

Course Plan
CS 6880 Advanced Topics in Software Engineering
Spring 2005

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Welcome to Course CS 6880

We are going to have a good time together

This document is the main document of student information for CS 6880.

This page will be regularly updated

LATEST NEWS

Below entries are listed: Most recent first, ie., in reverse chronological order.

- 9 December 2004: First release.

Contents

0	[0] Course Pre-requisite	2
1	[1] Course Aims & Objectives	2
1.1	[1.1] Course Aims	2
1.2	[1.2] Course Objectives	3
2	[2] Course Material	3
2.1	[2.1] Reference	3
2.2	[2.2] Practical Matters	3
3	[3] Lecture Plan	3
3.1	Monday 10 January	4
3.2	Monday 17 January	4
3.3	Monday 24 January	5
3.4	Monday 31 January	5
3.5	Monday 7 February	5
3.6	Monday 14 February	6
3.7	Monday 21 February	6
3.8	Monday 28 February	6

3.9	Monday 7 March	7
3.10	Monday 14 March	7
3.11	Monday 21 March	7
3.12	Monday 28 March	8
3.13	Monday 4 April	8
3.14	Wednesday 27 April: Exam	8
4	[4] Course Work	8
4.1	[4.1] General	8
4.2	[4.2] Specific Assignment Topics	9
4.3	[4.3] Assignments	9
5	[5] Examination	9
5.1	[5.1] Written, 2 Hour Test	9
5.2	[5.2] Assignment Reports – and Assignment Report Evaluation	10
6	[6] Tutoring	10
7	[7] Lecturer’s URLs	10

0 [0] Course Pre-requisite

It is expected that students have first had a course in Discrete Mathematics - for example based on a textbook like Susanna S. Epp’s book, *Discrete Mathematics - with Application*, used at NUS.

1 [1] Course Aims & Objectives

1.1 [1.1] Course Aims

The course aims to cover the following topics:

- A two week refreshment of Discrete Mathematics covering
 - Sets, Functions, Algebra, Lambda-Calculus and Math.Logic.
- A one week overview of Property and Model Oriented Abstractions.
- A three week systematic coverage of model-oriented abstraction techniques and tools:
 - Sets,
 - Cartesians,
 - Lists,
 - Maps,
 - Higher Order Functions and
 - Types

in the RAISE Specification Language, RSL.

- A three week brief overview of
 - Applicative,
 - Imperative and
 - Parallel

Specification Programming

- is followed by three weeks of paradigmatical lectures on:
 - Hierarchical and Compositional Abstractions,
 - Denotational and Computational Semantics, and on
 - Configurations: Contexts and States.

Students will weekly solve small exercises in each of these topical areas, and will work out, in groups, domain, requirements and software architecture models of Airports, Financial Services (Banks, Stock Exchanges), Hospitals, (E-)Market, etcetera.

1.2 [1.2] Course Objectives

- The course is a graduate course.
- It emphasises using formal, discrete mathematics.
- The course has as a main objective that of making sure that the course participant henceforth will be able to construct pleasing, elegant formal models of

2 [2] Course Material

2.1 [2.1] Reference

- Vol.1, **Software Engineering**, Publisher: Springer-Verlag
Abstraction & Modelling, Around March 2005
Dines Bjørner
- Vol.2, **Software Engineering**, Publisher: Springer-Verlag
Specification of Systems and Languages, Around March 2005
Dines Bjørner

2.2 [2.2] Practical Matters

- Students can download relevant chapters from the net - and print at own expense.
- The lecture-by-lecture topic plan given below refers to lecture appropriate postscript files and to corresponding slides.
- These slides are reduced to fit 8 to one page.
- Thus, You are not to read all of vols. 1+2.
- You are only to read those pages or sections that have been highlighted in Sect. 3 below.
- For an overview of the, so far 3 volume, book, please click this !

3 [3] Lecture Plan

- **Lectures** are **tuned** to **assignments**.
- Assignments are tuned to lecture(d) material.
- Assignments will be “issued”

- Assignments will be “lumped” into three reports:
 - Issued ... are to be handed in in week of ...,
 - issued ... are to be handed in in week of ..., and
 - issued ... are to be handed in ... before 4pm !

3.1 Monday 10 January

Lecture Topic: **Sets, Cartesians, Types and Functions** Vol.1, Chaps.3–6

- Slides
- First Hour:
 - Course Overview, Course Aims & Objectives
 - Sets and Cartesians
- Second Hour:
 - Types and Functions
 - Course Management

Assignment Name:

-

To be handed in .

3.2 Monday 17 January

Lecture Topic: **Lambda-Calculus, Algebras and Logic** Vol.1, Chaps.7–9

- Slides
- First Hour:
 - Lambda-Calculus, a terse Overview
 - Algebra, I
- Second Hour:
 - Algebra, II
 - Mathematical Logic, a Reminder

Assignment Name:

-

To be handed in .

3.3 Monday 24 January

Lecture Topic: **Atomic Types & Values, and Functions Definitions in RSL, and Property and Model Oriented Abstractions** Vol.1, Chaps.10–12

- Slides
- First Hour:
 - Atomic Types & Values in RSL
 - Functions Definitions in RSL
- Second Hour:
 - Property and Model Oriented Abstractions

Assignment Name:

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To be handed in .

