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预定类面向对象设计

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Restaurant

九章算法

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- Can you design a restaurant?

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Clarify

- What
- How

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Clarify

- What

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关键字：Restaurant

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Clarify

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- What

关键字：Restaurant

In / Out：？

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Clarify

九章算法

- What

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关键字：Restaurant

In / Out ：

Party / Table

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Clarify

- What

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关键字：Restaurant, Party, Table

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What

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属性：？

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What

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What

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- 吧台

- 大堂

- 包间

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What

关键字：Restaurant

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- 桌子的规格不一样，能坐的人数区别
- 吧台里，party的区分
- 收费？

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Clarify

- 针对本题

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大堂，所有桌子都一样，暂不考虑人数限制

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Clarify

- How

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规则？

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Clarify

- How

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- 是否能够预约？

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Clarify

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- How

- 是否能够送外卖？

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Clarify

- How

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- 每个Order需要区分是Dine-in还是Dine-out

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- 针对本题

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没有Reservation
没有Dine-out

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Clarify

思考模式1：

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Party 进入餐馆 -> Host指引到空桌 (find table) ->
一个waiter负责这桌客人 (assign waiter) -> 客人点菜 (ta
Chief 拿到order，按顺序做菜 (cook by order) -> Order做
(serve order) -> 客人吃完后付钱 (check out)

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九章算法

思考模式2：

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1. 客人进入餐馆，餐馆返回一个Table
2. 客人点菜，餐馆返回一桌菜
3. 客人付账，餐馆清空Table

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思考模式1：

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思考模式2：

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Core Object

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Restaurant

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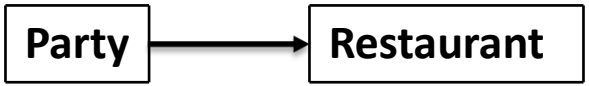

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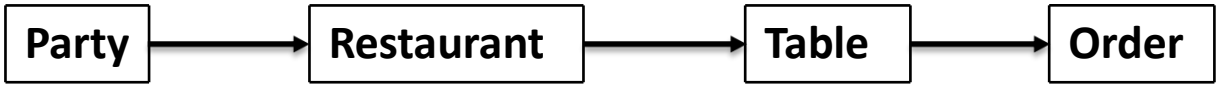

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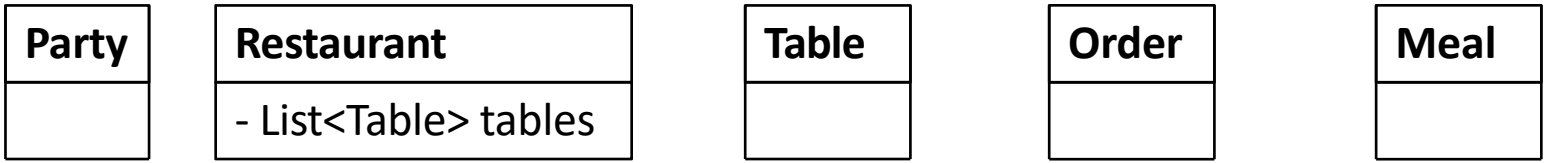

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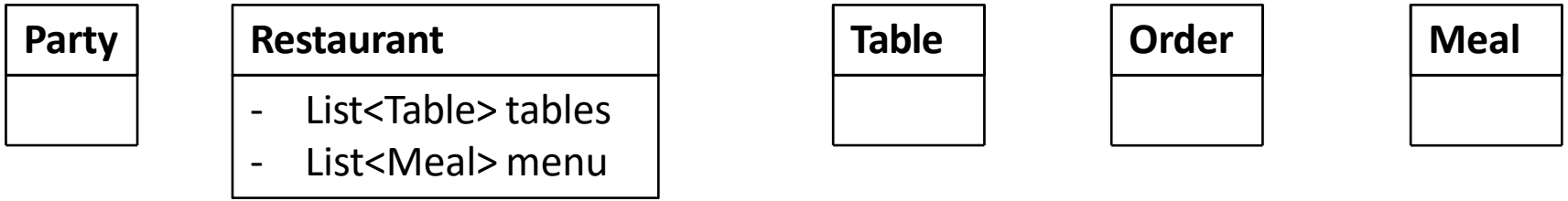

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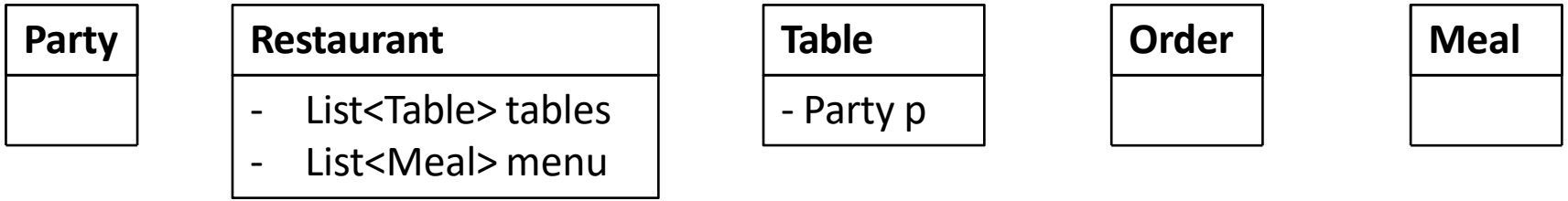

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Core Object

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Party

Restaurant
- List<Table> tables - List<Meal> menu

Table

Order

Meal

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Party

Restaurant
- List<Table> tables - List<Meal> menu

Table

Order
- List<Meal> meals

Meal

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Cases

- Party

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Cases

- Party

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- Make order ?

