Linköpings universitet
IDA Department of Computer and Information Sciences
Doc. Christoph Kessler

EXAM

FDA149 / TDDC54 **Software Engineering**

2006-02-16, 14:00–18:00

Name: ______________________ **Personnummer:** ______________________

Please mark solved problems with X:

Question	1	2	3	4	5	6	7	8	9	10	11	12
answered (X)												
score (points)												

Total score: ______________________ **Grade (U/G, U/3/4/5):** ______________________

Sign. Examinator: ____

Examinator: Christoph Kessler

Jour / tentavakt (Linköping): Christoph Kessler (070-3666687, 013-282406)

External supervisors for exams written outside Linköping,

please confirm with your signature below that you have checked the identity of the candidate and supervised this exam before you send it by mail to Christoph Kessler, IDA, Linköpings universitet, 58183 Linköping.

Supervisor (name, signature): ______________________ ______________________

Hjälpmedel / Admitted material:

None.

General instructions

- This exam has 12 assignments. Read all assignments carefully and completely before you begin.
- Those who only do **half the exam** (corresponding to the second half of the course or TDDC18), please solve only assignments 6 to 12. Hand in a copy of your Ladok account documenting the result you scored in the PUM exam (i.e., TDDC01, TDDC06, TDDB62 or equivalent) together with your exam.
- It is recommended that you use a new sheet for each assignment. Number all your sheets, and mark each sheet on top with your name, personnummer, and a page number.
- You may answer in either English or Swedish.
- Write clearly. Unreadable text will be ignored.
- Be precise in your statements. Unprecise formulations may lead to a reduction of points.
- Motivate clearly all statements and reasoning.
- Explain calculations and solution procedures.
- The assignments are *not* ordered according to difficulty.
- The exam is designed for 40 points and 4 hours (or 20p and 2h for half the exam). You may thus plan about 5 minutes per point.
- Grading: For FDA149: U, 3, 4, 5. For TDDC54 (CUGS master students): U, G.

  The preliminary threshold for passing is 20 points (10 points for those who write half the exam).
- The exams will be corrected by 6 different teachers in sequence. Hence, expect at least 3 weeks until the result will be available.

Assignments

1. (5 p.) **Software processes**

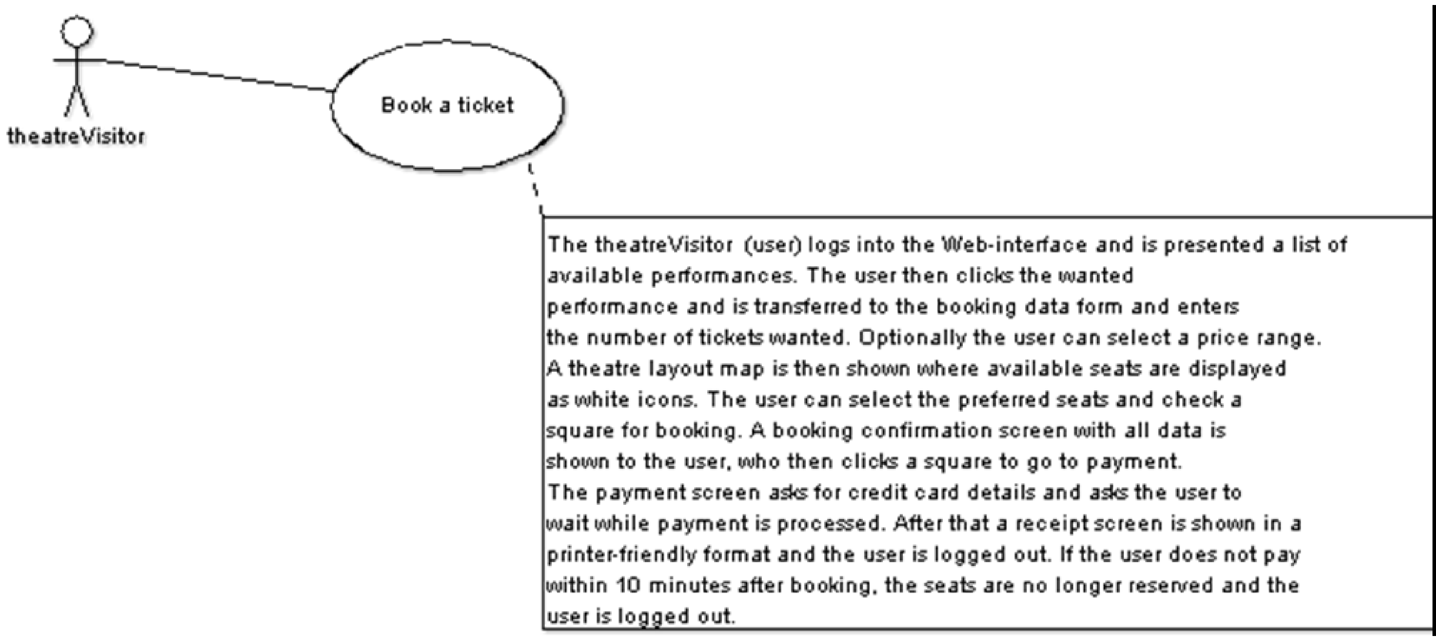
   (a) Write down a decision table for selection of life cycle or process models. The columns represent properties of the problem, properties of the organisation or wanted quality attributes and constraints of the forthcoming systems. The rows are the life cycle or process models, and the squares contain short information of the relation between the column and row. Make sure you have at least five life cycle or process models and comments in at least 10 squares. Example:

	P1	Q2	...
Waterfall model	The more change-prone requirements, the less appropriate is the model.	Easy to connect to a project management model.	...
...	...	...	...

