words) how the investigation might be approached/attacked.** That is, how you take the information in the preceding dot points and do something with it.
- **Outcomes of the investigation.**
- **Example applications in real-life engineering** (of what you have just described).

Page 3:

Nothing else but a **reference list**, correct with all details.

Topic A3 – Optimization

Write your report as an MSWord.doc document right from the first word. Do not write as docx and then later convert to doc, because any equations and symbols will be lost.

Choose a different discipline to A1 and A2.

You are to go back over the courses that you have done previously towards your degree. From any of the many disciplines (structures, geotech, water, waste, construction, transport, management, …) that you have studied, describe something that fits optimization. You choose the 'something'.

Use plain English. Assume that the reader is not a specialist in the 'something' that you have chosen. You are not writing a novel or essay – you are writing a concise technical report, and so don't pad with unnecessary 'Once upon a time' and 'They lived happily ever after'.

Page 1:
Give the following:

- **Discipline.** Name the discipline area. (1 line)
- **Situation.** What within this discipline are you looking at? (2 lines)

Then give information on the following. If you are using mathematics, also describe the symbols etc in words.

- **Controls.**
- **States.**
- **Outputs.**
- **Model.**
- **Objective(s).**
- **Constraints.**

Page 2:
Then:

- **Characterise the model.** Suggest why such a model is being used for your situation as opposed to some other model type.
- **Perform an optimization study on the above information.** Explain what you did.
- **Example applications in real-life engineering** (of what you have just described).

Page 3:
Nothing else but a **reference list**, correct with all details.

Assessment Component B

Final Examination

- The final examination is CLOSED BOOK.
- NO COMPUTERS, OR DEVICES FOR STORING INFORMATION, are to be taken into the examination room.
- Non-programmable calculators are permitted.
- Time allowed: 2 hours duration plus 10 minutes reading time.
- The examination format is anticipated to be multiple choice questions. Should this not be the case, students will be informed via Blackboard.