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Cases

- Restaurant

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Cases

- Restaurant

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- Find table

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Cases

- Restaurant

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- Find table
- Take Order

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Cases

- Restaurant

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- Find table
- Take Order
- Checkout

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Cases

- Table

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- N/A

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Cases

＋微信study322
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- Order

- N/A

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Cases

- Meal

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- N/A

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Use case summary

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- Mangement 类常见use case

Reserve: Serve: Checkout:

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Use case summary

九章算法

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- Mangement 类常见use case

Reserve: 暂不考虑

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Use case summary

九章算法

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- Mangement 类常见use case

Reserve: 暂不考虑

Serve: Find table, Take order

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Use case summary

九章算法

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- Mangement 类常见use case

Reserve: 暂不考虑

Serve: Find table, Take order

Checkout: checkout

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

Table

Order

- List<Meal> meals

Meal

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Use cases

- Find table
- Take order
- Checkout

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- Use case: Find table

- Restaurant find an available table, an change the table to be unavailable

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()

Table

Order

- List<Meal> meals

Meal

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Use cases

Find table

Take order

Checkout

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Party

Restaurant
- List<Table> tables - List<Meal> menu
+ Table findTable()

Table
- Boolean available

Order
- List<Meal> meals

Meal

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Use cases
Find table
Take order
Checkout

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()

Table

- Boolean available

+ boolean isAvailable()

Order

- List<Meal> meals

Meal

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Use cases

Find table

Take order

Checkout

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()

Table

- Boolean available

+ boolean isAvailable()
+ void changeStatus()

Order

- List<Meal> meals

Meal

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Use cases

Find table

Take order

Checkout

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Best practice

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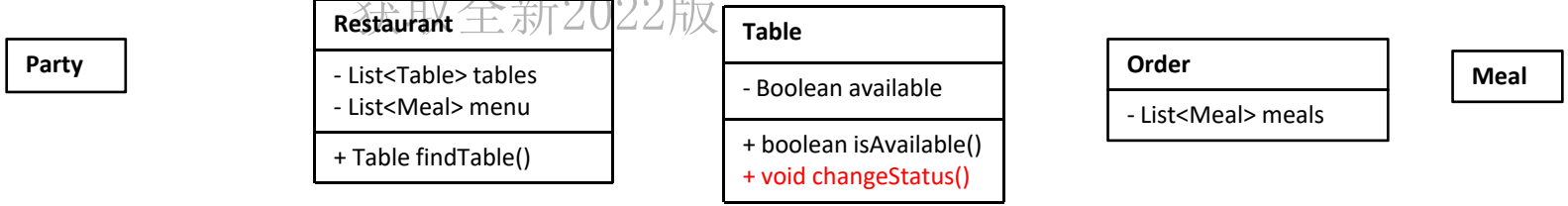

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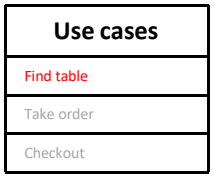

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Best practice

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()

Order

- List<Meal> meals

Meal

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Use cases

Find table

Take order

Checkout

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Class

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- Use case: Take order

- Restaurant takes an order

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Class

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()
+ void takeOrder(Order o)

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()

Order

- List<Meal> meals

Meal

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Find table
Take order
Checkout

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- Use case: Check out

- Restaurant checks out a table/order, mark the table available again
- Calculate order price

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()
+ void takeOrder(Order o)

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()

Order

- List<Meal> meals

Meal

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Find table
Take order
Checkout

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()
+ void takeOrder(Order o)

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()

Order

- List<Meal> meals
- Table t

Meal

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Find table
Take order
Checkout

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()
+ void takeOrder(Order o)
+ void checkout(Order o)

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()

Order

- List<Meal> meals
- Table t

Meal

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Take order

Checkout

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()
+ void takeOrder(Order o)
+ void checkout(Order o)

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()
+ void markAvailable()

Order

- List<Meal> meals
- Table t

Meal

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Use cases

- Find table
- Take order
- Checkout

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()
+ void takeOrder(Order o)
+ void checkout(Order o)

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()
+ void markAvailable()

Order

- List<Meal> meals
- Table t

Meal

- Float price

+ float getPrice()

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Use cases

Find table

Take order

Checkout

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Party

Restaurant

- List<Table> tables
- List<Meal> menu

+ Table findTable()
+ void takeOrder(Order o)
+ void checkout(Order o)

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()
+ void markAvailable()

Order

- List<Meal> meals
- Table t

+ float getPrice()

Meal

- Float price

+ float getPrice()

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Use cases

Find table

Take order

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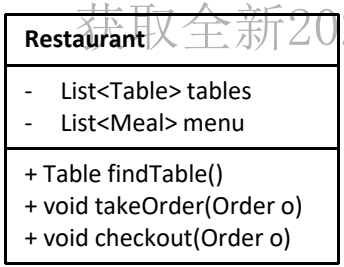

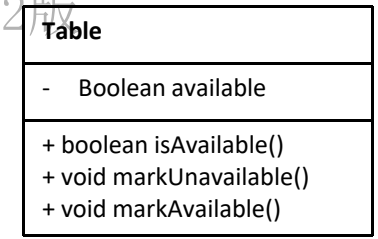

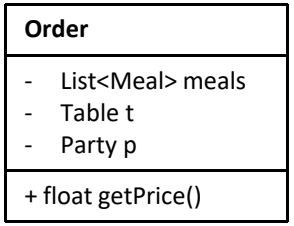

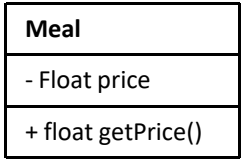

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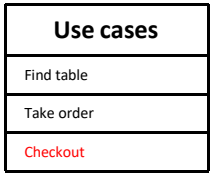

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Challenge

- Share table?

