First Semester Examination
Academic Session 2018/2019

December 2018/January 2019

EEE430 – SOFTWARE ENGINEERING
(KEJURUTERAAN PERISIAN)

Duration : 3 hours
(Masa : 3 jam)

Please check that this examination paper consists of ELEVEN (11) pages and FIVE (5) pages of printed appendices material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEBELAS (11) muka surat dan LIMA (5) muka surat lampiran yang bercetak sebelum anda memulakan peperiksaan ini.]

Instructions: This question paper consists of **SIX (6)** questions. Answer **FIVE (5)** questions: **THREE (3)** from section A and TWO (2) from section B. All questions carry the same marks.

[***Arahan:*** *Kertas soalan ini mengandungi **ENAM (6)** soalan. Jawab **LIMA (5)** soalan: TIGA (3) daripada Bahagian A dan DUA (2) daripada Bahagian B. Semua soalan membawa jumlah markah yang sama.]*

In the event of any discrepancies, the English version shall be used.

[Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah digunapakai.]

SECTION A

BAHAGIAN A

1. (a) What is the purpose of modelling in software engineering?

Apakah tujuan pemodelan di dalam kejuruteraan perisian?

(10 marks/*markah*)

(b) What is the difference between a task and an activity in the context of software engineering?

Apakah perbezaan di antara tugasan dan aktiviti di dalam konteks kejuruteraan perisian?

(20 marks/*markah*)

(c) Draw a use case diagram for an ATM (cash terminal). The system includes two actors: a customer, who draws money from his account either on the money chip on his bank card or in cash, and a security man, who fills money into the ATM.

Use cases should include: `DrawCash`, `LoadMoneyChip`, `CheckAccountBallance`, `FillATM`. Also include the following exceptional cases: `OutOfMoney`, `TransactionAborted` (i.e., customer selected the cancel button without completing the transaction) and `MoneyChipOutOfOrder`.

Remark: It is possible to use inheritance between use cases.

Lukiskan satu gambarajah kes penggunaan (use case) untuk satu mesin ATM (terminal tunai). Sistem ini melibatkan dua pelakon: satu pelanggan yang mengeluarkan wang daripada akaun beliau sama ada dalam bentuk kepingan cip wang atau tunai, dan seorang pegawai keselamatan yang mengisi wang ke dalam mesin ATM.

Kes-kes penggunaan tersebut perlu termasuk: `DrawCash`, `LoadMoneyChip`, `CheckAccountBallance`, `FillATM`. Perlu juga dimasukkan kes-kes pengecualian: `OutOfMoney`, `TransactionAborted` iaitu pelanggan memilih butang batal tanpa menyelesaikan keseluruhan transaksi) dan `MoneyChipOutOfOrder`.

Nota: Penggunaan pewarisan ('inheritance') adalah dibenarkan di antara kes-kes penggunaan.

(20 marks/*markah*)

(d) Refer to Figures 1.1 and 1.2 to answer question 1. Figure 1.1 is the `ReportEmergency` use case textual description, while Figure 1.2 is a scenario for `bob` and `alice` to request helps from `john` using `FRIEND`. By assuming that `warehouseOnFire` as the use case, draw a sequence diagram for the `warehouseOnFire` scenario of Figure 1.2. In your diagram, include the objects `bob, alice, john, FRIEND`, and instances of other classes you may need. Draw only the first five message sends.

Rujuk kepada Gambarajah-Gambarajah 1.1 dan 1.2 untuk menjawab soalan 1. Gambarajah 1.1 adalah penerangan teks kes penggunaan `ReportEmergency`, manakala Gambarajah 1.2 adalah satu senario bagi `bob` dan `alice` untuk meminta pertolongan daripada `john` menggunakan `FRIEND`. Dengan beranggapan bahawa `warehouseOnFire` adalah kes penggunaan tersebut, lukiskan satu gambarajah urutan untuk senario `warehouseOnFire` di Gambarajah 1.2. Di dalam gambarajah anda, masukkan objek-objek `bob, alice, john, FRIEND`, dan instans daripada kelas lain yang diperlukan. Lukiskan hanya lima mesej pertama yang dihantar.

