



UNIVERSITY OF COLOMBO, SRI LANKA

UNIVERSITY OF COLOMBO SCHOOL OF COMPUTING

DEGREE OF BACHELOR OF INFORMATION TECHNOLOGY (EXTERNAL)
Academic Year 2010/2011 – 2nd Year Examination – Semester 3

IT3104: Object Oriented Analysis and Design
PART 2 – Structured Question Paper

26th February, 2011
(ONE HOUR)

To be completed by the candidate

BIT Examination Index No: _____

Important Instructions:

- The duration of the paper is **1 (one) hour**.
- The medium of instruction and questions is English.
- This paper has **2 questions** and **13 pages**.
- **Answer both questions.**
- Both questions will carry equal marks.
- **Write your answers** in English using the space provided **in this question paper**.
- Do not tear off any part of this answer book.
- Under no circumstances may this book, used or unused, be removed from the Examination Hall by a candidate.
- Note that questions appear on both sides of the paper.
If a page is not printed, please inform the supervisor immediately.
- **Non-programmable Calculators may be used.**

Questions Answered

Indicate by a cross (×), (e.g. ×) the numbers of the questions answered.

| To be completed by the candidate by marking a cross (×). | Question numbers | |
|--|------------------|---|
| | 1 | 2 |
| To be completed by the examiners: | | |
| | | |
| | | |

1) Based on the following case study answer question 1.

Restaurant System

Case Study

The system to be developed is intended to support the day-to-day operations of a restaurant by improving the processes of making reservations and allocating tables to customers. The restaurant currently operates a manual booking system using handwritten forms stored in a large folder.

An example of the current manual booking form is given in Figure 1. Each row on this form corresponds to a particular table in the restaurant. Bookings are entered for a particular table, and the number of ‘covers’, or diners expected, is recorded for each booking, so that a suitably sized table can be allocated. The restaurant runs three sittings in an evening, known as the “pre-theatre”, the ‘dinner’ and the ‘support’ slots, but as the form illustrates, these slots are not strictly adhered to and bookings can be made for time periods that span more than one slot. Finally, a contact name and phone number are recorded for each booking.

DINNER BOOKINGS - DATE / /

| Table No. | 5.30 p.m. – 7.30 p.m. | | 7.30 p.m. – 10.00 p.m. | | 10.00 p.m. – 12.00 Mid Night | |
|-----------|-----------------------|-----------------|------------------------|-----------------|------------------------------|-----------------|
| | Covers | Name, Phone No. | Covers | Name, Phone No. | Covers | Name, Phone No. |
| 1 | | | | | | |
| 2 | | | | | | |
| 3 | | | | | | |

Figure 1: A manual booking sheet

Currently there are tables for 2 covers, 4 covers and 6 covers.

Annotations are made to the booking sheet to record various events. When a party arrives and is seated, the corresponding booking in the booking sheet is crossed out. The party can be seated at a table other than the booked if it is vacant. This is shown by drawing an arrow from the original booking to the new table in the booking sheet. If a customer phones to cancel a booking, a note is made in the booking sheet to indicate that the booking has been cancelled. Other pieces of information, such as the time by which a table must be vacated, can also be written on the sheet. Dinner can also be taken at the restaurant without making an advance booking, if a free table is available. This is known as a ‘walk-in’ and is shown on the sheet as a booking to record table occupancy, but no record of the customer’s name or telephone number is made.

Once the customers arrive, they are ushered into their respective table/tables, and the dining menu containing menu items (food, beverages and deserts etc.) is presented by the waiter and menu items chosen are noted down. Details of these menu items and their respective quantities are indicated in the invoice items. Customer is presented with the invoice and the relevant payment is made either by cash or using a credit card. Since a customer can have several bookings or reservations (if accommodation cannot be provided at a single table, multiple tables have to be allocated) at a particular time, invoice prepared may cover all such bookings.