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Class

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Party

Restaurant

- List<Table> tables
- List<Meal> menu
- Map<Table, List<Order>> orders

+ Table findTable()
+ void takeOrder(Order o)
+ void checkout(Order o)

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()
+ void markAvailable()

Order

- List<Meal> meals
- Table t
- Party p

+ float getPrice()

Meal

- Float price

+ float getPrice()

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Use cases

Find table

Take order

Checkout

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Class

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Party

Restaurant

- List<Table> tables
- List<Meal> menu
- Map<Table, List<Order>> orders

+ Table findTable()
+ void takeOrder(Order o)
+ void checkout(Order o)

Table

- Boolean available
- Int availableSeats

+ boolean isAvailable()

Order

- List<Meal> meals
- Table t
- Party p

+ float getPrice()

Meal

- Float price

+ float getPrice()

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Use cases

Find table

Take order

Checkout

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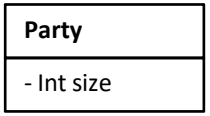

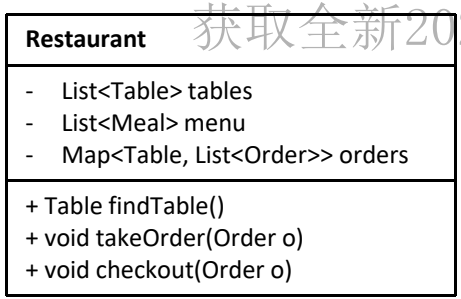

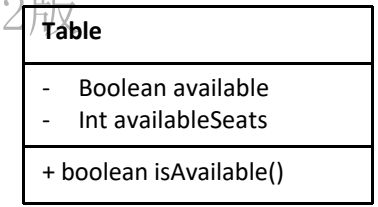

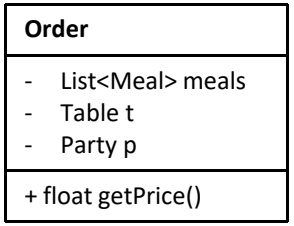

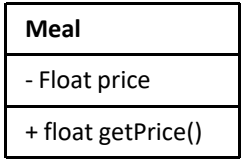

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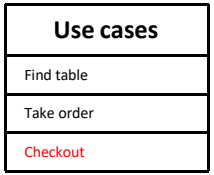

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Class

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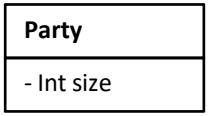

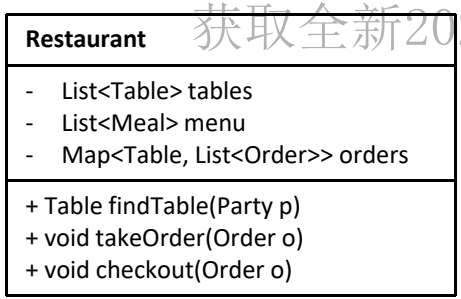

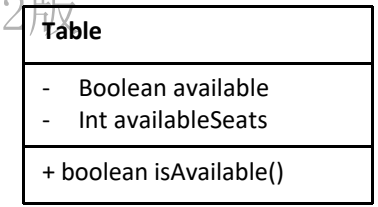

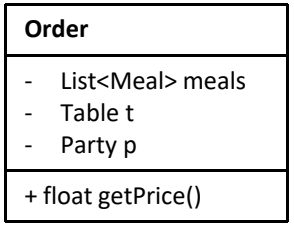

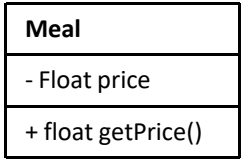

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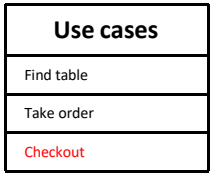

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Correctness

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Party

Restaurant

- List<Table> tables
- List<Meal> menu
- Map<Table, List<Order>> orders

+ Table findTable()
+ void takeOrder(Order o)
+ void checkout(Order o)

Table

- Boolean available

+ boolean isAvailable()
+ void markUnavailable()
+ void markAvailable()

Order

- List<Meal> meals
- Table t
- Party p

+ float getPrice()

Meal

- Float price

+ float getPrice()

NoTableException

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Use cases

- Find table
- Take order
- Checkout

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Challenge

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- How can you change your design to support reservation in your restaurant?

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课程大纲

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- 预定类OOD题型
- 预定类OOD解题思路
- Hotel reservation system
- Booking.com

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预定类题库

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- Restaurant reservation system

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预定类题库

九章算法

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- Restaurant reservation system
- Hotel reservation system

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预定类题库

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- Restaurant reservation system
- Hotel reservation system
- Flight/Bus/Train reservation system

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预定类题目特点

- 频率：中

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预定类题目特点

- 频率：中
- 难度：高

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预定类题目解题思路

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- What

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- 考虑预定的东西

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预定类题目解题思路

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- What

- 考虑预定的东西

例子：机票

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预定类题目解题思路

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- What

- 考虑预定的东西

例子：机票

机舱/座位号/...

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预定类题目解题思路

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- Use case

- Search
- Select

- Cancel

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预定类题目解题思路

- Use case

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

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Reservation

- 有哪些需要和面试官统一的contract?

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Reservation

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- 有哪些需要和面试官统一的contract?

