CSC4001 Software Engineering

Assignment 3

Due – 23:59pm, 8th May 2024 (Wednesday)

Note:Late submission will have grade of 0!!!

Note: This assignment was designed, proofread, and released by teaching assistant Junjielong Xu (SDS, 222043010). If you have any question, please feel free to contact the TA.

Question 1 UML Class Diagram (25 points)

Let's consider an example of a hotel booking system. You need to draw a UML class diagram to describe the system via referring to the description of the system.

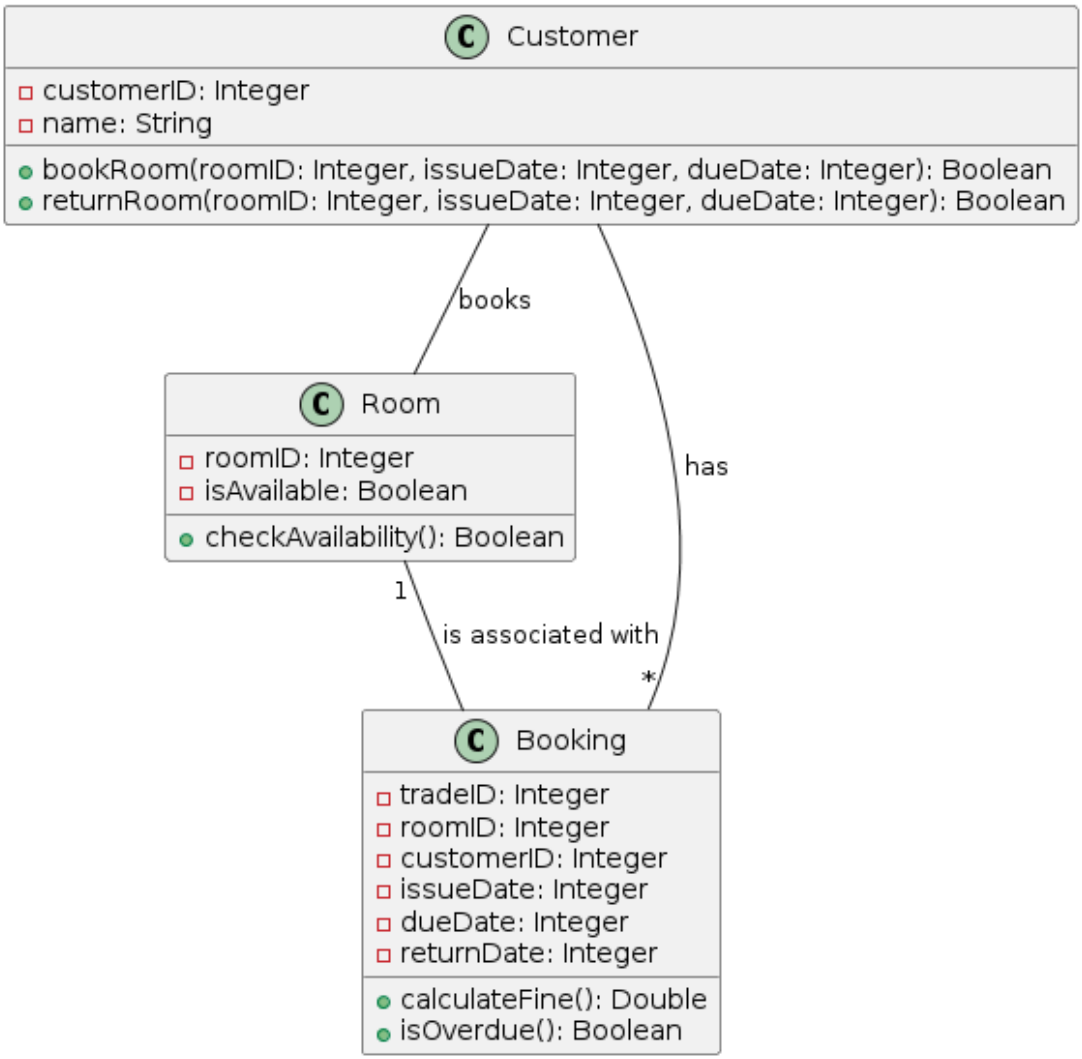
Description:

In an online hotel booking system, there are three class, i.e., **Customer**, **Room**, and **Booking**. A customer has two attributes: customerID and name, which are Integer and String type. The customer can book a room using the bookRoom method, and can return a room using the returnRoom method. Both of these two methods take three Integer value roomID, issueDate, and dueDate as input, and return a Boolean value as output. A room has two attributes: roomID and isAvailable. The former one is an Integer and the latter one is a Boolean. It has a checkAvailability method for room availability checking, which returns a Boolean value. The booking class records a room booking trade. It contains six different Integer value: tradeID, roomID, customerID, issueDate, dueDate, returnDate. It has a calculateFine method to calculate the total fee of the booking, where the fee is a Double value. It has an isOverdue method to check whether the returnDate is latter than the dueDate, which returns a Boolean value.

