Version EP/4

EGT3
ENGINEERING TRIPOS PART IIB

Tuesday 30 April 2019 2 to 3.40

Module 4M21

SOFTWARE ENGINEERING AND DESIGN

*Answer not more than **three** questions.*

All questions carry the same number of marks.

*The **approximate** percentage of marks allocated to each part of a question is indicated in the right margin.*

*Write your candidate number **not** your name on the cover sheet.*

STATIONERY REQUIREMENTS
Single-sided script paper

SPECIAL REQUIREMENTS TO BE SUPPLIED FOR THIS EXAM
CUED approved calculator allowed
Engineering Data Book

10 minutes reading time is allowed for this paper at the start of the exam.

You may not start to read the questions printed on the subsequent pages of this question paper until instructed to do so.

1 (a) Provide a definition for *Class* and *Object*. Describe the relationship between them. [10%]

(b) A company developed a drone that can deliver a defibrillator to a sudden cardiac arrest victim on a university campus. The company is now working on a computer system that allows a drone-defibrillator to be dispatched and the incidents to be tracked.

A Member of Staff can use this Dispatch System to submit a Request to dispatch a Drone-defibrillator to the requested location, and log the details of the Request and the Drone that was dispatched in the Dispatch System where an Incident is created.

(i) Design the system described above. Provide an illustration of the design with the help of a *Class Diagram*. [40%]

(ii) Using a *Sequence Diagram*, show the interactions between objects in the system as a result of a submitted Request. [30%]

(iii) Give some examples of additional functionality that could be introduced for successful adoption of the system. Update the *Class* or *Sequence Diagram* as appropriate to illustrate any suggested extensions. [20%]

2 (a) Explain what is meant by a *Design Pattern* in the context of *Object Oriented Design*. Give one example of a *Design Pattern*. [10%]

(b) The *Sequence Diagram* in Fig. 1 illustrates a Payment System processing a Payment from one Customer's Account to another Customer's Account. Draw the corresponding *Class Diagram* for this system. [30%]

(c) To combat potential fraud, a new Fraud Monitoring feature is added to the system described in (b) to analyse the fraud risk of each payment after it is processed. Additionally, the Customer is notified by a text message about each Payment debited or credited to their Account.

(i) Update the *Class Diagram* to illustrate these extensions. [30%]

(ii) Update the *Sequence diagram* to illustrate these extensions. [30%]

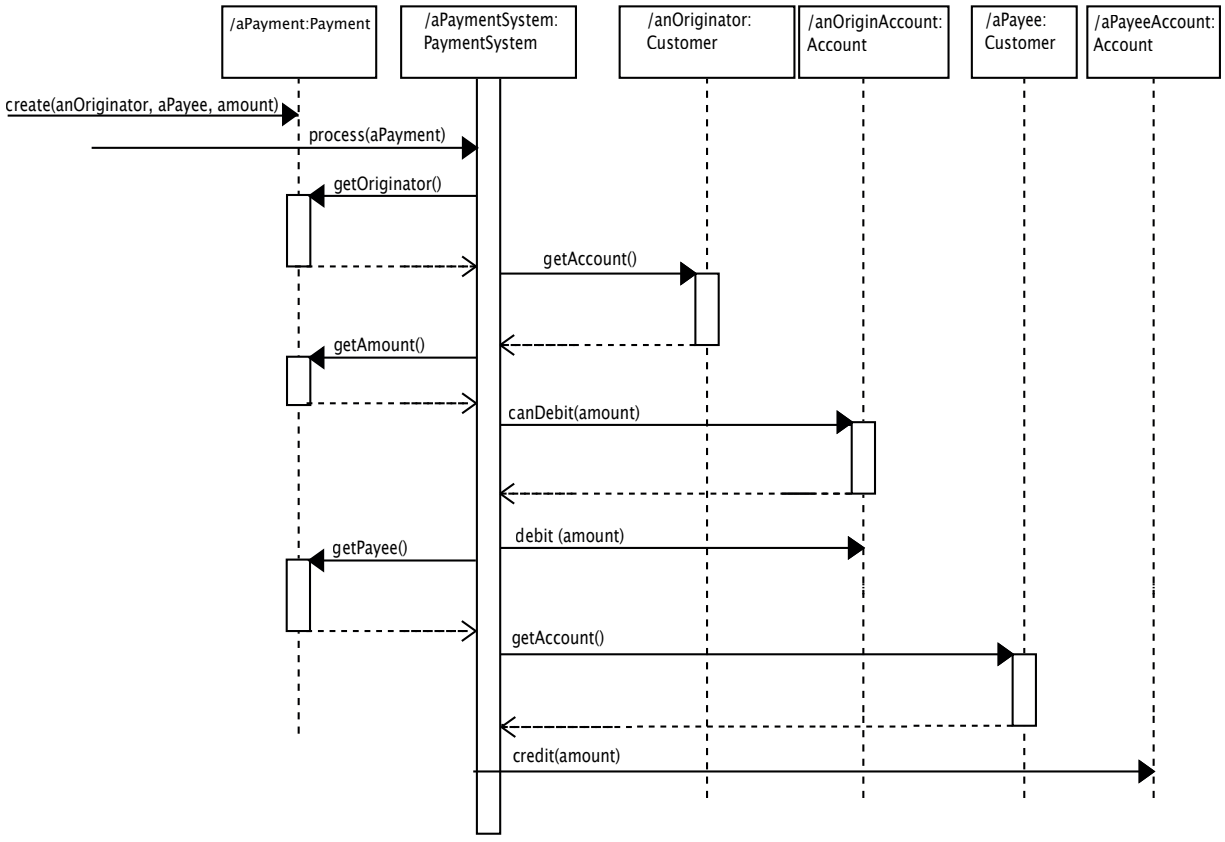

Fig. 1

3 (a) Describe what *Metaphors* are and why they are used. Give two examples of the use of *Metaphors* in *Graphical User Interfaces*. [10%]

(b) A large consumer electronics company is developing a smartwatch with an electrocardiogram (ECG) monitor. A user can place a finger on the side of the smartwatch case and make a 20 second recording of their ECG using an ECG application running on the smartwatch. The recording is saved on the device and can later be shared with the user's doctor.

(i) Design the *User Interface* (UI) for a software application for a smartwatch device with a touchscreen that implements this functionality. Identify all main screens and interaction elements, and explain their purpose. [30%]

(ii) Design a *Usability Test* for this smartphone application. [40%]

(iii) The ECG monitoring feature is particularly important for elderly care. Analyse the design of the application and identify any potential challenges of using the device to monitor the heart condition of the elderly. [20%]

4 (a) Give two examples of *Agile* methodologies, and compare and contrast them with more traditional software development models. [15%]

(b) A company is working on the development of software for monitoring of zebrafish in research laboratory settings. The results are used to investigate the genetic cause of human diseases, and identify and test new drugs to treat the diseases being modelled.

(i) Suggest a specific software development model suitable for this project. Discuss considerations to be taken into account in making this decision and explain the reasons for your choice. [25%]

(ii) Describe the software development process for the proposed model and give examples of the tools that can be used to manage the development process. [30%]

(iii) Identify what potentially could go wrong if your suggested software development model is employed. Describe the measures that the company could implement to reduce the likelihood of any potential issues. [30%]

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