The need for a computerized system

The restaurant management has identified a number of problems with the manual system. The system is slow, and the booking forms quickly become difficult to read. This can lead to operational problems, such as customers being prevented from making a booking because it is not obvious from the booking sheet that there is in fact a table free. There is no backup system: if a sheet gets destroyed, the restaurant has no record of what bookings have been made for that evening. Finally, it is very time-consuming to get even simple management data, such as the rate of table occupancy, from the existing booking sheets.

For these reasons, among others, the restaurant would like to develop an automated version of the existing booking sheet. The new system should display the same information as the existing sheet, and in roughly the same format, to make it easy for restaurant staff to transfer to the new system. When new bookings are recorded, or changes made to existing bookings, the display should be immediately updated, so that restaurant staff is always working with the latest information available.

The system must be able to record significant events that take place when the restaurant is open, such as the arrival of the customer. Operation of the system will be as far as possible by direct manipulation of the data presented on the screen. For example, it should be possible to change the time of a booking, or the table it is allocated to.

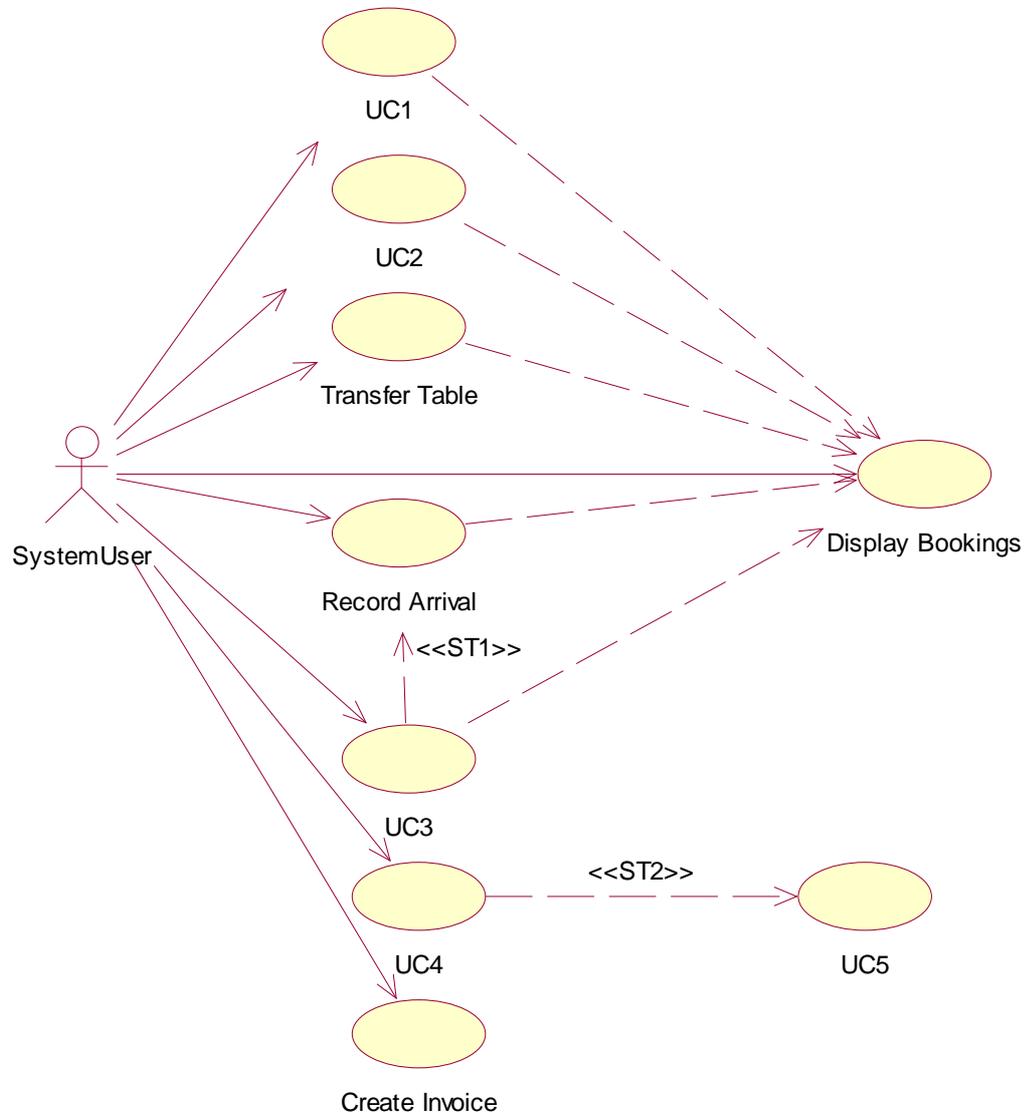
System needs to store information about dining menu, menu items and invoice details to support some of the functionalities needed to be supported.