Search criteria -> Search() -> List<Result> -> Select() -> Receipt

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Reservation

- Search criteria

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Reservation

- Search criteria

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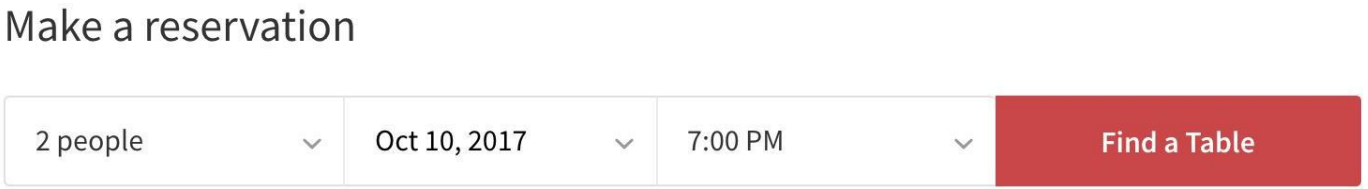

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Reservation

九章算法

- Search criteria

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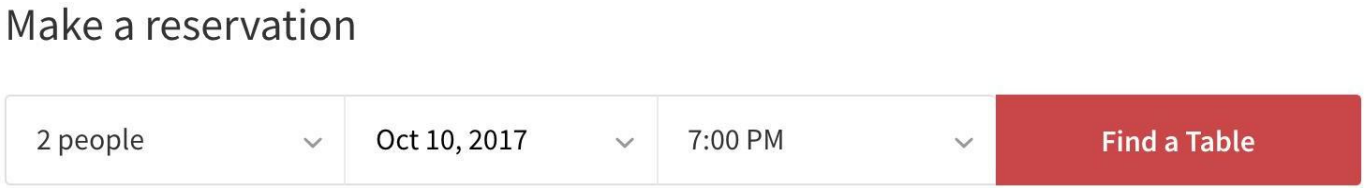

- 人数： 无拼桌，每张桌子大小相同，不会有超过桌子大小的人数

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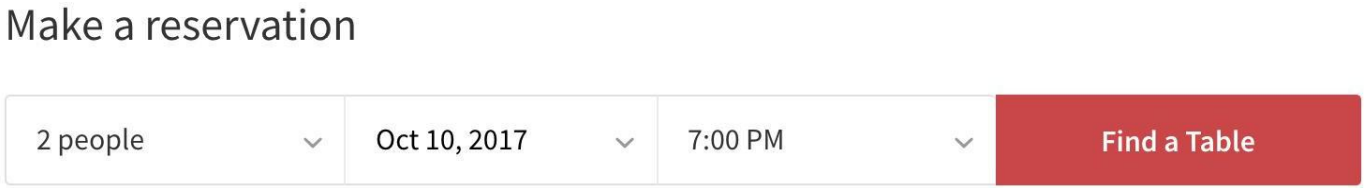

- 人数：无拼桌，每张桌子大小相同，不会有超过桌子大小的人数
- 日期：是否允许预定多日以后的？

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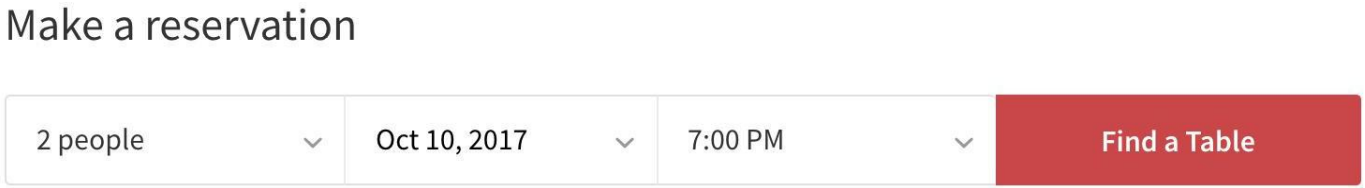

- 人数：无拼桌，每张桌子大小相同，不会有超过桌子大小的人数
- 日期：是否允许预定多日以后的？
- 时间： 是否所有时间都允许预定？

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九章算法

- Search criteria

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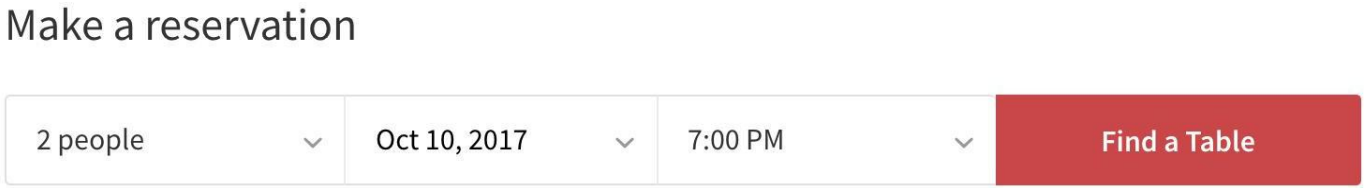

- 人数：无拼桌，每张桌子大小相同，不会有超过桌子大小的人数
- 日期：是否允许预定多日以后的？ - 允许
- 时间： 是否所有时间都允许预定？ - 24/7

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- Search criteria

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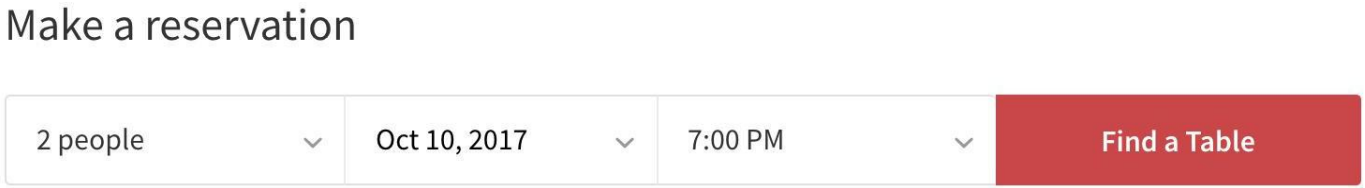