*Hints:

1. There is an association between the Customer and Room classes, as a customer can book or return a room.
2. There is also an association between the Customer and Booking classes, as a customer can have multiple booking records.
3. There is an association between the Room and Booking classes, as each booking record is associated with a specific room.

Hotel Booking System Class Diagram



Question 2 UML Sequence Diagram (25 points)

Let's consider an example of a hotel booking system. You need to draw a UML sequence diagram to describe the system via referring to the description of the system.

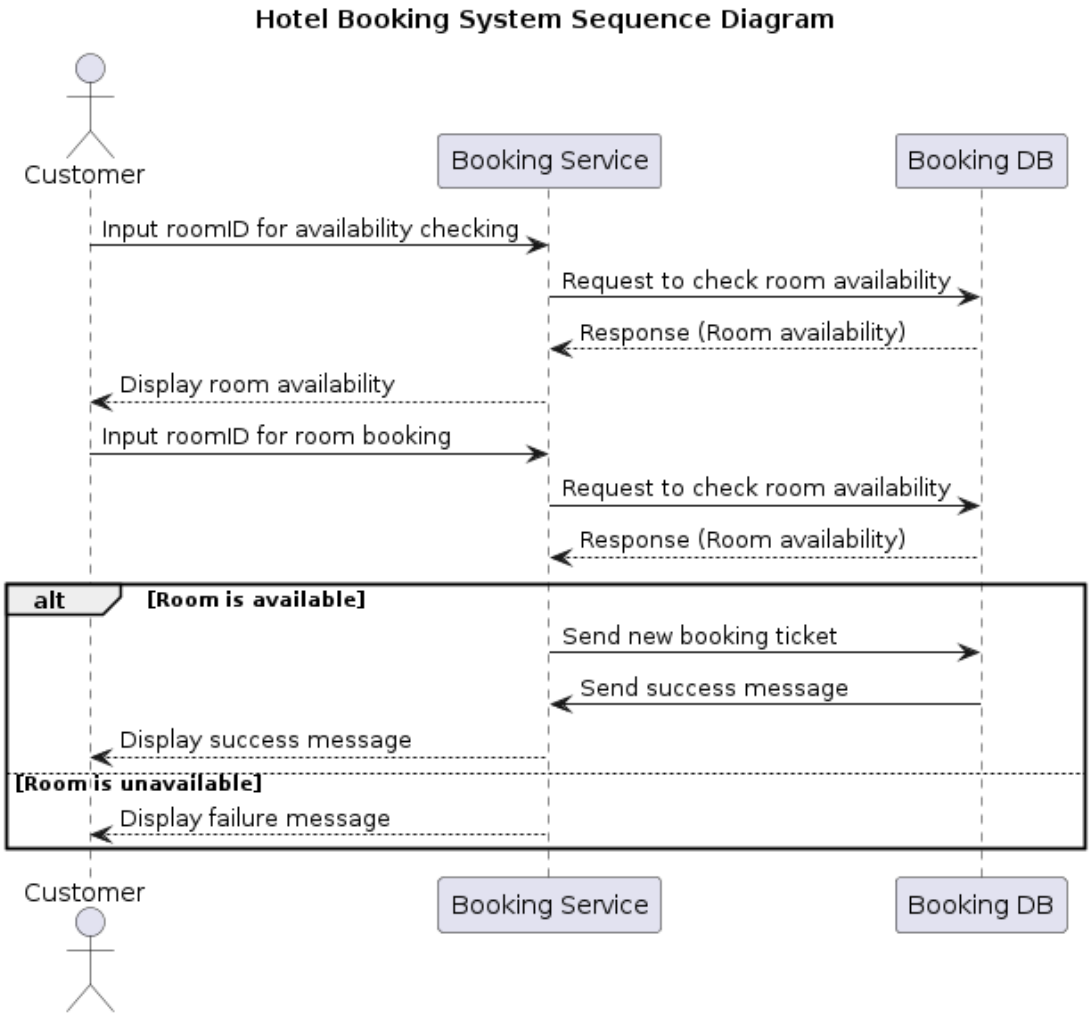
Description:

A **customer** can input a roomID to the **booking service** for availability checking, and the booking service will request the **booking database** to check the availability of the target room. Once the database sends the response to the system, the service will display the room availability to the customer. After that, the customer can input a room ID to the booking service for room booking. If the room is available, the booking service will request the booking DB to check the availability of the target room. Otherwise, the service will display the message of failed booking to the customer.

*Hints:

After a customer input a room ID to the booking service for the room booking, …

1. [Alternative] … if the response is “available”, the system will send a new booking ticket to the DB, and also update the information of the customer and room in the DB. The DB will send a success message to the system after finishing the information saving. And then, the system will display the message of successful booking to the customer.
2. [Alternative] … if the response is “unavailable", the system will display the message of failed booking to the customer.