System should also support the following :

- On line Reservation,
- Allow cash or credit card payments.
If a customer uses two or more tables with more than 8 covers, 7% discount is given. This will be applied for any kind of payment. Further 3% discount is given for credit card payments.
- Generate reports to support the management such as,
 - Details of Regular customers,
 - Customers who pay by credit cards (sorted according to the type of credit card),
 - Customers who do online reservations,
 - Table-wise demand for reservations etc.,
 - Total discounts given for credit card customers monthly(sorted according to the type of credit card),
 - Monthly Income for the restaurant,
 - Most popular menu items for a given month, year etc.

(a)

(i) Identify correct Use Cases from the given list to represent Use Cases designated from UC1 to UC5 in the Use Case diagram shown below. **(15 Marks)**



List of use cases:

- | | |
|-------------------|-------------------|
| A. Get Discount | B. Manage Walk-In |
| C. Manage Payment | D. Manage Booking |
| E. Cancel Booking | |

ANSWER IN THIS BOX

UC1 - Manage Booking/Cancel Booking

UC2 - Manage Booking/Cancel Booking

UC3 - Manage Walk-In

UC4 - Manage Payment

UC5 - Get Discount

(ii) What are the correct Stereotypes designated as ST1 and ST2 in the class diagram?

(05 Marks)

ANSWER IN THIS BOX

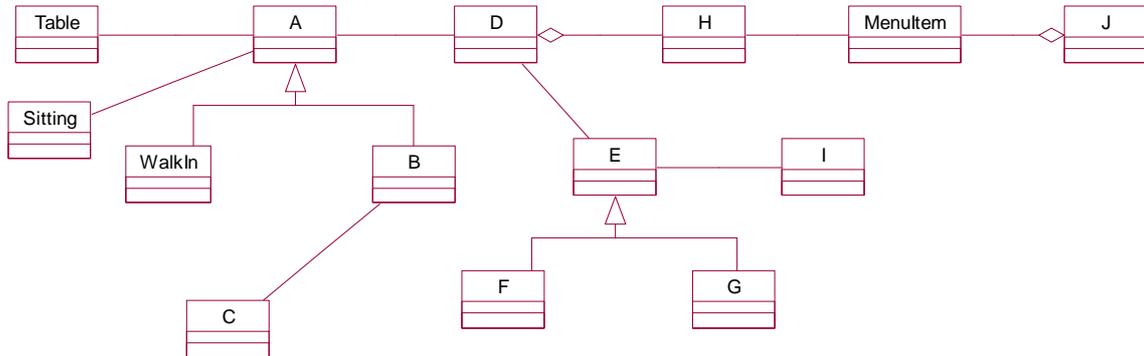
ST1 - include

ST2 - include

(b)

Identify the classes from among the given class list which are best suited for classes designated from A to J in the class diagram given below. **(30 Marks)**

Hint: A Booking can be a kind of Walk-in or a kind of Reservation.



