

Module 3F6: Software Engineering and Design

OBJECT ORIENTED SOFTWARE DESIGN

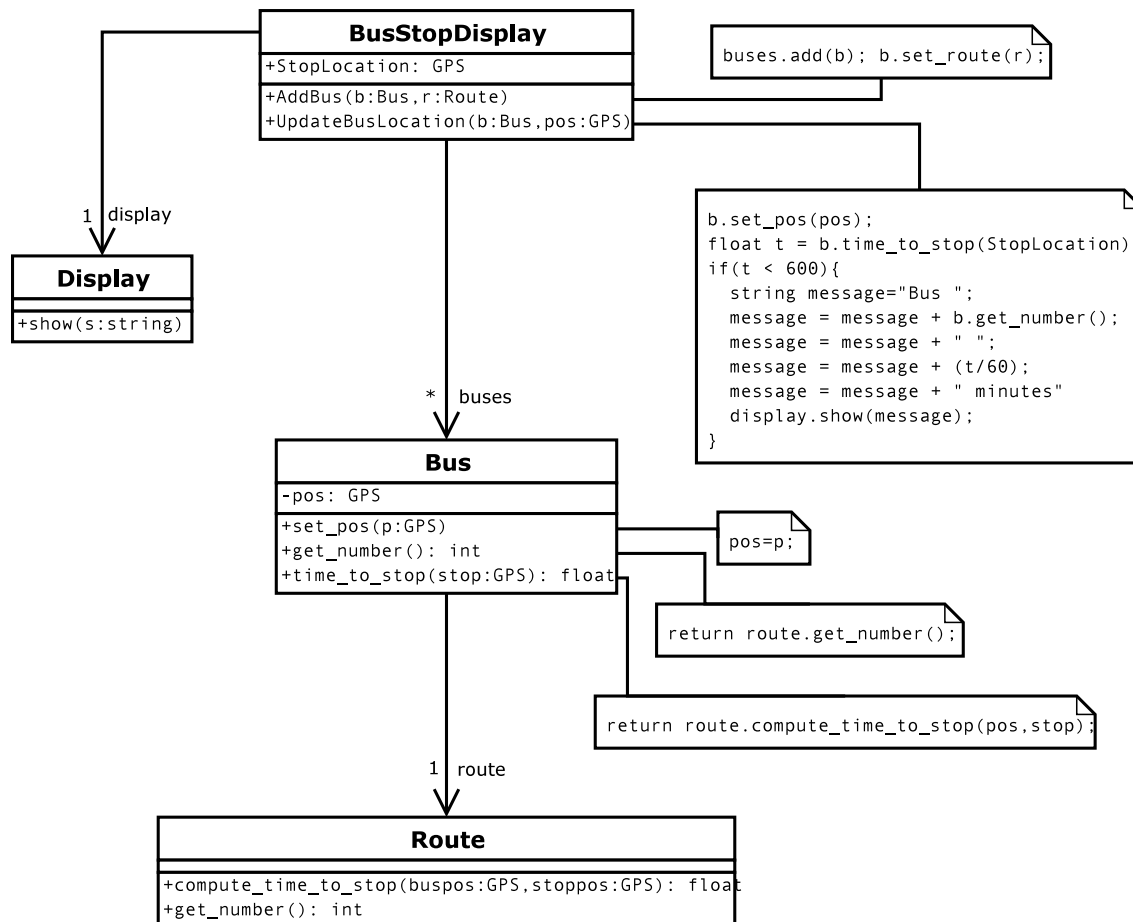
Examples Paper 1

*Straightforward questions are marked †*

*Tripos standard (but not necessarily Tripos length) questions are marked \**

UML

- Figure 1 shows a class diagram describing part of some software to provide a display at bus stops. Draw a sequence diagram showing what happens when the UpdateBusLocation function is called on BusStopDisplay. Assume that time\_to\_stop is calculated as 300.



## *Object Oriented Design*

2. A company wishes to develop software for a hard disk based video recorder. Part of the specification reads as follows:

### **Specification:**

**Program guide:** Once per day, the software will connect to a program guide server and will download the program guide. In addition to giving a list of programs with times for each channel, each program will have a short text synopsis and a list of genres that apply to it (e.g. news, drama, documentary, sci-fi, etc. ). The user must then be able to browse the program guide by channel, time or genre.