3.4 Monday 31 January

Lecture Topic: **Sets, Cartesians, Lists and Maps in RSL** Vol.1, Chaps.13-16

- Slides
- First Hour:
 - Sets in RSL
 - Cartesians in RSL
- Second Hour:
 - Lists in RSL
 - Maps in RSL, a first view

Assignment Name:

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To be handed in .

3.5 Monday 7 February

Lecture Topic: **Maps, Higher Functions and Types in RSL** Vol.1, Chap.1

- Slides
- First Hour:
 - Maps in RSL, a second view
 - Higher-Order Functions in RSL
- Second Hour:
 - Types in RSL

Assignment Name:

•

To be handed in .

3.6 Monday 14 February

Lecture Topic: Vol.1, Chap.1

- Slides
- First Hour:
 -
 -
- Second Hour:
 -
 -

Assignment Name:

-

To be handed in .

3.7 Monday 21 February

Lecture Topic: Vol.1, Chap.1

- Slides
- First Hour:
 -
 -
- Second Hour:
 -
 -

Assignment Name:

-

To be handed in .

3.8 Monday 28 February

Lecture Topic: Vol.1, Chap.1

- Slides
- First Hour:
 -
 -
- Second Hour:
 -
 -

Assignment Name:

-

To be handed in .

3.9 Monday 7 March

Lecture Topic: Vol.1, Chap.1

- Slides
- First Hour:
 -
 -
- Second Hour:
 -
 -

Assignment Name:

- To be handed in .

3.10 Monday 14 March

Lecture Topic: Vol.1, Chap.1

- Slides
- First Hour:
 -
 -
- Second Hour:
 -
 -

Assignment Name:

- To be handed in .

3.11 Monday 21 March

Lecture Topic: Vol.1, Chap.1

- Slides
- First Hour:
 -
 -
- Second Hour:
 -
 -

Assignment Name:

- To be handed in .

3.12 Monday 28 March

Lecture Topic: Vol.1, Chap.1

- Slides
- First Hour:
 -
 -
- Second Hour:
 -
 -

Assignment Name:

-

To be handed in .

3.13 Monday 4 April

Lecture Topic: Vol.1, Chap.1

- Slides
- First Hour:
 -
 -
- Second Hour:
 -
 -

Assignment Name:

-

To be handed in .

3.14 Wednesday 27 April: Exam

- Morning Examination, 2 Hours, Closed Book

4 [4] Course Work

4.1 [4.1] General

- Class is encouraged to compose themselves into n groups, g_i , of p_i students each — such that $\sum_{i=1}^n p_i = C$, where C is class size.
- We suggest group sizes of around 6–8 students each.

- Each group is given an assignment over which they will, as a group, each week work out a 2-5 page week report.
- The week reports partially fill in, ie., contribute to the month reports. A number of week reports thus constitute the month report.
- The two first month reports enter the final, the 3rd month, report.
- The reports are in English and in RSL.

4.2 [4.2] Specific Assignment Topics

1. What is an *Airport* ?
2. What is a *Air Traffic* ?
3. What is an *Container Terminal*, ie., a *Container Harbour* ?
4. What is a *Financial Service System* ?
5. What is a *Hospital* ?
6. What is the *Market* ?
7. What is a *Metropolitan Area Tourism Industry* ?
8. What is a *Metropolitan Railway System* ?

4.3 [4.3] Assignments

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5 [5] Examination

There will be two forms of examination:

- **Written, 2 Hour, “Closed Book” Test.** Counts 40%
- **Report Evaluation.** Counts 60%

5.1 [5.1] Written, 2 Hour Test

- The written, 2 hour test is a **closed book** test.
- You will be asked a number of questions. Each question is designed to test that you have understood the essence of one of the topics covered in the lectures.
- The questions will thus cover areas of the lectures not naturally coverable by the assignment reports. In the lectures, the lecturer will point out such typical written examination questions !
- The test questions complement those asked to be solved in the assignments.

5.2 [5.2] Assignment Reports – and Assignment Report Evaluation

- Each group submits one assignment report each month.
- There will thus be 3 (three) assignment reports.
- For the final report you are, please, to submit all “early” reports (possibly edited, as per your decision) as well as the answers to the last, posed questions.
- The final report will resemble major parts of a proper, full scale, real–life, commercial development document, one that can be read by itself, ie., free–standing.
- All (“early” and final) report front pages will state, in the below order:

```

Course Name:
Course Number:
Report Serial Number: #i (i=1, 2, 3), Date:
Assignment Topics:
  As stated above, in the frame, after each lecture's "Assignment Name"
Group members:
  Name 1, E-mail #1,
  Name 2, E-mail #2,
  ...
  Name i, E-mail #i,

```

- The final report will be all the previous (ie., early) reports + the last report. You are free to update, edit, revise, that is: Improve earlier reports.
- The lecturer will evaluate each assignment report, for the next weeks.
- Please use text processing system with adequate cross–referencing and indexing facilities. We suggest (that you learn and/or use) L^AT_EX.
- The lecturer’s final assessment will be based on some “mix” of early and final reports. Improvements will thus be notes — as will ability to turn in meaningful early reports.
- The lecturer will make the final assessments of both written tests and group report at course end.

6 [6] Tutoring

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7 [7] Lecturer’s URLs

The curious student may wish to inspect:

- Dines Bjørner’s CV(s)

for biographical data about the lecturer.

- Course Volumes

for information about the course text book.

- The Railway Domain

for information about a worldwide railway system domain R&D project instigated and headed by Dines Bjørner.

And:

- Dines Bjørner's Singapore Home Page

as the main entry to info related to the lecturer.