List of classes:

- | | |
|------------------------|-----------------|
| A. Payment | B. Customer |
| C. Booking | D. Reservation |
| E. Invoice | F. Cash Payment |
| G. Credit Card Payment | H. Invoice Item |
| I. Dining Menu | J. Discount |

ANSWER IN THIS BOX

A - Booking

B - Reservation

C - Customer

D - Invoice

E - Payment

F - Cash Payment or Credit Card Payment

G - Cash Payment or Credit Card Payment

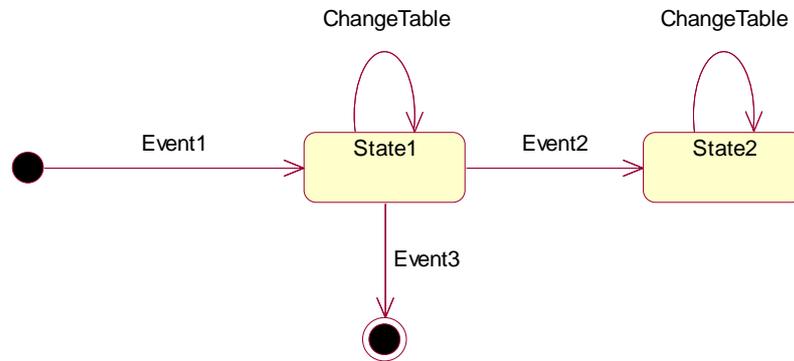
H - Invoice Item

I - Discount

J - Dining Menu

(c) A Student analyzing the system created a state chart diagram for *Booking* class.

Identify the proper states and events with guard conditions from the given lists for the state chart diagram given below. **(10 Marks)**



List of States, events with guard conditions:

- A. Create[TableObjectAssociated]
- B. RecordArrival
- C. Cancel
- D. Booked
- E. Seated

| <u>ANSWER IN THIS BOX</u> | |
|----------------------------------|---------------------------------|
| State1 - | Booked |
| State 2 - | Seated |
| Event1 - | Create[TableObjectAssociated] |
| Event2 - | RecordArrival |
| Event3 - | Cancel |
| | |
| | |

(d)

At present, the system can only create a booking for a customer provided that a vacant table (or tables) that can accommodate the required covers is(are) there for the required time slot (sitting). The management of the restaurant wants the system to provide a 'Waiting List' functionality in which the customers' reservation requirement information can be kept. When a table becomes vacant as a result of cancellation of a reservation, the system should be able to provide a list of customers who are in the waiting list. Then the customer can be informed about the vacancy in a first-come first served basis and if he/she wishes, a booking can be created. When this requirement was presented to the Systems Analyst, he suggested that this new requirement can be accommodated by doing slight changes to the model. His suggestion was to provide facility to create a 'Tentative' reservation without any associated table object. When the cancellation of a reservation or booking occurs, the system should look at any 'Tentative' reservations present and provide a list of customers that can be informed. Upon confirmation by the customer, the tentative reservation(s)/booking(s) can be converted to a proper reservation/booking with a associated table object(s).

- (i) What are the additional Use Cases that need to be added to the Use Case diagram in order to achieve this change? **(24 Marks)**

ANSWER IN THIS BOX

- | | |
|------------------------------|----------------------------------|
| 1. Present List of Customers | 2. Convert Tentative Reservation |
| 3. Check waiting list | |

- (ii) What is the new state that needs to be added and what is the Class associated with that state? **(10 Marks)**