(50 marks/*markah*)

Use case name	`ReportEmergency`
Participating actors	Initiated by `FieldOfficer` Communicates with `Dispatcher`
Flow of events	1. The `FieldOfficer` activates the "Report Emergency" function of her terminal. 2. `FRIEND` responds by presenting a form to the `FieldOfficer`. 3. The `FieldOfficer` fills out the form by selecting the emergency level, type, location, and brief description of the situation. The `FieldOfficer` also describes possible responses to the emergency situation. Once the form is completed, the `FieldOfficer` submits the form. 4. `FRIEND` receives the form and notifies the `Dispatcher`. 5. The `Dispatcher` reviews the submitted information and creates an `Incident` in the database by invoking the `OpenIncident` use case. The `Dispatcher` selects a response and acknowledges the report. 6. `FRIEND` displays the acknowledgment and the selected response to the `FieldOfficer`.
Entry condition	• The `FieldOfficer` is logged into `FRIEND`.
Exit condition	• The `FieldOfficer` has received an acknowledgment and the selected response from the `Dispatcher`, OR • The `FieldOfficer` has received an explanation indicating why the transaction could not be processed.
Quality requirements	• The `FieldOfficer`'s report is acknowledged within 30 seconds. • The selected response arrives no later than 30 seconds after it is sent by the `Dispatcher`.

Figure 1.1 `ReportEmergency` use case.

Gambarajah 1.1 Kes penggunaan `ReportEmergency`.

Scenario name	`warehouseOnFire`
Participating actor instances	`bob, alice:FieldOfficer` `john:Dispatcher`
Flow of events	1. Bob, driving down main street in his patrol car, notices smoke coming out of a warehouse. His partner, Alice, activates the "Report Emergency" function from her `FRIEND` laptop. 2. Alice enters the address of the building, a brief description of its location (i.e., northwest corner), and an emergency level. In addition to a fire unit, she requests several paramedic units on the scene given that area appears to be relatively busy. She confirms her input and waits for an acknowledgment. 3. John, the `Dispatcher`, is alerted to the emergency by a beep of his workstation. He reviews the information submitted by Alice and acknowledges the report. He allocates a fire unit and two paramedic units to the `Incident` site and sends their estimated arrival time (ETA) to Alice. 4. Alice receives the acknowledgment and the ETA.

Figure 1.2 The `warehouseOnFire` scenario for the `ReportEmergency` use case.
Gambarajah 1.2 Senario `warehouseOnFire` *untuk kes penggunaan* `ReportEmergency`.

2. You are designing an Airline Reservation System for AirAsia Airlines. AirAsia Airlines runs regular flights between Kuala Lumpur and five other cities in Malaysia. There are several daily numbered flights on regular schedule. The reservation system keeps track of passengers who will be flying in specific seats on various flights, as well as people who will form the crew.

   There are three kinds of employees in the organization; **pilots**, **hosts** and **ground personnel**. There is also a frequent-flier program which shows flight points to frequent passengers and they may use their points during reservation.

   AirAsia Airlines personnel sometimes fly as passengers in scheduled flights. For their reservations, the system only requests their personnel ID number. Their other info is already in the system. They are given points for each flight that they participate as a crew. Then during their reservation, they may use these points against their purchases. Besides, there is a regular 50% discount for airlines personnel and their families.

   The system should be able to help to perform the following functions:

   - Creating a new flight or modifying the attributes of a flight
   - Searching for a particular flight
   - Cancelling a flight on a specific day
   - Making or cancelling a booking on a particular flight

Anda sedang merekabentuk satu sistem tempahan penerbangan untuk penerbangan AirAsia. Syarikat penerbangan AirAsia mengoperasi penerbangan kerap antara Kuala Lumpur dan lima bandar-bandar lain di Malaysia. Terdapat beberapa penerbangan bernombor harian mengikut jadual yang tetap. Sistem tempahan menjejaki penumpang yang terbang berada di kerusi tertentu dalam penerbangan yang pelbagai, serta orang-orang yang akan membentuk krew anak-anak kapal.

