Assignments in the Joint Course on Software Engineering

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The perfect/ideal assignment

- Motivates students
  - Real life tasks
  - Managable with a reasonable amount of effort
- Repeats and practices contents
  - Allows a practical view on theoretically presented lecture contents
- Allows autonomy/independence
  - Allows students to develop some creativity in their solutions
Aims of assignments in our SE course

- Put lecture contents into case study context
  - Show applications of lecture contents
- Allow autonomy/independence
  - Include creative elements and discussions
  - Allow more than one “correct” solution
- Prepare for real life tasks
  - Not too small and too well-formed examples
- Encourage team work
  - Through separable tasks and/or discussion elements

Assignments and course topics

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<th>Part I: Introduction to software engineering</th>
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<tr>
<td>1. What is software engineering</td>
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<td>2. Quality criteria for software products</td>
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<td>3. Software process models</td>
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<td>4. Basic concepts for software development documents</td>
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<th>Part II: Requirements engineering</th>
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<td>5. Results of the “analysis and definition” phase</td>
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<td>6. Cost estimation</td>
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<td>7. Function-oriented view</td>
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<td>8. Data-oriented view</td>
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<td>9. Rule-oriented view</td>
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<td>10. Structured analysis</td>
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<td>11. State-oriented view</td>
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<td>12. Scenario-oriented view</td>
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<td>13. Object-oriented analysis</td>
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<td>14. Formal software specification and program verification</td>
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<td>15. Overview of design activities</td>
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<td>16. Structured design</td>
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<td>17. Object-oriented design</td>
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<td>19. Systematic testing</td>
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<td>22. Maintenance</td>
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<td>24. Quality of software development process and its standardisation</td>
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<td>25. Introduction to software ergonomics</td>
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<td>26. User manuals</td>
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<td>27. Project management</td>
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<td>28. Configuration and version management</td>
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Assignments in detail: Topic 5: Results of "analysis and definition" phase

- Review requirements specification of case study “Seminar Organisation”
  - Become familiar with lecture’s main case study
  - Get to know assignments style
  - Discover advantages of team work ("Four (to six) eyes see more than two..."

Review

- Background: arbitrary SW documents (e. g. requirements specification) have to be equally precise as programs
- Method (Review): Inspection of the documents by a group of evaluators by static reading the document (remark: 2 – 5 evaluators + author of the document)
- Process:
  1. Preparation of the participants
  2. Review meeting of the group: sequentially or by points of emphasis
  3. Produce a protocol

IEEE Std 1028-1988, Standard for Software Reviews and Audits
Review Protocol
(contents scheme)

Document:
Participants:
Leader:
Protocol:
Date, time of the meeting:

1. Summary
2. Problems of the document
   2.1 inaccuracies
   2.2 errors
   2.3 missing information
3. Remarks concerning the structure of the document
4. Remarks concerning the review meeting
   (preparation of the participants, length of the meeting, points of emphasis)

Discussion of solutions (1)

Taken from:
http://www.informatik.hu-berlin.de/swt/intkoop/se/assignments/solutions/

Solution: 1. Review the requirements document "Seminar organization"

Authors: Zoran Budimac, Kay Schützler
Date: Dec. 17, 2002

<table>
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<tr>
<th>Inaccuracies</th>
<th>Discussion</th>
<th>Observed by</th>
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<tbody>
<tr>
<td>3.11. Pre-condition: &quot;Name of the function as a function (e.g., &quot;function_name&quot;)&quot;</td>
<td>Pre-condition could be modified to &quot;Name of the function as a function (e.g., &quot;function_name&quot;)&quot; or &quot;Name of the function as a function (e.g., &quot;function_name&quot;)&quot; instead of a pre-condition (r)</td>
<td>Students - Ger</td>
</tr>
<tr>
<td>3.12. Version description: &quot;Version 2.0 announcements added. (What happens to version function after?) There is a need for more detail.&quot;</td>
<td>Should be stated more clearly that v. 3.0 announcements and enhancements functions</td>
<td>Industry - Eng</td>
</tr>
<tr>
<td>3.13. For every presentation participant with following data: &quot;Conductor (e.g., what is conductor?)&quot;</td>
<td>Probably not (-)</td>
<td>Students - Ger, Industry - Eng</td>
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Errors

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<th>Discussion</th>
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<td>3.19. &quot;Pre-condition succeeded; company got the bill and the presentation form.&quot;</td>
<td>Registration proof is probably the right term.</td>
<td>Students - Eng</td>
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Assignments in detail: Topic 6: Cost estimation

