Academy of Computer Science and Software Engineering

Module: IFM3A10 / IFM03A3
Informatics 3A – Introduction to Software Engineering

Campus: APK
Special SSA: July 2014

Date: 21 July 2014
Time: 09:00

Assessor: Mr F F Blauw (Theory)
Mr D A Coulter (UML)

External Moderator: Dr L Futcher (NMMU)

Duration: 180 minutes
Marks: 150

The question paper consists of 7 pages

Instructions:
• Answer all questions.
• Please write neatly and legibly.
• Do not write in pencil.
• Ensure that all diagrams are neatly drawn.
• Unless otherwise stated, diagrams do not constitute complete answers.
• Calculators may not be used.
SECTION A – THEORY

QUESTION 1
1.1. What is the difference between software engineering and system engineering? (2)
1.2. Name and discuss one essential attribute of good software. (2)
1.3. What are the four fundamental software development activities? (4)
1.4. You have been employed to develop client management software for Danlax Industries. During the development process you realise that you will have to put a lot of security in place to ensure that the clients’ information stays safe. However, for Danlax Industries does not want to incur the additional cost of maintaining high level of security in their new systems.

What should you do? Should you continue as is, or refuse to develop the system? Briefly discuss the ethical implications of either case. (2)

[10]

QUESTION 2
Requirements engineering is the process of establishing the services that the customer requires from a system and the constraints under which it operates and is developed.

2.1. Briefly describe the differences between Functional and Non-Functional requirements. (4)
2.2. Briefly describe domain requirements. (2)
2.3. After the requirements have been elicited, there is a chance that they might be incorrect. Briefly discuss two techniques that can be used to validate the requirements. (4)

[10]

QUESTION 3
OpenZatom Software has hired you as a software engineer. You have been assigned to design a stock management system for Tresdomit, a national distributor of woodwork related products.

Tresdomit would like to be involved throughout the development process and get more feedback from the developers. In the past they found it difficult to judge the project progress from just software design documents. It should be noted that due to the agreement between OpenZatom Software and Tresdomit the entire system will be developed on-site i.e. at Tresdomit business premises. It is also a requirement that the entire system be developed entirely from scratch i.e. all parts of the system must be developed by OpenZatom Software.

With the aid of diagram(s) to help your written discussion, select and discuss a software process model that should be used to develop the stock management. [10]
QUESTION 4
Extreme Programming (XP) is perhaps the best known and most widely used of the agile methods. As such, GeneZe Software has decided that they will change their development cycle to allow for XP. One drawback, according to GeneZe Software, is that XP might result in the less experienced (fresh from university) development falling behind.

4.1. Name and discuss one aspect of XP that will allow experience to be carried over to younger developers. (4)

4.2. Managing software developed using agile techniques work differently. Briefly discuss, using a diagram to assist, the agile project management process. (6)

[10]

QUESTION 5
You have been hired by Nimit web development to implement a web application that must provide a user with multiple ways to view and interact with data. The requirements for the interaction and presentation of data are likely to change in the future.

Keep in mind that the design process for identifying the sub-systems making up a system and the framework for sub-system control and communication is architectural design.

5.1. Which architectural design pattern would you recommend for the above project? With the aid of a diagram, describe the pattern you recommend. (5)

5.2. Briefly compare the advantages and disadvantages of your recommended pattern. (2)

5.3. Briefly describe the difference between architectural design patterns and application architectures. (3)

[10]

QUESTION 6
Given the socio-technical systems stack below, answer the questions that follow.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1:</td>
<td>Society</td>
<td></td>
</tr>
<tr>
<td>2:</td>
<td>Organization</td>
<td></td>
</tr>
<tr>
<td>3:</td>
<td>Business Processes</td>
<td></td>
</tr>
<tr>
<td>4:</td>
<td>Application System</td>
<td></td>
</tr>
<tr>
<td>5:</td>
<td>Communication and Data Management</td>
<td></td>
</tr>
<tr>
<td>6:</td>
<td>Operating System</td>
<td></td>
</tr>
<tr>
<td>7:</td>
<td>Equipment</td>
<td></td>
</tr>
</tbody>
</table>