Terdapat tiga jenis kakitangan organisasi; ***juruterbang****,* ***tuan rumah*** *dan* ***kakitangan darat****. Terdapat juga program penerbang-kerap yang menunjukkan mata ganjaran penerbangan kepada penumpang yang kerap dan mereka boleh menggunakan mata ganjaran mereka semasa tempahan.*

Kakitangan Syarikat Penerbangan AirAsia kadang-kadang terbang sebagai penumpang dalam jadual penerbangan. Untuk tempahan mereka, sistem hanya meminta nombor ID kakitangan mereka. Maklumat mereka yang lain sudah dalam sistem. Mereka akan diberi Mata Ganjaran untuk setiap penerbangan yang mereka terlibat sebagai krew. Kemudian semasa tempahan, mereka boleh menggunakan mata ganjaran ini terhadap pembelian mereka. Selain itu, terdapat diskaun biasa 50% untuk kakitangan syarikat penerbangan dan keluarga masing-masing.

Sistem ini dapat membantu untuk melaksanakan fungsi-fungsi berikut:

- *Mewujudkan penerbangan baru atau mengubah suai atribut- atribut penerbangan*
- *Mencari penerbangan tertentu*
- *Membatalkan penerbangan terakhir • hari tertentu membuat atau membatalkan tempahan dalam penerbangan tertentu*

(a) Draw the use case for the above system.

Lukiskan gambarajah kegunaan kes sistem di atas.

(20 marks/*markah*)

(b) Draw a UML Activity Diagram that shows the general business process flows.

Lukiskan gambarajah aktiviti PUM yang menunjukkan aliran proses perniagaan am.

(20 marks/*markah*)

(c) Derive the design class diagram for the above system.

Dapatkan reka bentuk gambarajah kelas bagi sistem di atas.

(20 marks/*markah*)

(d) Draw the sequence diagram for “buy a ticket” use case.

Lukiskan gambarajah jujukan bagi kes penggunaan 'beli satu tiket'.

(20 marks/*markah*)

(e) What are three possible operations of the system that are likely to fail and should be tested?

Apakah tiga kemungkinan operasi-operasi sistem yang mungkin gagal dan perlu diuji?

(20 marks/*markah*)

3. You are required to design a system for an on-site car battery delivery and installation service. The system description and textual description for two use cases of the system are shown in Appendix A.

Anda dikehendaki merekabentuk sebuah sistem untuk perkhidmatan penghantaran dan pemasangan bateri kereta di lapangan. Deskripsi sistem dan huraian teks untuk dua kes penggunaan disertakan di Lampiran A.

(a) Assume you are in the analysis stage. Based on the given use cases (1st and 2nd use cases), identify and describe the entity objects.

Anggapkan anda berada di peringkat analisa. Berdasarkan kes penggunaan yang telah diberikan (kes penggunaan pertama dan kedua), kenal pasti dan huraikan kesemua objek-objek entiti.

(25 marks/*markah*)

(b) Based on the 2nd use case, identify and describe the boundary and control objects and then develop the sequence diagram. You need to use part of the entity objects identified in 3 (a).

Berdasarkan kes penggunaan kedua, kenal pasti dan huraikan objek sempadan dan kawalan, kemudian hasilkan gambarajah urutan. Anda perlu menggunakan sebahagian daripada objek entiti yang telah dikenal pasti pada soalan 3(a).

(75 marks/*markah*)

SECTION B

BAHAGIAN B

4. (a) Based on the entity objects identified in Question 3(a), develop a complete class diagram for the entity objects. No need to consider the concept of inheritance.

Berdasarkan objek entiti yang telah dikenalpasti di Soalan 3(a), hasilkan gambarajah kelas yang lengkap untuk objek entiti. Tidak perlu mengambilkira konsep pewarisan.

(35 marks/*markah*)

(b) Assume you are in the system design stage. Based on the produced documents in 4 (a), decompose the system into subsystems and map each of the subsystems into a device or execution environment and represent it using a deployment diagram.

Anggapkan anda berada di peringkat rekabentuk sistem. Berdasarkan dokumen yang dihasilkan di 4(a), pecahkan sistem kepada subsistem dan petakan setiap subsistem kepada sebuah peranti ataupun persekitaran pelaksanaan dan wakilkannya dengan menggunakan gambarajah penempatan.

