

MTAT.03.094 – Software Engineering (Tarkvaratehnika)

Final Exam – 6 January 2009

EXAM STRUCTURE

- 20 multiple-choice questions in **Section A** worth one point each.
- 5 short-answer questions in **Section B** worth 20 points in total.
- 3 problem-oriented questions in **Section C** worth 20 points in total.

SECTION A

Please answer these questions in the “Multiple Choice Answer Sheet” to be found at the end of the exam.

QUESTION 1

Which of the following is not a software development method?

- (a) Waterfall
- (b) RUP
- (c) CMM
- (d) XP
- (e) Crystal

QUESTION 2

In the software development V-model, the output of the requirements analysis phase is used to design which of the following types of test?

- (a) Unit tests
- (b) Integration tests
- (c) System tests
- (d) User acceptance tests
- (e) Maintenance tests

QUESTION 3

Consider a Skype “add-on” that allows a Skype user to sign up for notifications about events related to his/her Skype friends (“buddies”). The add-on notifies users of *events*, like for example: a buddy has just signed in or signed out, or a buddy’s mood

message has changed. Which of the following is an example of a non-functional requirement for this add-on?

- (a) It must be possible to add new types of events and to remove existing ones
- (b) Users must be able to see and sign up to any of the available types of events
- (c) Every event is visible for 1 month after the user has seen this particular event
- (d) Users must be able to filter events by time period (last day, week, month), type and buddy
- (e) The add-on must be free of charge and available for download by any Skype user

QUESTION 4

Consider an application that manages an address book containing contact details of companies and individuals? This address book can be exported in several formats, including: (i) HTML so that it can be viewed in a browser; (ii) Windows Contact Schema – an XML format for representing contact details – so that it can be uploaded into other applications; and (iii) as a Comma-Separated Values files that can be uploaded into a spreadsheet application. Which of the following design patterns would you employ to design the export function of this address book application?

- (a) Façade
- (b) Singleton
- (c) Command
- (d) Strategy
- (e) Composite

QUESTION 5

Consider an application that manages an address book containing contact details of companies and individuals. This address book can be exported in Windows Contact Schema – an XML format for representing contact details. In order to export an object of class AddressBook into XML, you will need to generate XML code for each of the objects composing the AddressBook (which are objects of a class called “Contact”). And in order to generate XML code for an object of class Contact, you need to generate XML code for each of the objects that compose an object of class Contact. You foresee that in the future, the class Contact will be extended to include additional details. Which of the following patterns would you consider using to implement this XML export function?

- (a) Proxy
- (b) Singleton
- (c) Visitor
- (d) Strategy
- (e) Composite

QUESTION 6

Which of the following notations would be most appropriate to describe the process of handling an insurance claim in an insurance company?

- (a) UML activity diagram
- (b) UML object diagram
- (c) UML class diagram
- (d) UML sequence diagram
- (e) UML use-case diagram

QUESTION 7

Which of the following notations would be most appropriate to describe the messages exchanged between an Automatic Teller Machine (ATM) and a bank's internal IT systems when a customer uses the ATM to withdraw cash?

- (a) UML activity diagram
- (b) UML object diagram
- (c) UML class diagram
- (d) UML sequence diagram
- (e) UML use-case diagram

QUESTION 8

Which of the following notations would be most appropriate to describe the actions that a user can perform with an ATM?

- (a) UML activity diagram
- (b) UML object diagram
- (c) UML class diagram
- (d) UML sequence diagram
- (e) UML use-case diagram

QUESTION 9

Which of the following testing methods can be applied only if you have access to the source code?

- (a) Boundary value analysis
- (b) Equivalence partitioning
- (c) Random input
- (d) Path coverage
- (e) Acceptance testing

QUESTION 10

Which of the following types of test is most appropriate for validation?

- (a) Unit testing
- (b) Boundary value analysis
- (c) System testing
- (d) White-box testing
- (e) Beta testing

QUESTION 11

Which of the following testing methods guarantees that every possible bug is found?