6.1. What is understood by the term “socio-technical system”? (2)

PTO
6.2. Software engineering is only concerned with some of the layers in the socio-technical stack. Which layers are they? (1)

6.3. Briefly describe the organizational impact a socio-technical system may have on an organizational environment. (3)

6.4. What are emergent system properties? Briefly describe these properties and discuss two examples. (4)

QUESTION 7
7.1. It may not always be possible to develop a system that is absolutely dependable. Explain how some factor(s) may impact the development of a dependable system. You may use diagrams to aid in your discussion. (4)

7.2. When determining the balance between availability and reliability of a system, which do you believe should carry more weight? Motivate your answer. (2)

7.3. In terms of reliability, briefly discuss one possible means for a system to fail. HINT: Make use of terms linked to reliability. (4)

QUESTION 8
Given the risk triangle below, answer the questions that follow.

```
                ALARP Region
                   |  |
                   |  |
                   |  |
                   |  |
                   |  |
                   |  |
```

8.1. Define the three regions of the risk triangle. Particularly give attention to the ALARP region. (6)

8.2. Briefly explain what is meant by a “risk-driven requirements specification.” (4)
QUESTION 9
Software engineering has been more focused on original development but it is now recognised that to achieve better software, more quickly and at lower cost, a design process that is based on systematic software reuse is required.

9.1. Discuss three (3) key factors that you should consider when planning to reuse software. (6)

9.2. Give three (3) circumstances where you might recommend against software reuse. (3)

9.3. In general, would you recommend that software reuse should be considered as a worthwhile means of procuring a new system? Motivate your answer. (1)

[10]

QUESTION 10
The components in a distributed system may be implemented in different programming languages and may execute on completely different types of processor. Models of data, information representation and protocols for communication may all be different.

Roundkix Industries specialises in horse racing and betting. They would like to move their systems into the new era by allow clients to place bets online. The company would now like their customers to be able to use their system by making use of a web-browser to place bets. Bets will then be stored by Roundkix.

10.1. Recommend a client-server architecture that they can use. (1)

10.2. Provide the definition for the architecture you recommended. (2)

10.3. Justify why you recommended the architecture. (2)

10.4. Draw a diagram showing the structure of the chosen architecture. (4)

10.5. What is the main disadvantage of the architecture you recommended? (1)

[10]

Section A Total: [100]
SECTION B – PRACTICAL

QUESTION 11
Create a UML Use-Case Diagram to model the following:

The Comic-Sans system provides for a cloud based digital comic book reader and store. The core functionality of the system can be summarised as follows:

- There are three main roles played by users of the system namely: reader, publisher and administrator. The system has three distinct privilege levels. Everything that can be done by a reader can be done by a publisher. The administrator is a super-user with access to all system functionality.
- Readers are able to read comics online. Every access to a comic is first authenticated to ensure that it has been previously purchased.
- Readers are also able to purchase comics using either credit card or PayPal.
- Publishers have the ability to add comics to the system.
- The administrator is capable of managing users on the system.

QUESTION 12
Convert the following UML Activity Diagram of the exam access calculation into pseudo code:

QUESTION 13
Create a UML Class Diagram to model the following:

There are many kinds of lockable items which each support the lock operation. Doors, Vehicles and Clear Text are all variants of lockable item. A Securable List is a container of lockable items which supports the add, remove and lock all operations.
QUESTION 14
Create a UML Communication Diagram to show the reading of all the lines of text from a file of unknown size.

[10]

QUESTION 15
Create a UML Component Diagram to model the use of a ports based system to facilitate two kinds of payment (EFT and Credit Card) to an online clothing store.

[10]

Section B Total: [50]

— END OF EXAM —

Grand Total: [150]