(40 marks/*markah*)

(c) Identify a boundary use case for the system shown in Appendix A and write a textual description for it.

Kenal pasti satu kes penggunaan sempadan untuk sistem di Lampiran A dan tulis huraian teks untuknya.

(25 marks/*markah*)

5. (a) List out FOUR activities involved in requirements elicitation. Briefly explain how each activity is conducted at this stage.

Senaraikan EMPAT aktiviti yang terlibat di dalam 'requirements elicitation'. Terangkan secara ringkas bagaimana setiap aktiviti ini dilaksanakan pada setiap peringkat.

(20 marks/*markah*)

(b) Given a use case known as 'ReportEmergency' (as shown in Figure 5.1). Design a software that has already taken into account the exceptional case, in where there is no connectivity between FieldOfficer and FRIEND. Show that this can be done using <<extend>> and <<include>> relationships.

Diberi satu kes penggunaan sebagai 'ReportEmergency' (seperti yang ditunjukkan di dalam Gambarajah 5.1). Rekabentuk satu perisian yang telahpun mengambilkira kes pengecualian di mana hubungan di antara FieldOfficer dan FRIEND tidak dapat disambungkan. Tunjukkan bahawa ini boleh dilaksanakan menggunakan hubungan <<extend>> dan << include>>.

(40 marks/*markah*)

Use case name	ReportEmergency
Participating actors	Initiated by FieldOfficer Communicates with Dispatcher
Flow of events	1. The FieldOfficer activates the "Report Emergency" function of her terminal. 2. FRIEND responds by presenting a form to the officer. *The form includes an emergency type menu (general emergency, fire, transportation) and location, incident description, resource request, and hazardous material fields.* 3. The FieldOfficer completes the form by *specifying minimally the emergency type and description fields*. The FieldOfficer may also describe possible responses to the emergency situation *and request specific resources*. Once the form is completed, the FieldOfficer submits the form. 4. FRIEND receives the form and notifies the Dispatcher *by a pop-up dialog*. 5. The Dispatcher reviews the submitted information and creates an Incident in the database by invoking the OpenIncident use case. *All the information contained in the FieldOfficer's form is automatically included in the Incident. The Dispatcher selects a response by allocating resources to the Incident (with the AllocateResources use case) and acknowledges the emergency report by sending a short message to the FieldOfficer.* 6. FRIEND displays the acknowledgment and the selected response to the FieldOfficer.
Entry condition	• ...

Figure 5.1 ReportEmergency use case textual description for Question 5 (b).

Gambarajah 5.1 Penerangan berteks untuk kes penggunaan ReportEmergency bagi Soalan 5 (b).

(c) Design a software-based students attendance system, which has three actors; `student`, `lecturer`, and `dataManager`. Illustrate your design by using all FIVE UML diagrams.

Rekabentuk satu sistem perisian kehadiran pelajar yang mempunyai tiga pelakon: `student`, `lecturer` dan `dataManager`. Lakarkan rekabentuk anda menggunakan kesemua LIMA gambarajah UML.

(40 marks/*markah*)

6. (a) Consider the following class model shown in Figure 6.1.

Pertimbangkan model kelas berikut yang ditunjukkan dalam Gambarajah 6.1.