Hotel Booking System Sequence Diagram
Customer
Booking Service
Booking DB
Input roomID for availability checking
Request to check room availability
Response (Room availability)
Display room availability
Input roomID for room booking
Request to check room availability
Response (Room availability)
alt
[Room is available]
Send new booking ticket
Send success message
Display success message
[Room is unavailable]
Display failure message
Customer
Booking Service
Booking DB

Question 3 Dataflow Analysis (50 points)

```
1.  a = 2
2.  b = 10
3.  c = 5
4.  f = 0
5.  d = a*b
6.  if e < d goto L13
7.  b = b - c
8.  g = b * c
9.  if e < g goto L13
10. h = b - a
11. a = a * h
12. goto L5
13. if d == e goto L17
14. f = d - e
15. d = d - f
16. goto L13
17. a = 0
```

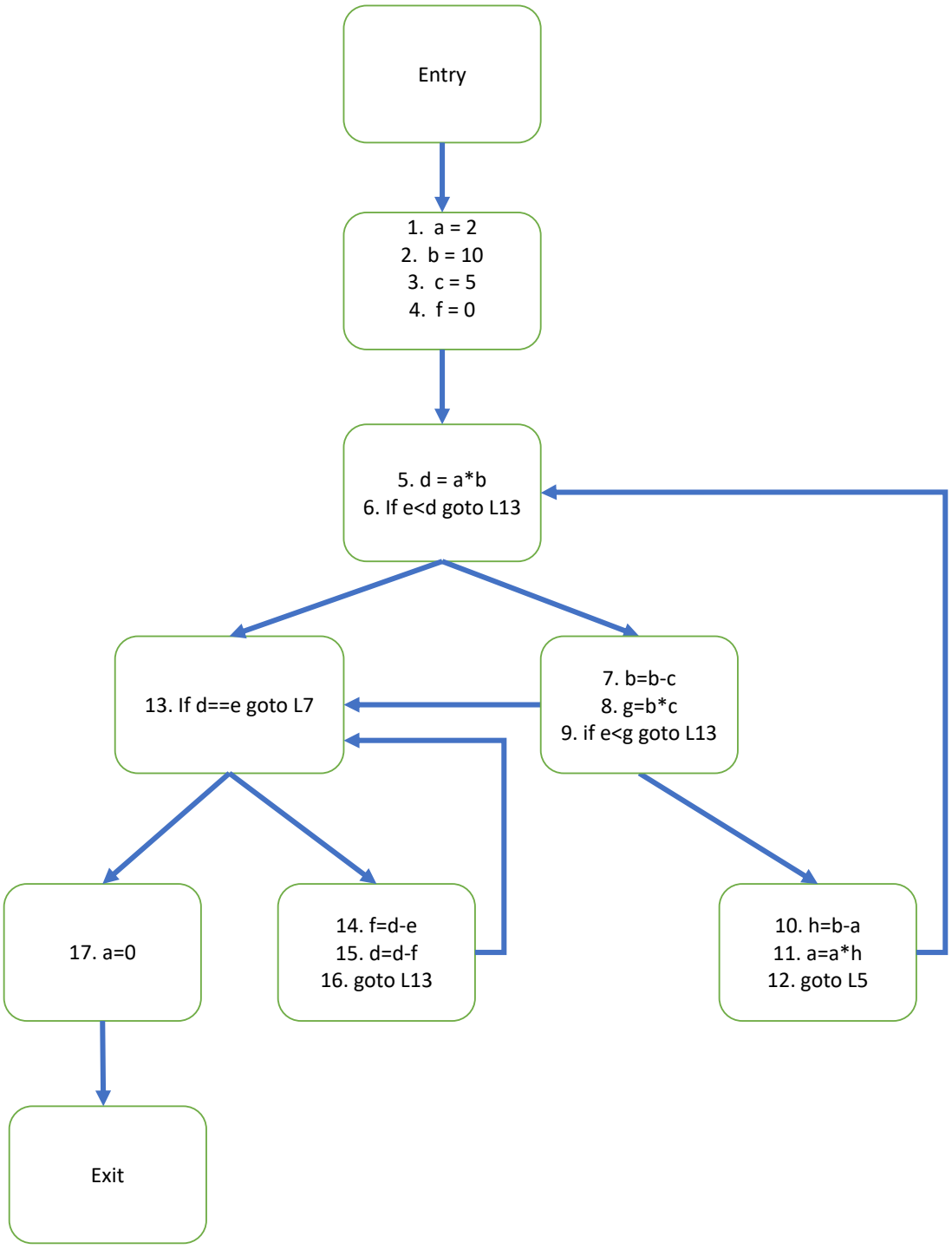
1. Construct the control flow graph (CFG) for the given 3AC code. [20 points]

2. Now, we will apply the iterative algorithm following the CSC lecture notes, to perform live variable analysis on the given 3AC code in a backward manner. Please provide the expressions for updating the Input state and Output state. [10 points]

3. If we consider lines 7, 8, and 9 as a basic block, what are the USE set and DEF set for this basic block? [10 points]

4. If we modify line 7 to “b = c + 10” and consider lines 7, 8, 9 as a basic block, what are the USE set and DEF set for this basic block? [10 points]

1.



2. OUT[B] = $\cup_{S\ a\ successor\ of\ B}$ IN[S], IN[B] = $use_B \cup$ (OUT[B] -$\mathbf{def}_B$)
3. use = {b, c, e}; def = {b, g}
4. use = {c, e}; def = {b, g}