

NANYANG TECHNOLOGICAL UNIVERSITY
SEMESTER 1 EXAMINATION 2016-2017
CE2006/CZ2006 – SOFTWARE ENGINEERING

Nov/Dec 2016

Time Allowed: 2 hours

INSTRUCTIONS

1. This paper contains 4 questions and comprises 6 pages.
2. Answer **ALL** questions.
3. This is an open-book examination.
4. All questions carry equal marks.
5. Refer to **Appendix A** on page 6 for the project description which is needed to answer all questions.

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1. Suppose you are the project manager who is responsible for the development and the successful delivery of the ReportZika system which is described in Appendix A.
 - (a) Which software development lifecycle model would you adopt for the development of ReportZika? Justify your answer.
(4 marks)
 - (b) Identify the actors and the interactions they have with the ReportZika and draw a UML Use Case Diagram to show the main functional activities of the system. Use <<include>> and <<extend>> relationships where appropriate.
(14 marks)

Note: Question No. 1 continues on Page 2

- (c) Write the Use Case Description(s) for the ReportZika when a staff member of a medical facility uses his/her mobile phone to report a Zika case and/or upload photographs to the system. Your Use Case Description(s) must include any pre-conditions, post-conditions, and the flow of events.
(7 marks)
2. (a) From a preliminary analysis of the ReportZika Use Case Diagram in Q1(b) and Use Case Description(s) in Q1(c), identify the classes and draw a UML Class Diagram that depicts the classes and the associations/multiplicities between them. You do not need to identify any attribute or operation within the classes.
(10 marks)
- (b) Design a Dialog Map to represent the functionalities of the ReportZika system. The Dialog Map should illustrate the main user functionalities identified in Q1 (b).
(10 marks)
- (c) During the planning of the implementation of the ReportZika system, you need to break down the project into a Work Breakdown Structure and sequence the tasks and their dependencies. List **Two** different methods you could use to estimate the time to complete each task. How would you determine the shortest time in which the project could be completed?
(5 marks)
3. (a) Refer to the initial project description in Appendix A, and the statement “The ReportZika users can access the system via web and mobile applications”.
- (i) Propose a software architecture to support this system feature. Explain in detail what should be included in each architectural component of the proposed architecture.
(7 marks)

Note: Question No. 3 continues on Page 3

- (ii) Explain the benefits of the proposed architecture.
(6 marks)
- (b) Refer to the initial project description in Appendix A, and the statement “Depending on the estimated Zika cluster data, the ReportZika sends hazard alerts to the registered users in a particular location”.
 - (i) Propose a design pattern to support this system feature. Explain the mechanism you will adopt such that the system sends alerts to the registered users in a *particular location*.
(4 marks)
 - (ii) Depict the design pattern proposed in Q3(b)(i) in a Class Diagram. Explain briefly the roles each Class plays in the design pattern.
(8 marks)
- 4. (a) Table Q4 defines the alerts that the ReportZika sends based on the Zika data and the pregnancy status of persons.
 - (i) Determine the equivalence classes of the two input parameters (i.e., Number of Zika cases confirmed daily and pregnancy status) relevant to testing the alert sending component.
(2 marks)
 - (ii) Determine the boundaries of the equivalence classes identified in your answers to Q4(a)(i). For each boundary, identify a value on the boundary, a value just below the boundary, and a value just above the boundary.
(2 marks)
 - (iii) You intend to perform **defensive testing** of the alert sending component. Design a set of test cases to test the alert sending component based on the equivalence classes and boundary values identified in your answers to Q4(a)(i) and Q4(a)(ii).
(8 marks)

Note: Question No. 4 continues on Page 4

Table Q4

| No of Zika cases confirmed daily | Every one other than those in Class B or Class A | Class B: couples planning pregnancy | Class A: pregnant woman |
|-----------------------------------------|----------------------------------------------------------|-----------------------------------------------|-------------------------------------|
| ≤ 5 | No alert | No alert | No alert |
| 6-20 | No alert | Take strict precautions against mosquito bite | Adopt strict mosquitoes precautions |
| > 20 | Frequently check and remove stagnant water in our homes. | Take strict precautions against mosquito bite | Adopt strict mosquitoes precautions |

- (b) When the user selects a position on Google map, the ReportZika determines the town that contains the location of the selected position. The `locateTown(List<Town> towns, Position position)` method (as shown in the Java code in Figure Q4) implements this application logic.
- (i) Draw the control flow graph for the `locateTown(List<Town> towns, Position position)` method. (5 marks)
- (ii) List the set of basis paths for performing basis path testing of the `locateTown(List<Town> towns, Position position)` method. Design a test case (including the input parameter `List<Town>` and `Position` and the expected return value) for each of the basis paths. (8 marks)

```
1. Town locateTown(List<Town> towns, Position position){  
2.   Town town = null;  
3.   Boolean isInTown = False;  
4.   for(int i = 0; i < towns.size(); i++) {  
5.     isInTown = checkTownBoundary(towns[i].boundary, position);  
6.     if (isInTown){  
7.       town = towns[i];  
8.       break; }  
9.   }  
10.  return town;  
11. }
```

Figure Q4

Appendix A

ReportZika Project Description

Project Mission Statement

The Singapore government tracks and releases clustered data of Zika cases (Zika cluster data) within the country. In the view of possibility of big Zika concerns when the number of Zika cases goes high, this information helps the government to issue medical attention and mosquito control such as fogging in the affected towns. It also helps people to plan their daily activities. It is expected that long term efforts of the country is needed to fight Zika. Therefore, we assume a wide deployment of labs to test Zika in big hospitals, a large number of polyclinics and family clinics would be useful. Our mission is to exploit the crowd data from all participating medical facilities to provide Zika cluster data to benefit the country.

Initial Project Description

The ReportZika is an intelligent cloud system that makes use of shared Zika data and/or photographs of symptoms (eye redness, skin rash, etc.) and historic Zika data from medical facilities to benefit the entire nation. It must support following features:

- The ReportZika users can access the system via web and mobile applications.
- The ReportZika allows medical facilities to register and login to the system and report new Zika cases with descriptions and/or upload photographs via web or mobile applications. Staffs of medical facilities can upload data and photographs with the date, time and location at which the case is confirmed.
- The ReportZika will analyze each submitted Zika case report and estimate the trend of the Zika situation of the town where the associated case is located based on historic and current known Zika breakout data. The system further estimates the data in Singapore based on the update of the particular town.
- The ReportZika must be able to use new Zika case estimation algorithms, but the system's internal structure and data must be minimally or not affected.
- The ReportZika attempts to track Zika breakout data at a daily basis depending on reported cases. Users, including both staff from the medical facilities and public individuals, can view the estimated Zika cluster data at any location based on the name of the town or by selecting a position on Google map. Depending on the estimated Zika cluster data, the ReportZika sends hazard alerts to the registered users in a particular location.

END OF PAPER

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Please read the following instructions carefully:

- 1. Please do not turn over the question paper until you are told to do so. Disciplinary action may be taken against you if you do so.**
2. You are not allowed to leave the examination hall unless accompanied by an invigilator. You may raise your hand if you need to communicate with the invigilator.
3. Please write your Matriculation Number on the front of the answer book.
4. Please indicate clearly in the answer book (at the appropriate place) if you are continuing the answer to a question elsewhere in the book.