- 人数：无拼桌，每张桌子大小相同，不会有超过桌子大小的人数
- 日期：是否允许预定多日以后的？ - 允许
- 时间： 是否所有时间都允许预定？ - 24/7

- Design: FindTableForReservation(Timeslot t)

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九章算法

- Search criteria

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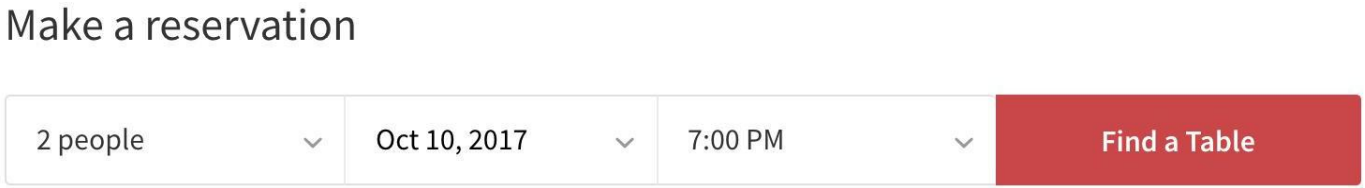

- 人数：无拼桌，每张桌子大小相同，不会有超过桌子大小的人数
- 日期：是否允许预定多日以后的？ - 允许
- 时间： 是否所有时间都允许预定？ - 24/7

- Design: FindTableForReservation(Timeslot t)
- Timeslot contains Date and time

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Reservation

- List<Result>

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Reservation

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- List<Result>

-当选择的时间段可以/不行时，系统应该给出什么反馈？

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Reservation

- 做法一：

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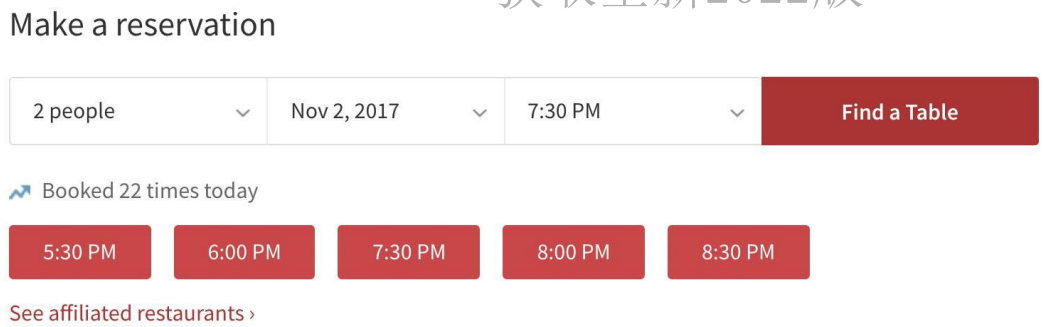

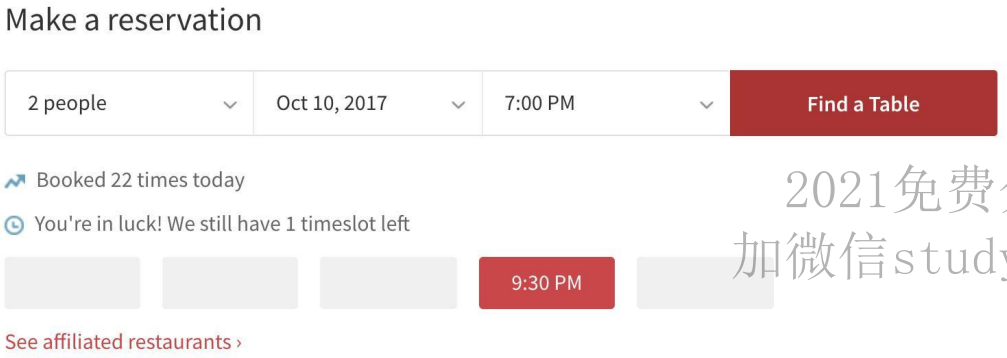

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Reservation

- List<Result>

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Result == Timeslot

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Reservation

- List<Result>

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Result == Timeslot

- Design: List<Timeslot> findTableForReservation(Timeslot t)
- Possible Challenge: 跟面试官讨论如何获得这个List

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九章算法

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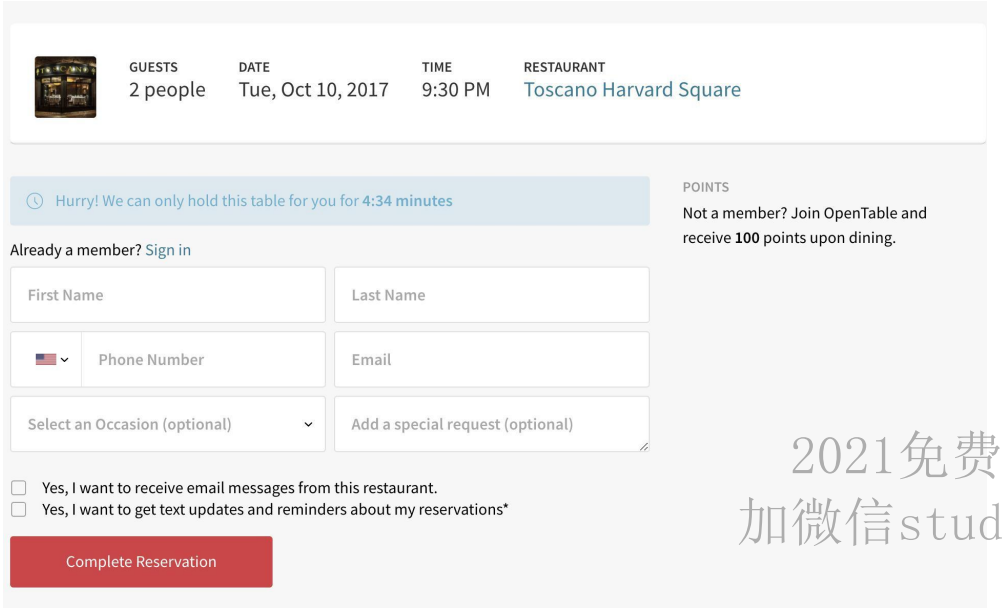
- 做法二：
  - 可以预定：直接进入Confirm阶段
  - 不能预定：Throw exception / Show message



