

The exam consists of four parts:

- 1) Testing of general knowledge 25%. Each right question counts 1. Each wrong counts – 0.5. Empty counts zero. See the note in the end of this document.
- 2) Planning 20%. All sub-questions count equally.
- 3) Requirements and modelling 35%. All sub-questions count equally.
- 4) Testing 20%. All sub-questions count equally.

## True of false questions.

- a) Maintainability is one of the essential attributes of good software . True  False
- b) Reusability is one of the essential attributes of good software. True  False
- c) Customised products are designed to meet the generic needs of several customers. True  False
- d) Early delivery of critical functionality to the customer is one of the advantages of using the Water Fall Model. True  False
- e) Agile approaches are suitable for development projects where the customers commit to become involved in the development process. True  False
- f) [agile] Agile approaches to development are not suited for small and medium-sized software product development. True  False
- g) [requirements] Consider the following requirement specification fragment for a ticket-issuing system  
“When the user presses the start button, a menu display of potential destinations is activated, along with a message to the user to select a destination”. This is a functional requirement. True  False
- h) [requirements] Consider the following requirement specification fragment for a ticket-issuing system  
“Between 0600 and 2300 in any one day, the total system down time should not exceed 5 minutes.  
“This is an availability requirement. True  False
- i) Activity diagrams show the activities involved in the process and their interaction True  False
- j) Use case diagrams show the interaction between the system and the external entities True  False
- k) [architecture] According to the Model View Controller architecture, all shared data is held in a central database that can be accessed by all sub-systems. True  False
- l) [CM] One of the aims of Configuration Management is to support system integration so that all developers can find out what components have been changed True  False
- m) [testing] During release testing, the system is not tested to check that it meets its usability requirements True  False

**Comment [LJ1]:** Maintainability, dependability and security, efficiency and acceptability

**Comment [LJ2]:** Chapter 3

**Comment [LJ3]:** Chap 5 it is false as the interaction is not in activity diagrams.

**Comment [LJ4]:** In book page 120 it is the environment

**Comment [LJ5]:** start chapter 6 on architecture false this is in a repository archi

- n) [OSS] In open-source development, any contributor to an open source development may fix bugs and suggest new features to a system. True  False
- o) [testing] Regression testing detects the absence of errors True  False
- p) [testing] During user testing, the system is tested in the company's environment. True  False
- q) [evolution] If the external legal environment for the system changes, new requirements can be generated. True  False
- r) [evolution] The number and complexity of system interfaces is one of the process metrics that can be used to assess maintainability? True  False
- s) [evolution] In general, effort of maintenance to add to or modify the system's functionality is estimated to be the lowest of all maintenance effort. True  False
- t) New technologies which become available may impose that software systems must change to take advantage of them. True  False
- u) Plan driven processes are used in system engineering because different parts of the system are developed by different groups at the same time and plans are needed to coordinate their activities. True  False
- v) Technology change is one risk for generic software projects. True  False
- w) Group size is one key factor for effectiveness of group communication. True  False
- x) Project estimates should also include the total cost of each activity. True  False
- y) Process reliability is one of the characteristics that one may want to improve in a process improvement effort. True  False

**Comment [LJ6]:** it should be user environment

**Comment [LJ7]:** In general, effort of maintenance to add to or modify the system's functionality be estimated to be the 65% of all maintenance effort.

**Comment [LJ8]:** Chapter 9 software evolution.

## Planning 20%

- a) You work at software company SC and you are responsible for deciding the software process to be used in a new project for the local electricity provider. There are 10 employees in the company, among which four newly employed, who strongly suggest that the company should shift to agile method for this new project. You organize a meeting with all the employees to listen to the different points of view when deciding whether or not to adopt an agile method of software development. List at least 3 questions that you will ask in this meeting:

1. Is an incremental delivery strategy realistic?
2. What type of system is being developed?
3. What is the expected system lifetime?
4. How is the development team organized?
5. Is the system subject to external regulation?
6. How large is the system that is being developed?
7. Is personnel available from the customer?
8. Will there be new technology involved?

Assume that, for a given project, the following facts are known:

- The Water Fall model is chosen for this new project
- it will start the 1<sup>st</sup> week January 2013
- up to four persons can work on the project
- the project can last up to six months
- the project can cost max 18 man months

- b) list the main four tasks to be performed in the project and give start and finish date and make a

WBS. Specify duration of tasks in weeks or days. Be clear about which unit you use.

Task	Duration in weeks
Requirements analysis and definition	7 (start week 1 finish week 7)
System and software design	6 (start week 6 finish week 11)
Implementation and unit testing	7 (start week 10 finish week 16)
Integration and system testing	6 (start week 15 finish week 20)

c) Make a Gantt chart, each column should represent a week. Each row should represent one of the four activities.

Week/activity	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	TOTAL	
Specification	3	3	3	3	3	1	1														17	
Design						2	2	2	2	2	2											12
Development										2	2	2	2	2	2	2						14
Integration															2	2	2	2	2	2	2	12
TOTAL	3	3	3	3	3	4	3	2	2	4	4	2	2	2	4	4	2	2	2	2	2	55

The constraint is 18 man months which is more than 72 weeks so an effort of 55 weeks does not exceed.

