FACULTY OF SCIENCE

Academy of Computer Science and Software Engineering

Module	**IFM3A10 / IFM03A3** Informatics 3A – Introduction to Software Engineering
Campus	APK
Exam	June 2016

Date	2 June 2016	**Time**	12:30
Assessors		Mr F F Blauw	
Internal Moderator		Dr W S Leung	
External Moderator		Mrs C Schroder (NMMU)	
Duration	180 minutes	**Marks**	150

The question paper consists of 6 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.

Adventures of Agent X#
Permission to Terminate

In the distance you hear a phone ringing. Will someone stop that ringing! you think to yourself. The ringing is getting louder and louder. As you open your eyes, you realise that it is your secret agent communication device requiring your attention.

Flicking open the communicator you grumble and an annoyed voice on the other side starts talking:

"It's Agent M++ here. Are you still sleeping, Agent X#? We have a crisis! The ADS, our Agent Dispatch System, is falling apart. Even though our organisation is growing, we cannot upgrade the system, as the ADS only supports Windows XP. This system is just not as useful as it used to be. We need a New ADS, or as we shall call it: NADS, and we need your help to build it!

"I as the spymaster need to manage our agents. I need to know who our agents are and details about them.

"Next, the Equipment Quartermaster is always building weird and wonderful contractions, but needs to know exactly what equipment is in storage and who currently has it on a field mission.

"Agent X#? Are you listening!

"Our Vehicle Masters are always forgetting which agent has taken which vehicle out on a mission.

"Oh, I almost forgot. I also need to send our agents on missions. I will need to know which agent is on which mission. Obviously the agents need to know the status of the missions they are on.

"Most importantly! When an agent returns from a mission, they need to be debriefed, but they also need to return all equipment and vehicles to their respective departments. Finally during debriefing, any casualties need to be logged.

"Are you up to it, Agent X#? Agent X#?"

You grumble as your put down your communicator. I suppose I will have to get to the base and start working, you think to yourself.

QUESTION 1

You reach the entrance to your secret agent base. The guard looks very bored and requests the secret code. Answer the following questions.

1.1. Provide a definition for Software Engineering. (3)

1.2. Explain why ethics is important as a Software Engineer. Consider examples. (7)

1.3. Why is it important for Software Engineers to have people knowledge and skills? Discuss an example. (5)

[15]

QUESTION 2

The guard looks at you sceptically, but allows you passage. Agent M++ has ruined your morning with this sudden demand of a new system. You open the Software Spy Handbook and start reading…

Pressman & Maxim (2015) defines the seven tasks for requirements engineering as:

1. Inception
2. Elicitation
3. Elaboration
4. Negotiation
5. Specification
6. Validation
7. Management

2.1. Considering the first step: inception, why is this step very important? (2)

2.2. Considering NADS, what type of application (as in application domain) would you say it is? Motivate your answer. (3)

2.3. Following on Inception is Elicitation and Elaboration. Briefly describe how these two steps are performed in practise. (4)

2.4. The next step is Negotiation. Considering NADS, are there any requirements that you think should be changed? If so, why? (3)

2.5. Discuss one consideration when eliciting requirements from stakeholders and its impact on stated requirements. (4)

[15]

QUESTION 3

Agent M++ comes over to your hideout. She looks at your with distaste in her eyes. Immediately she demands to see some work done on the NADS. You show her some preliminary designs.

3.1. Considering NADS, draw a Use Case diagram describing the requirements elicited from Agent M++. (15)

3.2. Draw an Activity Diagram for the "Complete Mission" use case. (10)

[25]

QUESTION 4

Agent M++ looks impressed. "Great!" she says. "But, shouldn't you at least have some plan before you start building?"

Pressman & Maxim (2015) defines the five tasks for a software engineering model as:

1. Communication
2. Planning
3. Modelling
4. Construction
5. Deployment

4.1. Using diagrams to aid you in your written discussion, discuss these activities in context of the following two prescriptive models:

- Waterfall model
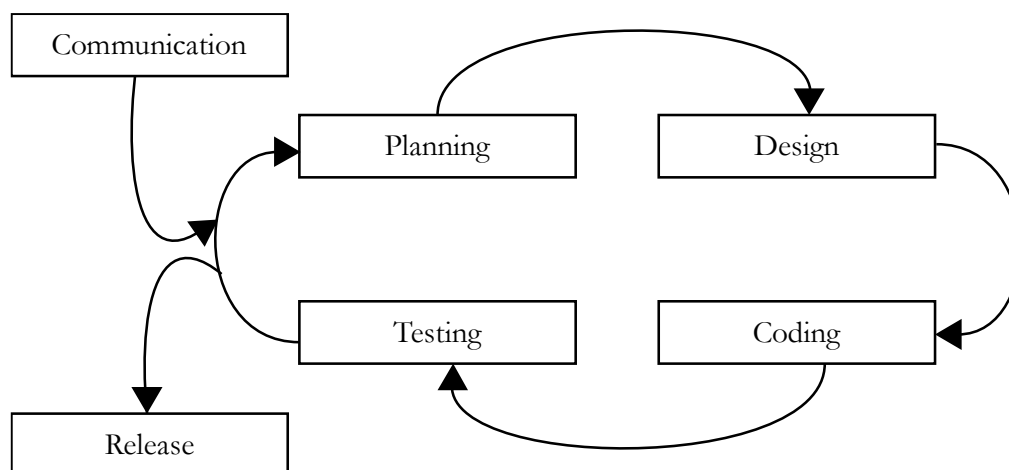- Incremental model (10)

4.2. Compare the advantages and disadvantages of these two prescriptive models in context of their typical usage scenarios. Make reference to NADS in your discussion (10)

[20]

QUESTION 5

"That's too much paperwork, Agent X#! There must be a more extreme measure you can follow?"

Consider the agile development model below:

5.1. Making reference to the activities shown in the agile method above, discuss how their execution differs to that of a prescriptive model. (10)

5.2. For NADS, would you consider changing from a prescriptive model to an agile process model? Why? Are there any considerations? (5)

[15]

QUESTION 6

6.1. Architects use blueprints, composers use sheet music, and software engineers can use UML. Briefly discuss UML, its uses, as well as principles that should be considered when using UML. (5)

6.2. Consider the following code. Draw an Interaction Sequence Diagram to model the code. You may assume that the "Program" automatically calls Main. (15)

```csharp
class Program
{
    static void Main()
    {
        bool water;
        // input from user to get value for "water"
        Agent me = new Agent();
        Mission myMission = new Mission(me);
        myMission.GetTransport(water);
        myMission.Execute();
    }
}
class Mission
{
    private Agent _mainAgent;
    private Vehicle missionTransport;
    public Mission (Agent mainAgent)
    {
        _mainAgent = mainAgent;
    }

    public void GetTransport(bool waterMission)
    {
        missionTransport = new Vehicle(waterMission);
    }

    public void Execute() {
        mainAgent.Dispatch(missionTransport);
    }
}
class Agent
{
    public void Dispatch(Vehicle myTransport) {
        // Off on a mission
        myTransport.Go();
    }
}
class Vehicle
{
    private bool _needsAmphibian;
    public Vehicle(bool waterMission) {
        _needsAmphibian = waterMission;
    }
    public void Go()
    {
        if (_needsAmphibian)
            System.Console.WriteLine("Splash");
        else
            System.Console.WriteLine("Vroom");
    }
}
```

[25]

QUESTION 7

7.1. Considering NADS, which generic architectural style will you base your design on? (1)

7.2. Use a diagram to discuss the style you selected in 7.1. Make reference to the NADS system. (5)

7.3. Discuss a consideration that needs to be taken into account when choosing an architectural style. (4)

7.4. Do design principles with regard to webapp and mobile app design differ from that of "traditional" systems; or are they similar? Discuss you answer. (10)

[20]

QUESTION 8

"Do you think you will need someone to you help you with your implementation? How will that impact your design?"

8.1. Discuss the relation between the following design concepts:
- Functional Independence
- Separation of Concerns (4)

8.2. One important design concept is that of modularity. However, designing with modularity in mind can lead to further design issues, particularly when we consider the concepts of "Functional Independence" and "Separation of Concerns". Discuss one such issue. Is there a way around it? (4)

8.3. Good design should demonstrate attributes such as functionality, usability, reliability, performance, and supportability. However, all designs cannot exhibit exactly the same level of each. Discuss how a balance is achieved. (4)

8.4. During the design process, does a design have to be perfect the first time? Explain. (3)

[15]

QUESTION 9

Suddenly Agent M++ spins around as her communicator rings. You hear her say something about WhatsApp and encryption as she scurries off.

This year so far has seen a lot when it comes to user's privacy. Here we can cite examples such as the FBI vs Apple case as well as the WhatsApp End-to-End encryption. What do you think the future holds for privacy and security in the information technology sphere?

[5]

You feel satisfied with yourself. In less than 3 hours you have made good progress on the new agent dispatch systems. You still feel that acronym is a little unfortunately, but you feel too tired for now to care.

All in all, software engineering is still an ongoing mission that will require constant learning and discipline. However, it is an exciting field, one you will not easily leave.

— END OF EXAM —

Grand Total: [150]

I hope you had a fun semester! Stay safe during the recess and remember to work hard on your projects! - FB