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九章算法

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- 做法二：
  - 可以预定：直接进入Confirm阶段
  - 不能预定：Throw exception / Show message

- Design: Pair<Table, Timeslot> findTableForReservation(Time slot) throws NoTableForReservationException

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Reservation

九章算法

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- 做法二：
  - 可以预定：直接进入Confirm阶段
  - 不能预定：Throw exception / Show message

-Design: Pair<Table, Timeslot> findTableForReservation(Time slot) throws NoTableForReservationException

- Design: void confirmReservation(Pair<Table, Timeslot> reservation)

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Reservation

九章算法

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- 为什么我们可以跳过List<Result>这个步骤？

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Reservation

九章算法

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- 为什么我们可以跳过List<Result>这个步骤？

因为Table是一样的，用户不用选择也不会知道是订1号桌还是2号桌

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Restaurant

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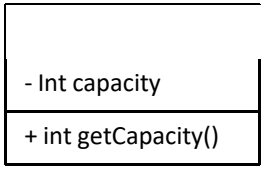

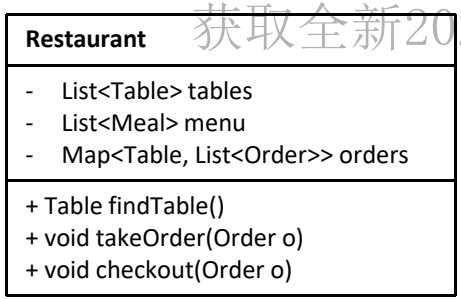

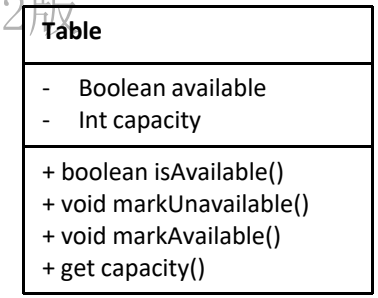

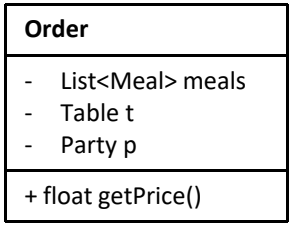

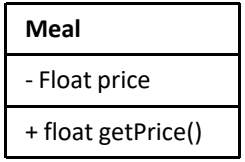

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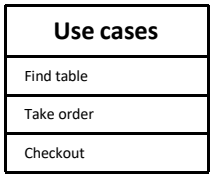

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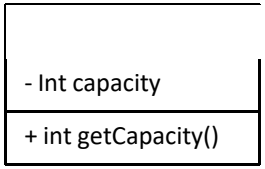

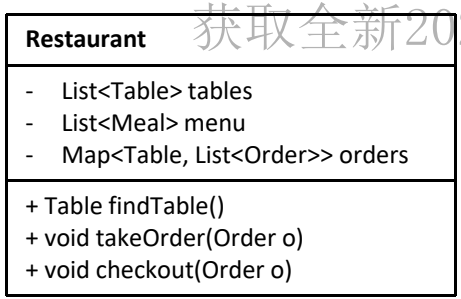

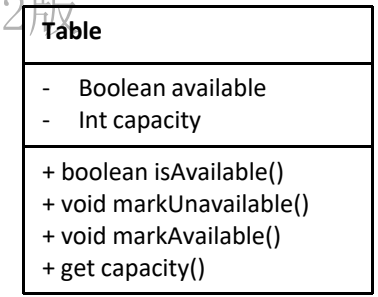

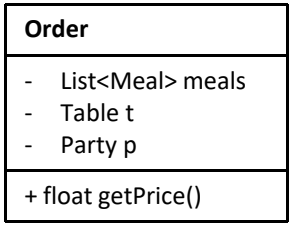

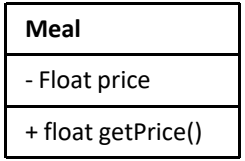

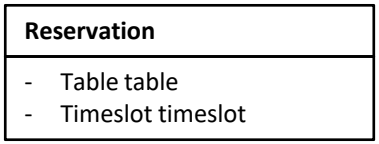

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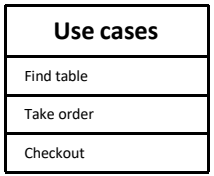

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Restaurant

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Party

+ int getCapacity()

Table

- Boolean available
- Int capacity

+ boolean isAvailable()
+ void markUnavailable()
+ void markAvailable()
+ get capacity()

Order

- List<Meal> meals
- Table t
- Party p

+ float getPrice()

Meal

- Float price

+ float getPrice()

Restaurant

- List<Table> tables
- List<Meal> menu
- Map<Table, List<Order>> orders

+ Table findTable()
+ void takeOrder(Order o)
+ void checkout(Order o)
+ Reservation findTableForReservation(Timeslot t)

Reservation

- Table table
- Timeslot timeslot

NoTableException

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Use cases

Find table

Take order

Checkout

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Restaurant

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NoTableForReservationExceptio n

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Use cases

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Checkout

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Any problems?