- (a) Equivalence partitioning
- (b) Boundary value analysis
- (c) Path coverage
- (d) Decision coverage
- (e) None of the above

QUESTION 12

A traceability matrix allows one to find out which test cases are associated to a given:

- (a) Class in a class diagram
- (b) Method in a class
- (c) Activity in an activity diagram
- (d) Test protocol
- (e) None of the above

QUESTION 13

Which of the following best describes the difference between RPC and messaging?

- (a) RPC requires more lines of code than messaging
- (b) RPC is a synchronous communication technology while messaging is asynchronous
- (c) System failures are more likely in messaging than in RPC
- (d) RPC is always faster than messaging
- (e) Messaging systems only allows point-to-point communication while RPC systems supports point-to-point and broadcast communication

QUESTION 14

Which of the following is an example of an XP practice?

- (a) Iterations of around 2 months
- (b) Documenting user requirements in terms of functions
- (c) Open workspace for developers, in close proximity to the customer
- (d) 2-hours meetings at the end of each working day
- (e) Each programmer owns an identifiable part of the code

QUESTION 15

In XP, a burn-down chart is used to track:

- (a) The velocity of a programmer, measured for example in terms of new lines of code written by that programmer each day
- (b) The number of story points that have been added to the project each day
- (c) The number of story points that have been tested each day
- (d) The number of story points (or the amount of work) left to do at different points in time until the deadline
- (e) The number of man-hours used each day

QUESTION 16

Consider the following Java method. What is its McCabe's cyclomatic complexity?

```
static int func(int x) {  
    int y;  
    if (x==0)  
        y = 3;  
    else if (x==1)  
        y = 4;  
    else if (x==2)  
        y = 5;  
    else  
        y = 0;  
    return y;  
}
```

- (a) 1
- (b) 2
- (c) 3
- (d) 6
- (e) None of the above.

QUESTION 17

Imagine that you have a Java method written by one of your colleagues, with a cyclomatic complexity of 7. The method calculates a shortest-path between two points in a graph. What would you do?

- (a) Try to split the method into two methods by moving the first 50% of the lines of code to one method and the other 50% of lines to another method.

- (b) Try to factor away some of the conditional (if/then/else) statements and nested loops into separate methods.
- (c) Perform a boundary value analysis of the method in order to test it.
- (d) Try to refactor the entire class and the classes it is connected with.
- (e) Nothing in particular.

QUESTION 18

Imagine that you have a Java method written by one of your colleagues, with a cyclomatic complexity of 30. The method performs a calculation of the price of a product, taking into account different factors, such as optional components included in the product, chosen delivery method and applicable discounts. What would you do?

- (a) Try to split the method into two methods by moving the first 50% of the lines of code to one method and the other 50% of lines to another method.
- (b) Try to factor away some of the conditional (if/then/else) statements or nested loops into separate methods.
- (c) Try to refactor the entire class and the classes it is connected with.
- (d) Perform a boundary value analysis of the method in order to test it.
- (e) Nothing in particular.

QUESTION 19

Consider an application that manages an address book containing contact details of companies and individuals. When calculating the number of unadjusted function points for this application, which of the following is an example of a user inquiry?

- (a) Add a new contact (person or company) into the address book
- (b) Retrieve all contacts sorted and grouped by city
- (c) Save all contacts into an XML format
- (d) Delete an existing contact
- (e) Display the entire address book

QUESTION 20

Consider an application that manages an address book containing contact details of companies and individuals. When calculating the number of unadjusted function points for this application, which of the following is an example of a user input?

- (a) Display the entire address book sorted by name
- (b) Retrieve all contacts located in a given city
- (c) Save all contacts into an XML format
- (d) Edit an existing contact
- (e) None of the above

SECTION B

Provide a concise answer to each of the following questions. Please answer these questions in a separate piece of paper. Answers can be given in Estonian or English.

