

EGT3
ENGINEERING TRIPOS PART IIB

Monday 2 May 2022 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.

You may not remove any stationery from the Examination Room.

1 (a) Explain what is meant by a class and an object in the context of object oriented design. [5%]

(b) A medical test services company has a number of test centres where patients can be tested in person. The company has a computer system that maintains the details of all test centres and their locations, and provides access to patients' personal information such as their name, date of birth and their home address.

A member of staff can use the computer system to schedule appointments for patients to get a test at a test centre. The staff member can access the system by looking up the patient (assume that the name and date of birth identify the patient uniquely), and identifying the next available appointment in the centre nearest to the patient's home address. Once a suitable time slot is identified, the staff member can book a test for the patient.

(i) Design the system described above. Provide an illustration of the design with the help of a class diagram. [35%]

(ii) Draw a sequence diagram to demonstrate the scenario of a member of staff using the system to book a test for a patient. [30%]

(iii) Extend your design to allow the system to send an email notification to the patient and their GP surgery once the test is booked. Update the class and sequence diagrams to illustrate this extension. [30%]

- 2 (a) In software engineering, discuss the differences between a composite design pattern and a decorator design pattern. [10%]
- (b) A company sells flower arrangements online. A customer can choose from a range of bouquets offered by different florists, add items to their order and pay by a credit card.
- (i) Design an object oriented system that allows customers to add items to their order and to pay for them. Draw a class diagram that describes the system. [20%]
- (ii) Draw a sequence diagram that demonstrates a scenario where a customer is charged for an order that contains one item. [20%]
- (iii) Extend your design to support sales to business customers as well as personal customers. The business customers can pay by invoice rather than credit card. Update your class and sequence diagrams. [20%]
- (iv) The online store offers an eco friendly gift box for flower bouquets instead of a standard plastic wrap at additional cost. Discuss the use of a decorator design pattern to implement this functionality. Suggest a suitable implementation and illustrate your design using an updated class diagram. [30%]

3 (a) Discuss the principles of a good user interface (UI) design. [10%]

(b) A smartwatch app allows users to operate their robot vacuum-mop cleaner remotely from anywhere in the world. The users can instruct the robot to start cleaning at a specific time via their smartwatch, specify whether they want it to vacuum or mop and then receive notification of a successfully completed job. Assume that the smartwatch has a small touchscreen.

(i) Identify all main screens and interaction elements required to implement this functionality, explain their purpose and design constraints, and show the corresponding UI flow. [20%]

(ii) Suggest what could go wrong in the main use case and extend your UI design to include any relevant error screens. [20%]

(iii) Usability studies identified that the users frequently checked the app after they instructed the robot to start the clean. Analyse what the users' intentions might have been, identify three possible use cases and enhance your UI design accordingly, illustrating any additional main screens and interaction elements. [30%]

(iv) Further feedback indicated that the users frequently asked to improve the app notification feature, yet found the notifications of successfully completed jobs unhelpful. Identify two potentially helpful notifications and discuss the details of their implementation, such as when and how they should be displayed. [20%]

- 4 (a) Give an example of an agile methodology in software engineering. Compare and contrast it with traditional software development models. [15%]
- (b) A company is developing control software for an automated car braking system.
- (i) Specify the software development methodology that would be most suitable. Discuss considerations to be taken into account in making this decision and explain the reasons for your choice. [20%]
- (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. [20%]
- (iii) Design a usability study for the software. [20%]
- (iv) The latest model of the car will have a network connection with all software updates and patches being delivered wirelessly. Discuss how this is likely to affect your development process, and the implications it will have for the project costs. [25%]

END OF PAPER

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