### Requirements 35%

Company X will develop a POS (Point-Of-Sale) system to be used to manage the sales in retail stores. It includes hardware components such as a computer, a bar code scanner, a printer and also software to manage the operation of the store. The most basic function of a POS system is to handle sales. When a customer arrives at a POS counter with items to purchase, the cashier will start a new sale transaction. The POS system reads the barcode of an item, then it will retrieve the name and price of this item from the backend catalogue system and interact with inventory system to decrease the stock amount of these items. When the sale transaction is over, the customer can pay in cash or credit card. After the payment is successful, a receipt will be printed. Note that for promotion, the store frequently issue gift coupons. The customer can use the coupons for a better price when purchasing items. Another function of a POS system is to handle returns. A user must log in to use the POS. The users of a POS system are the employees of the store including cashiers and the administrator. The administrator can access the system management functions of the POS system including user management and security configuration that cashiers cannot do.

- a) Make use case diagrams for all functions in the system (see powerpoint)
- b) Given that one the main functional requirements is “F1 Handle sales” and one of its sub functional requirements is “F1.1 retrieve name and price of items”, list the other functional requirements of the system.

Requirement ID	Description
F1	Handle sales
F1.1	Retrieve name and price of items
F1.2	Handle payment
F1.2.1	Handle payment cash
F1.2.2	Handle payment credit card
F1.3	Print receipt
F1.4	Read barcode
F1.5	Decrease stock amount of item
F1.6	Compute total amount
F2	Handle coupons
F2.1	Issue Coupon
F2.2	Make discount to coupon owner
F3	Manage users
F3.1	Handle login
F3.2	Handle logout
F3.3	Define user, define user rights
F4	Handle returns

- c) Make the text description (structure specification) of the functional requirements “F1.1 retrieve name and price of items”.

Name	F1.1 retrieve name and price of items
Input	Barcode
Output	Name and price of item
Action	Access backend catalogue system and retrieves product description from barcode
Precondition	Valid barcode
Postcondition	Price and name available

- d) Specify the the scenario “handle sales of 3 items with cash payment”

0	Start new sale transaction
1	Read bar code of item
2	Retrieve name and price of item
3	Read bar code of item
4	Retrieve name and price of item
5	Read bar code of item
6	Retrieve name and price of item
7	Compute total amount of sale
8	Handle payment cash
9	Print receipt
10	Decrease stock amount of item

- e) Specify the sequence diagram for the scenario above. See powerpoint for the sequence diagram.
- f) Define the logical entities of the system and their attributes: (we can expect that students have made a class diagram)

Employee: name, social number

Cashier:

Administrator:

Item: name, price, color, brand, size

Coupon: value



## Testing

Consider the POS system.

- a) Briefly describe the main phases you plan to test the system. Make a precise assumption about which development model is used if necessary.

Development testing, where the system is tested to discover bugs and defects.

Release testing where the system is tested to check that it meets its requirements

User testing where the system is tested in the user's environment.

The student should show understanding of module testing and integration testing. Also black box and white box. See note at the end of this document.

- b) Which guidelines do you use for defect testing? Give short and concise examples.

Chose inputs that force all error messages to be generated

Design inputs that might cause buffers to overflow

Repeat the same input numerous times

Force invalid outputs to be generated

Force computation results to be too large or too small.

- c) Write high level Test cases (Testdata, preconditions and expected results) for testing the functional requirement "Retrieve name and price of items".

Testdata	Preconditions	Expected results
Barcode	Valid barcode & item is in	Name and Price

	catalogue	
Barcode	Barcode not valid	Invalid barcode
Barcode	Valid barcode & items not in catalogue	Items not in catalog

Note about task 1

I oppgave 1 står det i oppgaveteksten at feil svar trekkes med -1 poeng. I løsningsforslaget står det derimot at feil svar skal trekkes med -0,5 poeng. Etter å ha rettet så mange oppgaver har vi valgt å kun trekke -0,5 poeng fordi:

- Denne oppgaven er den klart vanskeligste, og det å trekke et helt poeng straffer i overkant mye, spesielt med tanke på at mange av svarene kan diskuteres (det er mer snakk om å krysse av det \_riktigste\_ svaret, ikke hva som er riktig/galt).
- Gjennomsnittscore når man trekker -0,5 ligger allerede veldig lavt, på ca 15,08. Dersom vi skal trekke hele poeng vil gjennomsnitt rask komme under 10, noe som virker veldig lavt for en oppgave som teller 25 poeng. Så langt er det ingen som har klart å svare alt riktig på denne oppgaven, og skal vi trekke mer forsvinner det meste av A og B-karakterer, og i overkant mange vil rykke fra C til D.

Note about 4a)

I oppgave 4a) har studentene nevnt flere typer tester enn det som står i løsningsforslaget, for eksempel acceptance testing (gjern med FAT og SAT) og system testing. Flere nevner også V-model testing.