QUESTION 21

What is test-driven development? What are the main steps in a test-driven development cycle? [4 points]

QUESTION 22

What is equivalence partitioning? What are the advantages of using equivalence partitioning over random input? How does equivalence partitioning relate to boundary value analysis? [4 points]

QUESTION 23

What is a wireframe? What is it used for? [4 points]

QUESTION 24

What are the main differences between the Cocomo I and the Cocomo II models for software cost estimation? [4 points]

QUESTION 25

In which circumstances would you use function points for software cost estimation? In which circumstances would you use lines of code (LOC)? [4 points]

SECTION C

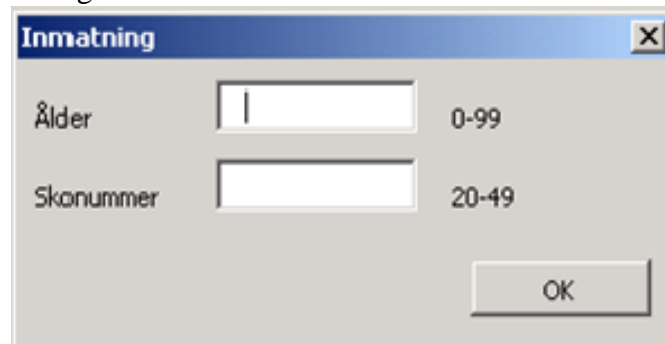
Please answer these questions in a separate piece of paper. Answers can be given in Estonian or English.

QUESTION 26 [5 points]

Consider the following application screen with 2 input fields

- ▶ Which black-box testing would you choose and why?
- ▶ Which test cases would you write?

Note: Ålder means “Age” and Skonummer means “Shoe number”.



The screenshot shows a window titled "Inmatning" with a close button (X) in the top right corner. It contains two input fields. The first field is labeled "Ålder" (Age) and has a range of "0-99". The second field is labeled "Skonummer" (Shoe number) and has a range of "20-49". An "OK" button is located at the bottom right of the window.

QUESTION 27 [6 points]

Here are hypothetical coefficients for the "basic" COCOMO model:

Project	a	b	c	d
Organic	0.01	1.0	1.0	1.0
Semi-Detached	0.02	1.0	1.0	2.0
Embedded	0.03	2.0	1.0	2.0

Recall that the COCOMO equations are:

$$E = a KLOC^b$$

$$D = c E^d$$

Using the above hypothetical coefficients, what would the COCOMO basic model predict to be the development effort needed for a new release of an HTML editor? How long is the development time? Assume the original development team is available to staff the project, and that the new release is anticipated to involve 50,000 lines of code. Justify any assumptions you make and show the calculations that led to your results.

QUESTION 28 [9 points]

The goal of this exercise is to design an object-oriented model for the Tic-tac-toe game (in Estonian: Trips-Traps-Trull)

Description (taken from Wikipedia):

Tic-tac-toe, alternatively called noughts-and-crosses, is a pencil-and-paper game for two players, O and X, who take turns marking the spaces in a 3×3 grid, usually X going first. The player who succeeds in placing three respective marks in a horizontal, vertical or diagonal row wins the game. For example, the following game is won by the first player, X:



1. *User Story*. Consider the usecase of winning a tic-tac-toe game. Write one example of a user-story for this usecase.
2. *Object Diagram*. Draw the corresponding object diagram of the pre- condition of the winning state.
3. *Class Diagram*. Draw a class diagram which captures the internal states of a tic-tac-toe game for two human players (ignore the user interface or any other methods like saving or loading). Specifying methods in the classes is optional.

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Multiple Choice Answer Sheet

Your Name:

Please write the correct answer next to each question number. For example, if you believe that the correct answer to question 1 is option “A”, please write “A” in the cell next to Q1.

Q1		Q11	
Q2		Q12	
Q3		Q13	
Q4		Q14	
Q5		Q15	
Q6		Q16	
Q7		Q17	
Q8		Q18	
Q9		Q19	
Q10		Q20	