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Any problems?

九章算法

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- How to know if a table is open for reservation for a timeslot?

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Any problems?

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- How to know if a table is open for reservation for a timeslot?

要知道每张桌子的预定情况

Table
- Boolean available - Int capacity - List<Timeslot> reservations
+ boolean isAvailable() + void markUnavailable() + void markAvailable() + get capacity()

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Any problems?

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- How to know if a table is open for reservation for a timeslot?

把时间点转换为时间段

Table
- Boolean available - Int capacity - List<TimePeriod> reservations
+ boolean isAvailable() + void markUnavailable() + void markAvailable() + get capacity()

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- Table table
- Timeslot timeslot

NoTableException

NoTableForReservationExceptio n

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Use cases

Find table

Take order

Checkout

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Party

+ int getCapacity()

TimePeroid

- Time start
- Time end

Table

- Boolean available
- Int capacity

+ boolean isAvailable()
+ void markUnavailable()
+ void markAvailable()
+ get capacity()

Order

- List<Meal> meals
- Table t
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+ float getPrice()

Meal

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NoTableException

NoTableForReservationExceptio n

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Use cases

Find table

Take order

Checkout

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Party

+ int getCapacity()

TimePeroid

- Time start
- Time end

Table

- Boolean available
- Int capacity

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+ void markAvailable()
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Reservation

- Table table
- TimePeroid timePeriod

NoTableException

NoTableForReservationExceptio n

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Use cases

- Find table
- Take order
- Checkout

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Party

+ int getCapacity()

TimePeroid

- Time start
- Time end

Table

- Boolean available
- Int capacity
- List<TimePeroid> reservations

+ boolean isAvailable()
+ void markUnavailable()
+ void markAvailable()
+ get capacity()

Order

- List<Meal> meals
- Table t
- Party p

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Meal

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Restaurant

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Reservation

- Table table
- TimePeroid timePeriod

NoTableException

NoTableForReservationExceptio n

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Use cases

- Find table
- Take order
- Checkout

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Party

+ int getCapacity()

TimePeroid

- Time start
- Time end

Table

- Boolean available
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- Map<Table, List<Order>> orders
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+ void confirmReservation(Reservation r)

Reservation

- Table table
- TimePeroid timePeroid

NoTableException

NoTableForReservationExceptio n

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Use cases

- Find table
- Take order
- Checkout

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Cancel reservation

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- Restaurant takes a cancel reservation request, and ask the table to free that timeslot.

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Restaurant

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Party

+ int getCapacity()

TimePeroid

- Time start
- Time end

Table

- Boolean available
- Int capacity

+ boolean isAvailable()
+ void markUnavailable()
+ void markAvailable()
+ get capacity()

Order

- List<Meal> meals
- Table t
- Party p

+ float getPrice()

Meal

- Float price

+ float getPrice()

Restaurant

- List<Table> tables
- List<Meal> menu
- Map<Table, List<Order>> orders
- Map<Table, List<TimePeroid>> reservation

+ Table findTable()
+ void takeOrder(Order o)
+ void checkout(Order o)
+ Reservation findTableForReservation(Timeslot t)
+ void confirmReservation(Reservation r)
+ void cancelReservation(Reservation r)

NoTableException

NoTableForReservationExceptio n

Reservation

- Table table
- TimePeroid timePeroid

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Use cases

Find table

Take order

Checkout

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Hotel reservation system

九章算法

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- Can you design a hotel reservation system?

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Hotel reservation system

九章算法

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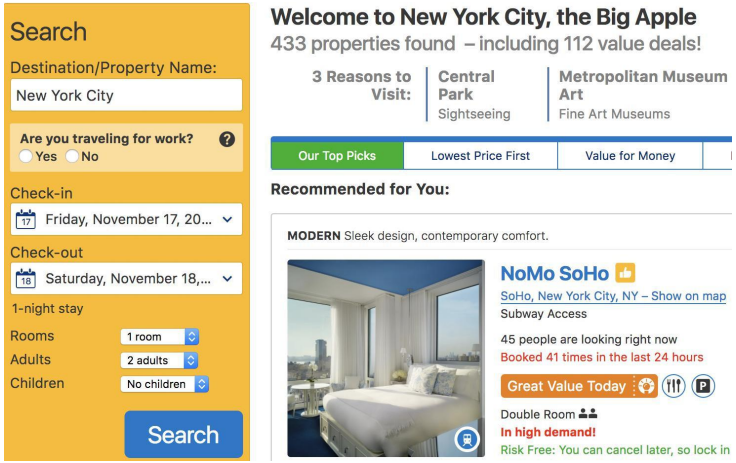
- Can you design a hotel reservation system?



VS.