   P1=Requirements volatility
   Q2=Manageability

2. (4 p.) **Use-case modeling in UML**

   (a) Read the following use-case diagram:



The theatreVisitor (user) logs into the Web-interface and is presented a list of available performances. The user then clicks the wanted performance and is transferred to the booking data form and enters the number of tickets wanted. Optionally the user can select a price range. A theatre layout map is then shown where available seats are displayed as white icons. The user can select the preferred seats and check a square for booking. A booking confirmation screen with all data is shown to the user, who then clicks a square to go to payment. The payment screen asks for credit card details and asks the user to wait while payment is processed. After that a receipt screen is shown in a printer-friendly format and the user is logged out. If the user does not pay within 10 minutes after booking, the seats are no longer reserved and the user is logged out.

   Think of some classes and draw a sequence diagram that captures most of the behaviour from the use case. Also write down use-case behaviour you have not included in the sequence diagram.

3. (4 p.) **Software project organization**

   (a) Write down detailed instructions of how to measure:
   (A) The maintainability of a system.
   Suitable keywords: complexity, size, documentation, comments, observed maintenance, replacement.

(B) The relevance of a prototype of a highly interactive system.
Suitable keywords: perceived relevance, invoked commands, completeness, tasks completed, weighting measures

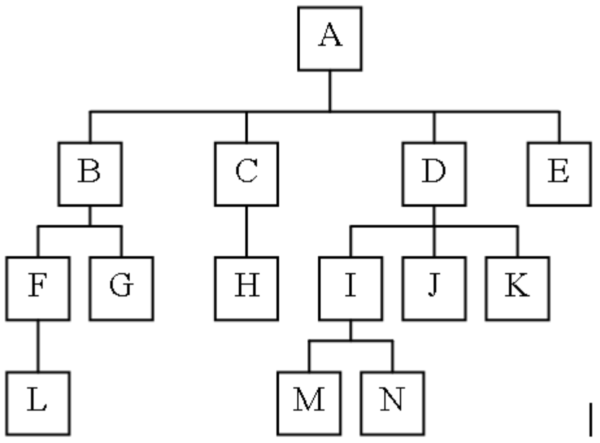
4. (1 p.) **Design patterns**

   (a) What is a *design pattern*? (1p)

5. (6 p.) **Testing**

   (a) Define the terms below: (2 p)
   (A) Fault
   (B) Failure
   (C) Test
   (D) Test case

   (b) The following figure illustrates the component hierarchy in a software system. Describe the sequence of tests for integration of the components using
   – a bottom-up approach and
   – a sandwich approach. (4 p)



The following assignments apply to the second part of the course.

6. (6 p.) **OO technology**

   (a) Explain the term *syntactic substitutability*.
   Explain the terms *covariance* and *contravariance* of parameter types, in the context of design by contract.
   Which of these two imposes an extensibility problem in OO-based component-based design, and why? (3p)

   (b) Explain the *Syntactic Fragile Base Class Problem*. What are its implications for the compatibility of binary components compiled from OO programs? (3p)

7. (1 p.) **Metaprogramming**

   (a) Define the term *introspection*, and give an example of where and how it is used in some component system. (1p)

8. (1 p.) **Model-driven architecture (MDA)**

   (a) Explain how MDA supports reuse. (1p)

9. (3 p.) **Enterprise JavaBeans (EJB)**

   (a) Name two advantages of using Enterprise JavaBeans (EJB) when developing Java business applications. (2p)

   (b) One could argue about whether Enterprise JavaBeans are object oriented or not. What are the arguments against? (1p)

10. (4 p.) **CORBA**

    (a) How does CORBA achieve programming language transparency for static calls? (Describe the principle and those main parts involved in CORBA static calls that are primarily relevant for enabling language transparency. What is the purpose of each part? Which parts are to be written by the programmer, and which ones are generated and how?) (3p)

    (b) What does the CORBA trader service do? (1p)

11. (3 p.) **Software Architecture Systems**

    (a) Software architecture systems are said to be a first step towards separation of concerns. Which concerns are separated, and what are the advantages of this? (1.5p)

    (b) Define the term *layered architectural style* (also known as *onion architectural style*) and give an example of a software system with this style. (1.5p)

12. (2 p.) **Aspect-Oriented Programming**

    (a) Aspect oriented programming simplifies software development by providing a mechanism for implementing concerns that crosscuts modules. Describe a major disadvantage with aspect oriented programming. (1p)

    (b) What is an *advice* in aspect-oriented programming? (1p)