ANSWER IN THIS BOX

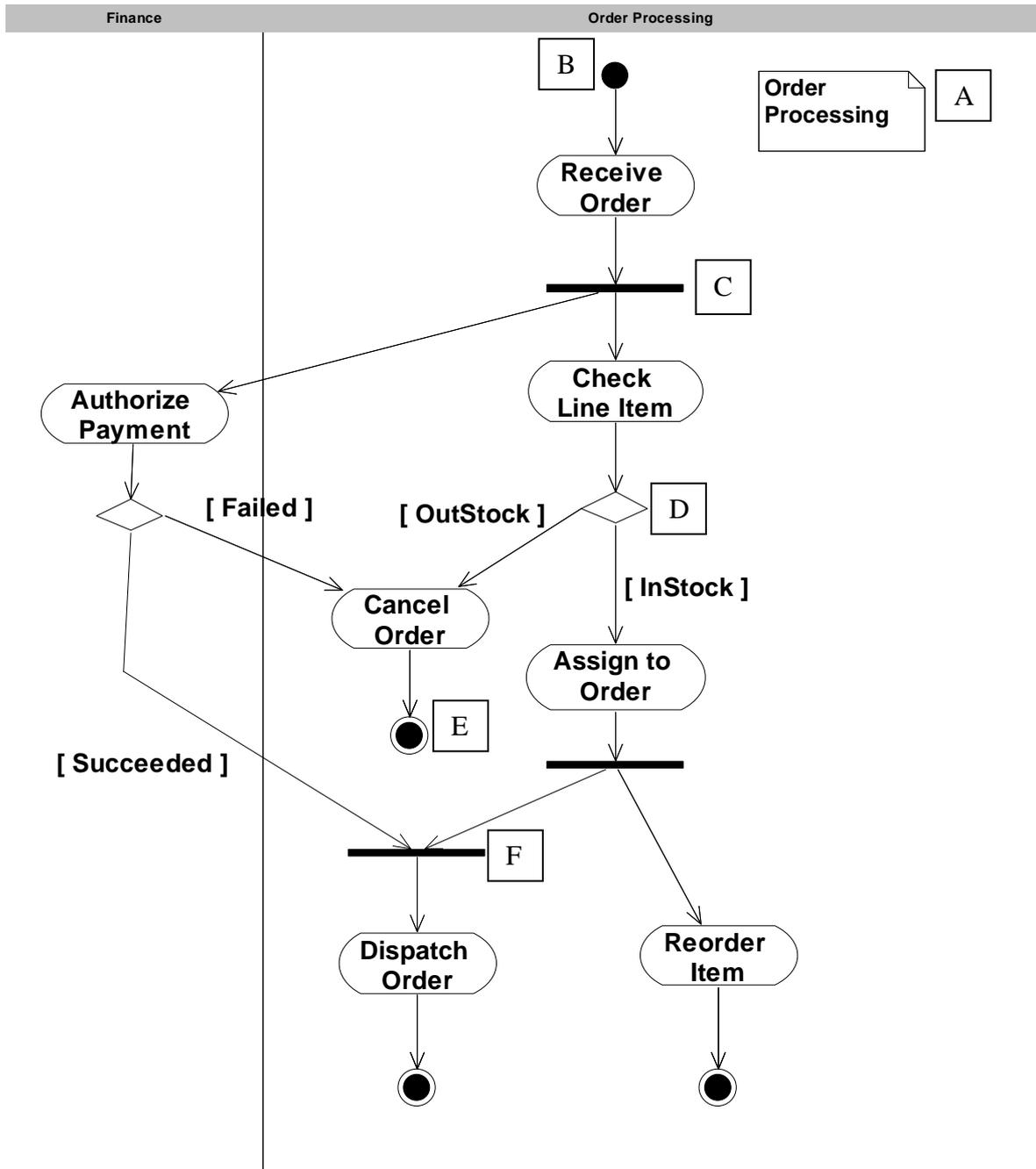
Tentative
Reservation

- (iii) Do you think that by adding the additional Use Cases and a new state as above, the new requirement of the system can be met? If not, indicate your suggestions. **(06 Marks)**

ANSWER IN THIS BOX

Yes.

2) (a) Based on the following activity diagram drawn for an Order Processing scenario, answer the questions from (i) to (v).



