



Faculty of Science

Academy of Computer Science and Software Engineering

Final Summative Assessment

First Opportunity

Module	IFM03A3 / IFM3A10 Informatics 3A – Introduction to Software Engineering
Campus	APK
Month	June 2021

Date	4 June 2021	Reading Time	10 minutes (08:30) <small>download and read assessment paper</small>
Assessor	Mr T Moodley	Writing Time	180 minutes (11:40)
External Moderator	Prof A van der Merwe (UP)	Submission Time	30 minutes (12:10) <small>export diagrams, compile & save document, and upload</small>
Marks	150	Submission Closes	12:10

Instructions

- Answers may be typed, or hand-written and photographed.
- Ensure that all diagrams are neatly drawn, either by hand or using a drawing tool.
- Unless otherwise stated, diagrams do not constitute complete answers.
- Where possible, provide answers in the form of a list.
- Where possible, upload your submission as a single **PDF document**.
- Please **DO NOT** compress (ZIP, RAR, etc.) your submission.
- Please upload on the Google backup submission form: <https://forms.gle/w9PyvVxXATP5zfLj9>
- Please upload your submission before the closing time at **12:10**

AntExterminators

Teamwork makes the dream work.

Mr Jerry approaches you in a huff and a puff, looking frightened and bewildered.

“Thank you!” Mr Jerry yells, “You have done an excellent job with our Ant Tracker. The AntTracker was used in Aspen Autos community centre to track the movement of all the ants, and we managed to successfully identify the queen. But with all great things, the end has come. It is time to get rid of these overpopulated ants! An idea came to me in my sleep, why not start my own ant extermination business, and we can finally rid them from this planet?”

“I want to be able to, along with my assistant, manage my team of ant exterminators. We keep a strict record of exactly when each of our ant exterminators was recruited and how many ants they have exterminated. Each ant exterminator has a speciality, which only I want to know. Some deal with flying ants, while others deal with ants that like to hide and build massive anthills.”

“The stock manager – Ms Doom – needs to know exactly what and how many cans of insecticide are currently in storage and how many are currently being used. Depending on how many call-outs we get per week, she adjusts her restock order accordingly.”

“Then there is the swatter manager – Mr Swats – and he must know exactly which swatter is being used. Swatters need to be serviced regularly. Otherwise, they will fall apart. Each swat needs to be registered when returning from assignment, and a service should be booked when the swatter has swatted 100 times.”

“Ant exterminators are assigned based on their speciality. When there is an assignment, I must know which ant exterminator is currently on that assignment. I also need to know the status of the assignment, as provided by the ant exterminator. We cannot have too many idle ant exterminators! Before the exterminators go out they must ensure they log the vehicle out, and in some cases they should be able to request for backup, when they need to dig hard for those ants.”

“An ant exterminator returning from assignment, must log a report, but they also need to return all insecticide cans (full or empty) and swatters to their respective departments. Finally, during the reporting, the ant exterminators need to log the ants that were killed, if any. A record is kept, according to be used later.”

“I want to see exactly which ants can be found in which areas around our service area. If I see an increase, we might need to hire more ant exterminators.”

“Do you think you can help out?”

QUESTION 1

- 1.1. Provide a definition for Software Engineering. (3)
- 1.2. As a software engineer, you architect and compose software. But what is software? (3)
- 1.3. Compare the nature of software versus the work of other engineering disciplines. (4)

[10]**QUESTION 2**

One of the most difficult tasks software engineer faces is understanding the requirements. The seven tasks of requirements engineering can be defined as follows:

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

- 2.1. Which **requirements analysis model** would be the best for the project described by Mr Jerry? Motivate your answer by referring to the steps described above. (7)
- 2.2. Provide a concise **problem statement** for the AntExterminators. (4)
- 2.3. Provide a brief **proposed solution** for the AntExterminators. (4)

[15]**QUESTION 3**

- 3.1. Name one **non-functional requirement** that specifically applies to **AntExterminators**. Explain how you believe it can be applied and how it can then be measured.
NOTE: Do not use general non-functional requirements such as security, reliability, availability, etc. (5)
- 3.2. List *all* the **functional requirements** that you can extract from Mr Jerry's description of AntExterminators. *NOTE: The mark allocation does not indicate the number of functional requirements.* (6)
- 3.3. Draw a **use case diagram** illustrating the use cases derived from the requirements identified in **Question 3.2**. (20)
- 3.4. If you could **alter** the functional requirements for **AntExterminators**, what would you add or change, and why? Please ensure you motivate each change. (4)

[35]**QUESTION 4**

Draw an **activity diagram** for a use case entitled: "Return from assignment".

[15]

Question 5

Consider the following C# code. Draw an **Interaction Sequence Diagram** to model the code. You may assume that **Main** is automatically executed.

```

01: class Program
02: {
03:     static void Main()
04:     {
05:         bool ground = // value from GUI
06:         AntExterminator me = new AntExterminator();
07:         Assignment myAssignment = new Assignment(me);
08:         myAssignment.GetTransport(ground);
09:         myAssignment.Execute();
10:     }
11: }
12:
13: class Assignment
14: {
15:     private Exterminator _mainExterminator;
16:     private Vehicle missionTransport;
17:     public Assignment (Exterminator mainExterminator)
18:     {
19:         _mainExterminator = mainExterminator;
20:     }
21:
22:     public void GetTransport(bool groundMission)
23:     {
24:         missionTransport = new Vehicle(groundMission);
25:     }
26:
27:     public void Execute() {
28:         mainExterminator.Dispatch(missionTransport);
29:     }
30: }
31:
32: class Exterminator
33: {
34:     public void Dispatch(Vehicle myTransport) {
35:         // Off on an assignment
36:         myTransport.Go();
37:     }
38: }
39:
40: class Vehicle
41: {
42:     private bool _needsDigger;
43:     public Vehicle(bool groundMission) {
44:         _needsDigger = groundMission;
45:     }
46:     public void Go() {
47:         if (_needsDigger)
48:             System.Console.WriteLine("Dig dig dig.");
49:         else
50:             System.Console.WriteLine("Swat swat swat.");
51:     }
52: }

```

[20]

QUESTION 6

- 6.1. Which **software development process** do you think will be best for the development of **AntExterminators**? Motivate your decision based on AntExterminators. (3)
- 6.2. Provide a brief description of the **operation** of the software development process you selected in Question 6.1. You may use a diagram to aid you. (7)
- [10]**

QUESTION 7

- 7.1. What is a **software architecture**? (3)
- 7.2. During the architectural design process, where should security be considered? Motivate your answer. (3)
- 7.3. Data is at the base of the design model, and it is usually considered before all other aspects. Why is this? (2)
- 7.4. Considering **AntExterminators**, which **generic architectural style** will you base your design on? Motivate your decision. (2)
- 7.5. Use a diagram to describe the architectural style you selected in **Question 7.4** while referring to AntExterminators in the diagram. (10)
- [20]**

QUESTION 8

- 8.1. Choose any one (1) **design pattern** (*creational, structural, or behavioural*) that could be applied to AntExterminators. Motivate why you chose this pattern, then briefly describe it. (5)
- 8.2. When starting an architectural design, you are faced with many architectural styles. Which style would you make use of and what are some factors you need to consider when choosing an appropriate style in relation to AntExterminators? (5)
- 8.3. Draw a conceptual class diagram for AntExterminators demonstrating the design pattern that you chose in **Question 8.1**. (10)
- [20]**

QUESTION 9

Considering that AntExterminators deals with highly sensitive data, discuss measures you will put in place to ensure the integrity of data.

[5]

» End of Exam «