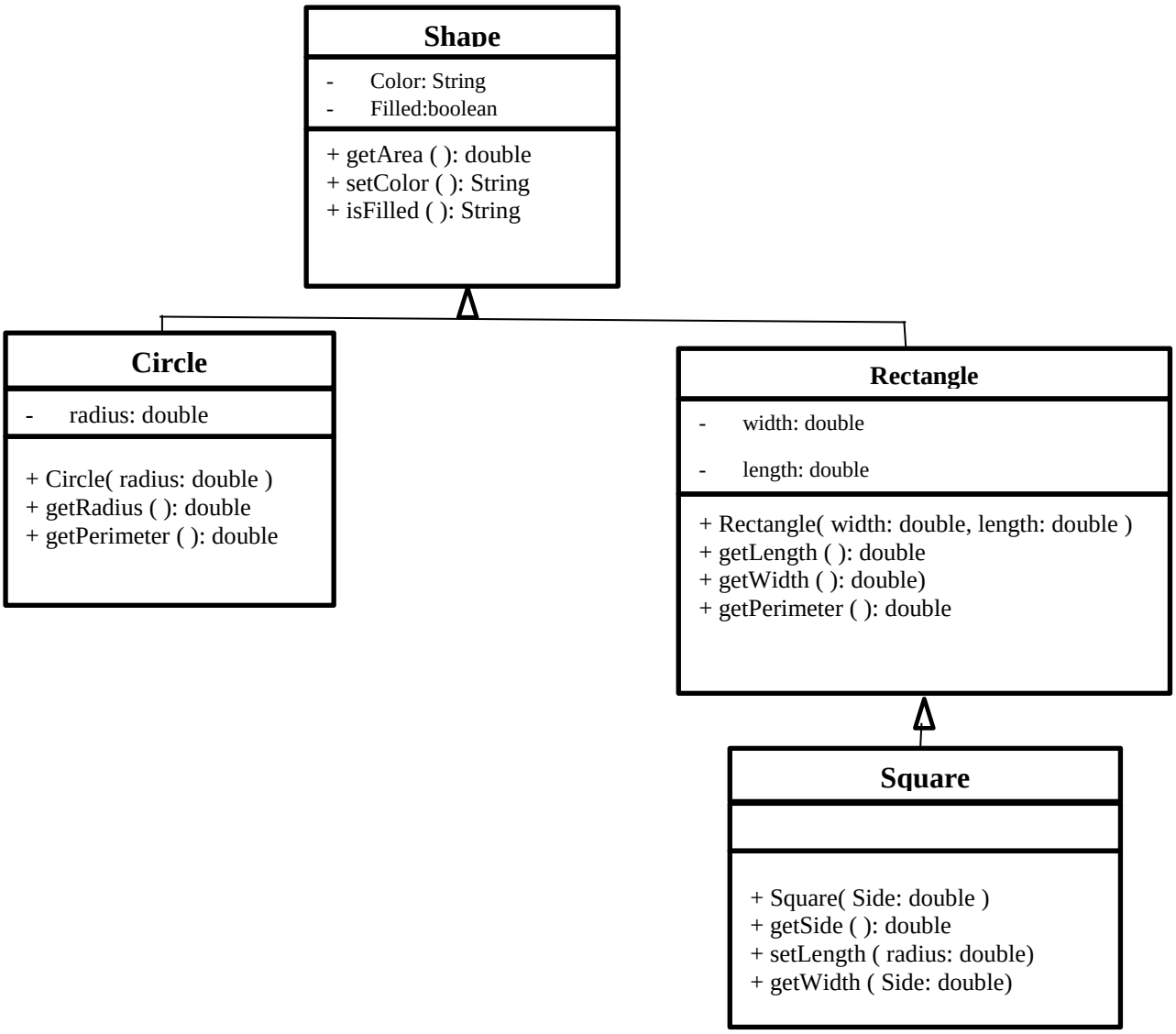

Figure 6.1. Class diagram

Gambarajah 6.1. Gambarajah kelas

(i) Identify the **type** and **visibility** of each attribute and operation for the **Circle class**.

*Kenal pasti **jenis** dan **penglihatan** setiap atribut dan operasi untuk **kelas Circle**.*

(10 marks/*markah*)

(ii) Design a relational database schema for the **Shape class**.

*Rekabentuk satu pangkalan data hubungan skema untuk **kelas Shape**.*

(10 marks/*markah*)

(iii) Write the appropriate JAVA code that will map the **Rectangle class**.

*Tulis kod JAVA yang sesuai yang akan memetakan **kelas Rectangle**.*

(20 marks/*markah*)

(iv) Using Object Constrained Language (OCL), write an invariant for the **Square class** which makes the width and height always be the same.

*Menggunakan bahasa dihalang objek (OCL), tulis satu invarian untuk **kelas Square** yang menjadikan lebar dan tingginya sentiasa sama.*

(10 marks/*markah*)

(v) Given a legacy **Triangle class** that will be reused and join class diagram shown in Figure 6.1. Which design pattern will be used? Justify your choice.

