UPPSALA UNIVERSITET

Methods of Programming DV2

http://www.it.uu.se/edu/course/homepage/pm2/VT09/

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Unofficial motto:

You can write good programs
even if you have to use C!

Purpose of the course

”Techniques and methods for developing correct, stable, maintainable and efficient software. ”
(from the course plan)

You will not learn how to program (you should already know) but…

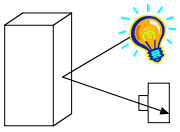
You will learn how to:

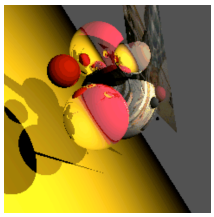
- write code which is easy to read and to maintain
- write code which is stable and works well
- write good documentation
- use program development tools
- profile and optimise code

...by carrying out a substantial programming project!

The project

Develop a *ray tracer* – a program which given a description of a three-dimensional scene, creates a two-dimensional picture by computing the path of the light rays from light sources to a ”camera”.





There is a detailed project specification on the course web site.
(Remember? http://www.it.uu.se/edu/course/homepage/pm2/VT09/)

What is ”good code”?

- Understandable – good style, elegant, concise, good algorithms, good documentation
- Correct – gives the right results for all valid input
- Safe – rejects invalid input, doesn’t silently do something wrong, resistant to faults in the surrounding environment
- Maintainable – adding/changing/removing functionality
- Efficient – acceptable CPU, memory, disk etc. usage, real-time response requirements
- Reusable – in new applications/contexts
- Portable – another CPU type, OS, window environment, etc.

How do we achieve this?

Particularly as we use a primitive language such as C…

Methods and techniques

- Good specifications (SE students will do most of it for you)
- Proper design (in advance, pseudocode, (data)flow charts)
- Coding standards (consistency, good practise, avoid pitfalls)
- Abstraction (a crucial issue!!!)
- Code review and analysis (better to find bugs before testing)
- Testing (code with testing in mind, plan your testing, save tests)
- Debugging (understand the bug, why was it there?)
- Rapid prototyping (early testing, partial functionality, code stubs…)
- Optimisation (get the code working first)
- Profiling (know what to optimise)
- Documentation (start early)
- Development/hazard log (future changes, problems, explanations)
- Software Engineering stuff in general.

Tools

Primarily traditional Unix development tools

- Source code management (CVS)
- Libraries (libxml…)
- Program build (compilers, make)
- Code analysis (compilers, lint…)
- Testing (scripts)
- Debugging (gdb…)
- Profiling (gprof…)
- Data preparation (XML editor)

Course setup

- Supporting lectures and literature (course compendium)
- Coding standards
- Work in groups of 3 – form groups **now** and e-mail the TA's.
- Effort: period 3, low speed (10%), period 4, normal speed (30%)
- Assignment 1 – Abstract data types (done by week 7)
- Assignment 2 – Basic ray tracer (done by week 14)
- Assignment 3 – More complete ray tracer (done by week 19)
- Assignment 4 – Optimise the program (done by week 22)
- Assignment 5 – Make a movie! (done by week 22)
- During assignments 2 and 3 students from the SE course will plan and carry out system tests and code inspections.

Deadlines and such…

- The deadlines are firm. If you need an extension, have a good reason and ask *well in advance*.
- The TA can give the following grades to each assignment:
  - Fail (U) – You flunk the course. Only happens if you don't take the work seriously or lack basic qualifications.
  - Revise (K) – The work has serious shortcomings which must be corrected at once. Resubmit as soon as possible!
  - Pass and revise (GK) – The work has minor shortcomings which need not be corrected until the next assignment (but *must* be corrected by that time).
  - Pass (G) – The work is fine! (But the TA may still have given useful comments.)

Assessment

To pass the course (grade 3):

- Pass the project (i.e. all assignments)
- Pass a home exam (with questions about your particular project)

To pass the course with distinction (grade 4/5):

- Passing the project and home exam with *at least* grade 4 will earn you a 4 grade on the course.

You can *additionally* take an optional traditional exam (with questions about the course literature) in which case

- your grade on the course will be the average of the grade of the project and the two exams.

Prerequisites

- A total of 120 credits (new style, or ECTS credits)
- Mathematics 30 credits
- Computer Science 45 credits including
- Methods of Programming DV1
- Algorithms and Data Structures DV1
- Algorithms and Data Structures DV2
- Compiler Design MN1/DV1

or equivalent courses.

- Computer Programming MN1+2 is considered equivalent to Methods of Programming DV1+Algorithms and Data Structures DV1.