(i) Identify the *Swim Lanes* drawn for the above scenario?

(10 Marks)

ANSWER IN THIS BOX

Finance
Order Processing

(ii) Identify two action pairs that can occur in any order or concurrently.

(16 Marks)

ANSWER IN THIS BOX

(I) Authorize Payment & CheckLine item

(II) Dispatch Order & Reorder Item

(iii) Give two examples for a guard condition from the above diagram.

(10 Marks)

ANSWER IN THIS BOX

Failed, succeeded, outstock, instock

(I) Check Authorize Payment

(II) Check Line Item

- (iv) Identify the elements labelled from A to F of the above activity diagram from the list given below. (18 Marks)

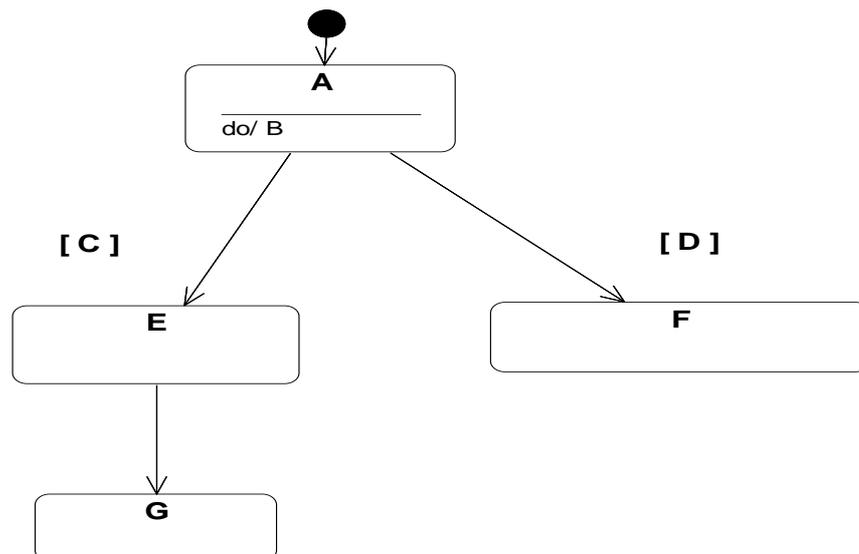
Fork, Join, Note, Starting Node, Decision Point, Swim Lane, Ending Node, Guard Condition

ANSWER IN THIS BOX

| | Element |
|-----------|-----------------------|
| A. | Note |
| B. | Starting Node |
| C. | Fork |
| D. | Decision Point |
| E. | Ending Node |
| F. | Join |

- (v) Drawn below is a state diagram for the payment authorization specification of the Order Processing scenario. Based on the given payment authorization specification, identify the states / activities for labels A-G. (21 Marks)

Payment Authorization Specification:



Payment authorization begins by doing an authorization. The check payment activity finishes by signalling that the payment is approved. If the payment is OK, the given order waits in the Authorized state until the deliver event occurs. Otherwise, the order enters the rejected state.

ANSWER IN THIS BOX

| | Element |
|----|----------------|
| A. | Authorizing |
| B. | Check payment |
| C. | Payment OK |
| D. | Payment not OK |
| E. | Authorized |
| F. | Rejected |
| G. | Delivered |

(b) State whether the following statements are *true* or *false*.

(25 Marks)

ANSWER IN THIS BOX

| Statement | True / False |
|--|--------------|
| A package diagram shows how several objects collaborate in a single use case. | False |
| UML may be used to reveal the physical implementation architecture with <i>component</i> and <i>deployment</i> diagrams. | True |
| <p>The Object diagram drawn below violates the multiplicity specification of the above class diagram.</p> | True |
| Deployment diagrams commonly contain components and interfaces. | False |
| A class diagram is a diagram showing a collection of classes and interfaces, along with the collaborations and relationships among classes and interfaces. | True |