*Diberikan **kelas Segitiga** legasi yang akan diguna semula dan menyertai gambarajah kelas yang ditunjukkan dalam Gambarajah 6.1. Corak rekabentuk mana yang akan digunakan? Sahkan pilihan anda.*

(10 marks/*markah*)

(b) Consider the following JAVA code segment shown in Figure 6.2 and answer the following questions.

Pertimbangkan segmen kod JAVA berikut yang ditunjukkan dalam Gambarajah 6.2, dan jawab soalan-soalan berikut.

(i) Perform path testing using flow graph for the code segment given in Figure 6.2 and compute graph complexity.

Lakukan ujian laluan menggunakan graf aliran untuk segmen kod yang diberikan di dalam Gambarajah 6.2 dan tentukan graf kerumitan.

(20 marks/*markah*)

(ii) Derive three possible test cases for the code segment shown in Figure 6.2.

Dapatkan tiga kemungkinan kes ujian untuk segmen kod yang ditunjukkan dalam Gambarajah 6.2.

(20 marks/*markah*)

```
Public static int average (int [] value, int min, int max, int N) {
int  i, totalValid, sum, mean;
i=0;
totalValid=0;
sum=0;
while ( i < N  &&  value != -999 ){
        if ( value [i] >= min && value [i] <= max ){
                totalValid = totalValid + 1;
                sum = sum + value [i];
        }
        i=i+1;
        if ( totalValid > 0 )
        {
        mean = sum / totalValid;
        }
                                else
        {
        mean  = -999;
        }
        return mean ;
}
```

Figure 6.2. JAVA Code segment

Gambarajah 6.2 Segmen kod JAVA

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APPENDIX

LAMPIRAN

EEE430 SOFTWARE ENGINEERING

JADUAL CO-PO MAPPING

QUESTION	CO	PO
1	1	4
2	2	4
3	3	7
4	4	7
5	2	4
6	3	7

Appendix A

LAMPIRAN A

System Description

The system is used by a company to facilitate the process of car battery delivery and installation service of their customer. The customer will use the system to request for the replacement of their car battery. The customer only can request for the service through an app installed inside their smartphone. The service is available from 7.00 am to 1.00 am, 365 days a year. The company provides the car battery for any type of cars available in Malaysia. The coverage area is Klang Valley, Penang and Johor Bharu. When the customer request for the service, the system will inform the nearest available technician. Once receiving the request, the technician will go to the customer's place and replace the car battery.
The textual description for two of the use cases of the system are as follows:

1st use case

Use case name: BookBattery
Participating Actors: Initiated by Customer and communicates with Technician
Entry Condition: The customer activates BookBattery function through an app on their smartphone, and the location service is already activated.

Flow of Events:

1. The system requests the customer to log in using user ID.
2. The customer login into the system.
   If the login is successful, the system checks the current time and the location of the customer. If the time is not from 7.00 am to 1.00 am, or the location is not within the coverage area, the system responds by displaying an error message. If there is no issue on time and also the location, the system responds by requesting the customer to fill in the car information.
   If the login is unsuccessful, the system requests the customer to re-login or activates the forget password function and this use case is terminated.
3. The customer fills in the car plate number and selects the maker of the car and the car model.
4. The system responds by displaying the picture and also the price for the available car battery for the selected type of car.
5. If the customer agreed to purchase, the customer clicks the "Book Now" button and car information together with the location of the car is sent to the system. If not, the customer clicks the "Cancel" button, and this use case is terminated.

6. The system identifies the nearest available technician.If the system can locate the nearest available technician, the system displays the picture, name, motorcycle's plate number and staff ID number of the technician. In addition, the estimated arrival time also will be displayed.If the system cannot locate the nearest available technician, a "Sorry" message will be displayed, and this use case is terminated.
7. The system displayed a message together with the technician's information when the technician arrived at the location, and the customer sends an acknowledgment when it is confirmed that the technician already arrives at the location.
8. Once the technician has completed their job, the system displays "Thank you" message and requests the customer to rate the quality of the service delivered by the technician.
9. The customer gives his/her rating or clicks cancel if choose not to rate the technician.