- Apply Function Points method to case study “Seminar Organisation”
  - Discover differences between theory and practice
  - Learn how to deal with imprecise (verbal) requirements specifications
Assignments in detail: Topic 10: Structured analysis

- Review product model of case study "Seminar Organization"
  - Examine example Data Flow Diagrams and Data Dictionaries
  - Discover advantages and disadvantages of Structured Analysis
  - Again deal with imprecise (verbal) and additionally more precise (Semi-formal) documents

Assignments in detail: Topic 13: Object-oriented analysis

- Derive a use case diagram and a class diagram from a problem description
  - Understand (and read carefully) verbal documents of other authors
  - Practice recognition of object oriented entities in texts
  - Manage different point of views (text interpretations) between team members
Assignments in detail: Topic 14: Formal software specification

- Formal specification techniques: Algebraic specification and specification with Z
  - Retrieve a deeper understanding of lecture examples by modifying them
  - Discover the preciseness of formal specifications
  - Practice to think of all possible cases for the specified entities

Assignments in detail: Topic 19: Systematic testing

- Apply regression testing tool ATOS to a small example programme
  - Get to know the concept of regression tests
  - Derive sensible test cases for undocumented software
  - Understand the concept behind the tool
Assignments in detail: Topic 20: Functional testing

- Build a classification tree for one business process of case study “Seminar Organisation”
  - Practice classification tree method
  - Use the method’s standard tool (CTE: Classification Tree Editor)
  - Again derive sensible test cases (but now from the requirements specification, not from a program)

Classification tree method
(orig. developed by Daimler-Chrysler)

- Steps in Classification Tree method:
  1. Choose object i.e. procedure or sub-system;
  2. Determine the input domain of the object;
  3. Determine the aspects for testing;
  4. Form classifications by partitioning the input domain into classes according to these aspects;
  5. Repeat 3 and 4 as appropriate and form classification tree;
  6. Form combination table from the tree;
  7. Mark test cases and form a text version for generation of test sets;
  8. Define test sets;
  9. Derive expected output from the specification;
  10. Perform test and evaluate output;
  11. Check program coverage.
Classification tree method: example

Test object: computer vision system recognizing the size of different building blocks

Input Domain

Aspects

Shape

Color

Size

Small

Large

Red

Blue

Green

Colour

Building blocks

classification

class

Input Domain

Use Case (FP20):
Booking: from registration to booking (1)

Use case: booking: from registration to booking

Goal: registration notification and sending invoice to the client

Category: primary

Preconditions: -

Post condition success: client is notified

Post condition failure: notification to clients that presentation is fully booked, or does not exist, or a booking for the client has been already made

Actor: client manager, client, company

Triggering event: client registration is available
Use Case (FP20):
Booking: from registration to booking (2)

- **Description:**
  1. client data retrieval (1 complex function)
  2. presentation verification (1 middle function)
  3. booking undertaking (1 simple function)
  4. registration notification and sending invoice (1 simple function)
  5. sending invoice copy to the accounts department (1 simple function)

- **Extension:**
  1A. client data actualization
  1B. when client is associate of the company, associated company data are updated and accessed
  1C. invoice verification

- **Alternatives:**
  1A. inclusion of a new client
  2A. when the presentation is fully booked, offer alternative one
  2B. notification of "false presentation", if the presentation does not exist

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CTE Assignment: Solution 1

- **FP20: Booking**
  - Customer
    - new
    - old
  - Presentation
    - not bookable
    - bookable
  - Reason
    - fully booked
    - not existing
    - already applied
    - cancelled
  - Alternative
    - available
    - unavailable
Assignments in detail: Topic 21: Software Metrics

- Play around with a software metrics tool
  - Discuss metrics values concerning the measured objects
  - Discover the idea of metrics as indicators
  - Get some easy points (as a reward for bearing assignments so far...)

Conclusions

- Students don’t find assignments too motivating
  - Especially reviews tend to be stressing
  - Playing around with tools (more at the end of the course) gives more fun
- They admit that practice isn’t always that motivating either
  - In fact practice stresses even more...
- By now a small but good pool of assignments
  - Assignments fit to the course
  - Assignments give a taste of reality
Outlook

- Bigger pool of assignments wanted
  - To variate more from year to year
  - To include other topics like configuration management, project management, …

- All assignments mentioned in this presentation available in English versions
  - To be found at the JCSE web-site

- Discussions of sample solutions and other assignments will follow
  - Also to be presented at the JCSE web-site