**Recording programs:** The user should be able to use the program guide to select programs for recording. The software should maintain a list of programs scheduled for recording and when a program is selected for recording, should check that it does not clash with any programs in the list. If there is a clash, the user should be given the choice between cancelling the selected program, or keeping it and removing all clashing programs from the list.

The user should be able to browse the list of programs scheduled for recording by channel, time or genre and should be able to delete programs from the list.

When it is time to record a program, the software should send a signal to the channel tuner to tune it to the correct channel, and record the program.

**Viewing programs:** When a recording is complete, the program should be added to the list of recorded programs. The user should be able to browse this list also by channel, time or genre and to be able to delete programs from this list.

Sketch a design for the software, giving your answer as a class diagram showing the main classes, attributes and methods that will be needed.

A company sells books via a web-based portal. Part of the software that implements this service is shown in Figure 2. Questions 3–8 refer to this diagram.

### *UML Diagrams*

3. Describe the classes and relationships shown in the UML diagram
4. A customer has two books in their shopping basket. Draw a sequence diagram which shows the customer checking out and confirming the order.
5. The company wishes to expand their range to include CDs and videos in addition to books. Draw a UML diagram which shows how the software must be changed to implement this.

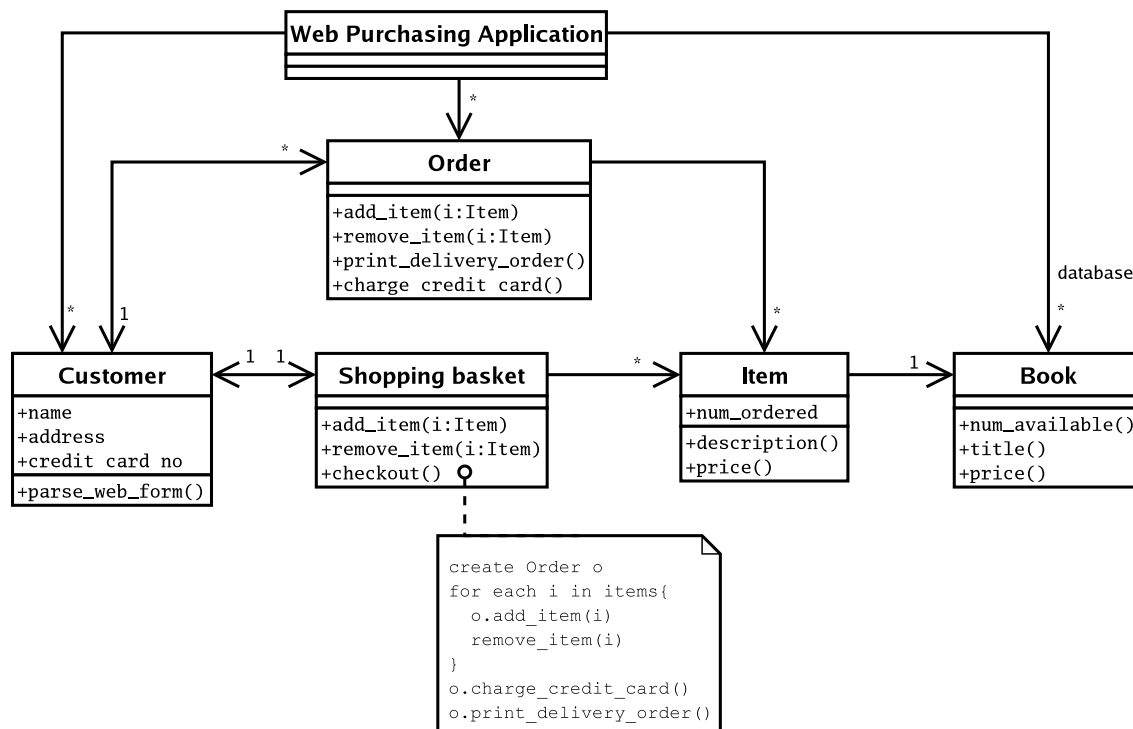


Figure 2: UML showing web based book selling software

### Design Patterns

- 5.\* Show how the decorator pattern could be used to provide a gift wrapping service (at £1 per item). Include notes in your UML diagram with pseudocode indicating how the new operations might be implemented.
- 6.\* Show how the composite pattern could be used to provide particular sets of books (or CDs etc) at a discount (for example, customers who purchase all three books in “The Lord of the Rings” would obtain a 10% discount).
- 7.\* The company wishes to expand their sales to include corporate customers who will be billed monthly (rather than be charged by credit card). Show what changes are necessary to the system to implement this change.