2nd use case

Use case name : ServiceCustomer

Participating Actors : Initiated by Technician and communicates with Customer

Entry Condition : The system notifies the technician that there is a request for service.

Flow of Events :

1. The technician reviews the request by activating "Service Customer" function through an app in the smartphone.If the technician accepts the request, the system calculates the estimated time of arrival to the customer's location. If the technician rejects the request, the system locates different technician, and this use case is terminated.
2. The system sends the technician's information including the estimated arrival time to the customer.
3. The technician activates the "arrived" function when he/she arrived at the customer's location.
4. The technician activates the "service completed" function when he/she has complete the service.

Appendix A

LAMPIRAN A

Deskripsi Sistem

Sistem ini digunakan oleh sebuah syarikat untuk menguruskan proses penghantaran dan pemasangan bateri kereta pelanggan. Pelanggan akan menggunakan sistem ini untuk memohon penukaran bateri kereta mereka dan permohonan hendaklah dibuat melalui aplikasi di dalam telefon pintar. Perkhidmatan penukaran bateri boleh dilakukan antara pukul 7 pagi hingga 1 pagi, 365 hari setahun. Perkhidmatan yang disediakan adalah untuk kesemua jenis kereta yang terdapat di Malaysia. Liputan kawasan adalah Lembah Kelang, Pulau Pinang dan Johor Bharu. Apabila pelanggan memohon perkhidmatan, maklumat akan disampaikan kepada juruteknik yang terdekat. Setelah menerima permohonan daripada pelangaan, juruteknik akan pergi ke tempat pelanggan dan membuat penukaran bateri kereta.
Huraian teks untuk dua kes penggunaan bagi sistem ini adalah seperti berikut:-

Kes penggunaan pertama
Use case name: BookBattery
Participating Actors: Initiated by Customer and communicates with Technician
Entry Condition: The customer activates BookBattery function through an app on their smartphone, and the location service is already activated.

Flow of Events:
1. The system requests the customer to log in using user ID.
2. The customer login into the system If the login is successful, the system checks the current time and the location of the customer. If the time is not from 7.00 am to 1.00 am, or the location is not within the coverage area, the system responds by displaying an error message. If there is no issue on time and also the location, the system responds by requesting the customer to fill in the car information.
   If the login is unsuccessful, the system requests the customer to re-login or activates the forget password function and this use case is terminated.
3. The customer fills in the car plate number and selects the maker of the car and the car model.
4. The system responds by displaying the picture and also the price for the available car battery for the selected type of car.
5. If the customer agreed to purchase, the customer clicks the “Book Now” button and car information together with the location of the car is sent to the system. If not, the customer clicks the “Cancel” button, and this use case is terminated.

6. The system identifies the nearest available technician.If the system can locate the nearest available technician, the system displays the picture, name, motorcycle's plate number and staff ID number of the technician. In addition, the estimated arrival time also will be displayed.If the system cannot locate the nearest available technician, a "Sorry" message will be displayed, and this use case is terminated.
7. The system displayed a message together with the technician's information when the technician arrived at the location, and the customer sends an acknowledgment when it is confirmed that the technician already arrives at the location.
8. Once the technician has completed their job, the system displays "Thank you" message and requests the customer to rate the quality of the service delivered by the technician.
9. The customer gives his/her rating or clicks cancel if choose not to rate the technician.

Kes penggunaan kedua

Use case name : ServiceCustomer
Participating Actors : Initiated by Technician and communicates with Customer
Entry Condition : The system notifies the technician that there is a request for service.

Flow of Events :

1. The technician reviews the request by activating "Service Customer" function through an app in the smartphone.If the technician accepts the request, the system calculates the estimated time of arrival to the customer's location. If the technician rejects the request, the system locates different technician, and this use case is terminated.
2. The system sends the technician's information including the estimated arrival time to the customer.
3. The technician activates the "arrived" function when he/she arrived at the customer's location.
4. The technician activates the "service completed" function when he/she has completed the service.