EGT3

ENGINEERING TRIPOS PART IIB

Monday 3 May 2021   1.30 to 3.10

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 and at the top of each answer sheet.*

STATIONERY REQUIREMENTS

Write on single-sided paper.

SPECIAL REQUIREMENTS TO BE SUPPLIED FOR THIS EXAM

CUED approved calculator allowed.

You are allowed access to the electronic version of the Engineering Data Books.

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

The time taken for scanning/uploading answers is 15 minutes.

Your script is to be uploaded as a single consolidated pdf containing all answers.

1 (a) In object oriented design, explain the difference between an interface and an abstract class. [5%]

(b) A video games store allows customers to choose either physical (disc) or digital (download) format for delivery of their games. If the customer chooses the physical format, the disc is sent to their address. If the digital format is preferred, an email is sent to the customer with the link for the download. A customer can order more than one game at a time.

(i) Design an object oriented system that fulfils an order placed by a customer, and draw a class diagram that describes the system. [30%]

(ii) Draw a sequence diagram that demonstrates a scenario where one video game in the digital format and one video game in the physical format are delivered to the same customer. [30%]

(iii) The video games store decides to offer films in addition to games that can also be either downloaded digitally or delivered on a disc. Extend your design to support this new offer and update the class diagram to illustrate this extension. [35%]

2   (a)   Explain why use case modelling is beneficial in user interface (UI) design.   [5%]

(b)   A Quick Espresso Bar chain would like to create a specialised Point of Sale application that customers can use in-store to place their order. The customers should be able to select an espresso, specify its size, add extras such as milk or a glass of still or sparkling water, and choose the type of chocolate square served on the side. They should also be able to choose whether to eat in or take away. Finally, the customer must pay with a card.

   (i)   Define a set of representative user types.   [10%]

   (ii)   Identify and describe the main use case.   [25%]

   (iii)   Design the UI for a software application for a tablet device with a touchscreen that implements this functionality, and allows the main use case to be completed in the quickest possible way. Identify all main screens and interaction elements, and explain their purpose.   [40%]

   (iv)   Give two examples of additional functionality that could be introduced to improve overall user experience. Identify any additional screens and interaction elements required to support these features.   [20%]

3 (a) In object oriented design, explain what is meant by decoupling. [5%]

(b) A research team has developed a smartphone application for capturing and automatically labelling images for the dataset they are building, in order to test their Artificial Intelligence (AI) object recognition software. The main view of the application has a live image from the camera (live viewfinder), with a thumbnail preview (small images of the photos) displaying the most recent captures at the bottom as illustrated in Fig. 1. When the user taps on the live viewfinder, the image is taken and added to the dataset. Then the AI engine analyses the image and assigns it a label. Additionally, the thumbnail preview is updated with the new image.
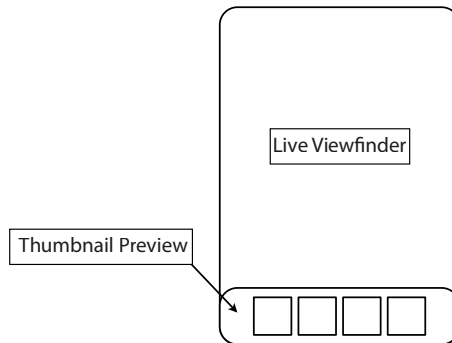

Fig. 1

(i) The sequence diagram in Fig. 2 shows the capture of one image for the dataset. Draw the corresponding class diagram for this system. [35%]

(ii) Identify the design pattern that can help to decouple the classes by allowing the AI engine and thumbnail preview to be notified when a new image is added to the dataset. Update the class diagram. [30%]

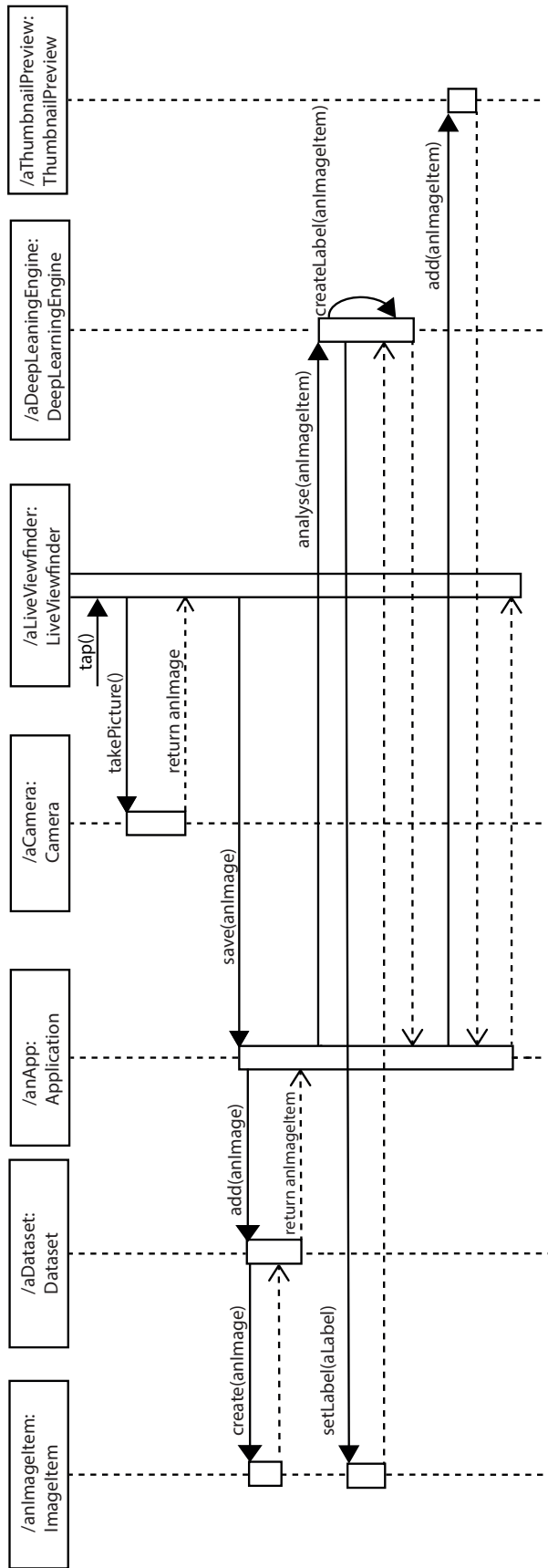(iii) Update the sequence diagram for the enhanced design. [30%]

(cont.

Fig. 2

(TURN OVER

4   (a)   In software engineering, discuss advantages and disadvantages of continuous integration practices.   [10%]

(b)   A company is working on an independent news website that uses a novel approach to publish a diversity of opinion on matters concerning public life and democracy.

   (i)   Suggest the software development methodology that would be most suitable for the development of the public news website. Describe this software development methodology and explain how it can be used in the project.   [25%]

   (ii)   Design a testing strategy for the website. Identify the key test areas that would allow the company to address the main risks in the project, and specify the appropriate tests to mitigate these risks.   [30%]

   (iii)   Describe the deployment pipeline that might be suitable for the public news website project, its main stages, the tools that might be used and the benefits of following the proposed approach.   [35%]

END OF PAPER