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Clarify

- What

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是为一间酒店设计预定房间系统，还是先选择酒店的系统？

Design上会有哪些区别？

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是为一间酒店设计预定房间系统，还是先选择酒店的系统？

- 搜索条件区别

人数 + 时间 VS. 人数 + 时间 + 地址

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是为一间酒店设计预定房间系统，还是先选择酒店的系统？

- 返回结果区别

Rooms VS. Hotels

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是为一间酒店设计预定房间系统，还是先选择酒店的系统？

- 针对本题：

先设计一间酒店，再设计选择酒店的系统

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Clarify

- What

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

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- What

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

除了考虑题目中的名词之外，还需要从上述的三处考虑，What类型的提问主要针对List<Result>

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Clarify

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关键字：Room

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Clarify

- What

关键字：Room

Room Type	Sleeps	Today's Price	Your Choices	Select Rooms	Confirm Your Reservation
Classic Room with King Bed in high demand! 1 king bed This room includes 1 extra large double bed, cable TV and a work area. Private bathroom Free WiFi • Iron • Free toiletries • Bathroom • Telephone • Towels • Linens		$259 Excludes: Taxes and US$ 21.78 Property service charge per night There's an even lower price available! Sign in to see it	• Low rate – no money back • Service charge	0	I'll reserve Confirmation is immediate 101 other people looking now
		$344 Excludes: Taxes and US$ 21.78 Property service charge per night	✔ FREE cancellation before Oct 19, 2017 ✔ No advance payment • Service charge	0	
		$354 Excludes: Taxes and US$ 21.78 Property service charge per night There's an even lower price available! Sign in to see it	Breakfast included ✔ FREE cancellation before Oct 19, 2017 ✔ No advance payment • Service charge	0	
Penn 5000 Room with Double Bed Only 1 room left! 1 full bed This room includes a refrigerator and a flat-screen TV. Private bathroom Free WiFi More		$269 Excludes: Taxes and US$ 21.78 Property service charge per night There's an even lower price available! Sign in to see it	• Low rate – no money back • Service charge	0	
		$354 Excludes: Taxes and US$ 21.78 Property service charge per night There's an even lower price available! Sign in to see it	✔ FREE cancellation before Oct 19, 2017 ✔ No advance payment • Service charge	0	
		$364 Excludes: Taxes and US$ 21.78 Property service charge per night	Breakfast included ✔ FREE cancellation before Oct 19, 2017 ✔ No advance payment • Service charge	0	

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Clarify

- What

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针对本题：房间的人数和价格可能会不同

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Challenge

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针对本题：房间的人数和价格可能会不同。

如何设计房间类？

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Challenge

如何设计房间类？

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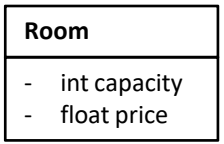

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Challenge

如何设计房间类？

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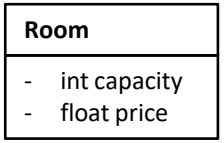
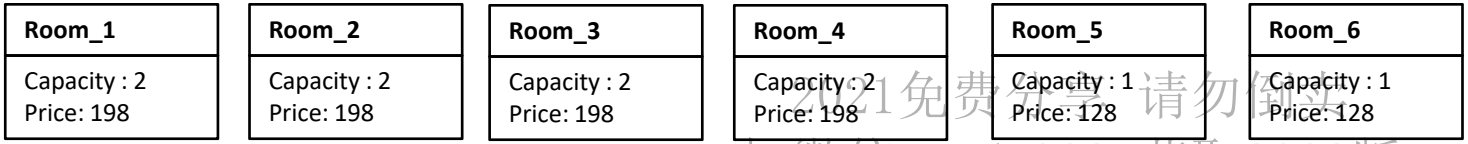


List<Result> -> List<Room>



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Challenge

如何设计房间类？

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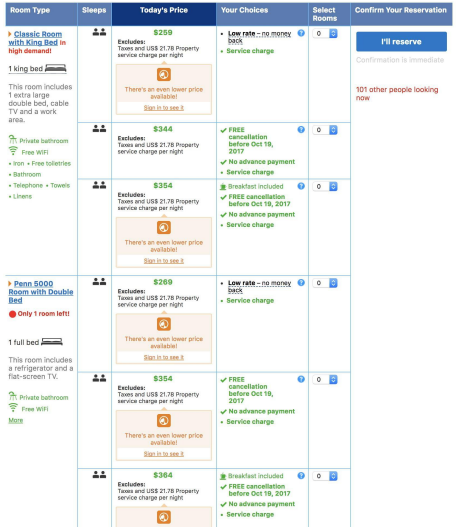
Room
- int capacity - float price



List<Result> -> List<Room>

Room_1	Room_2	Room_3	Room_4	Room_5	Room_6
Capacity : 2 Price: 198	Capacity : 2 Price: 198	Capacity : 2 Price: 198	Capacity : 2 Price: 198	Capacity : 1 Price: 128	Capacity : 1 Price: 128

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Clarify

- How

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规则？

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Clarify

- 预定类规则：

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Search criteria

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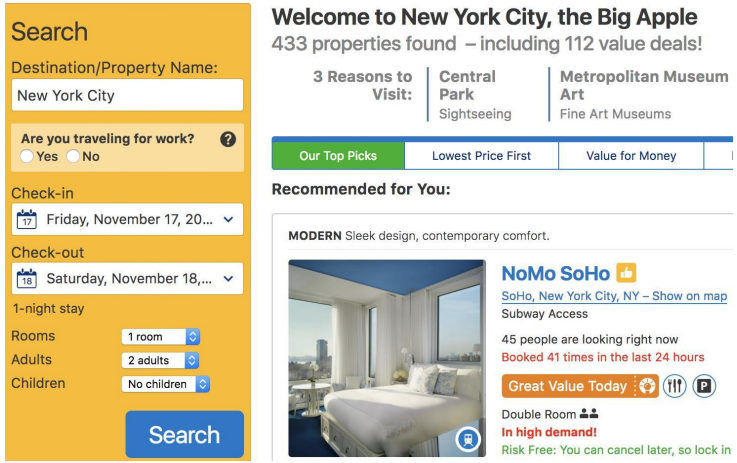
Search criteria



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Core object

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Core object

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Hotel

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Request

Hotel

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Request	Hotel	RoomType

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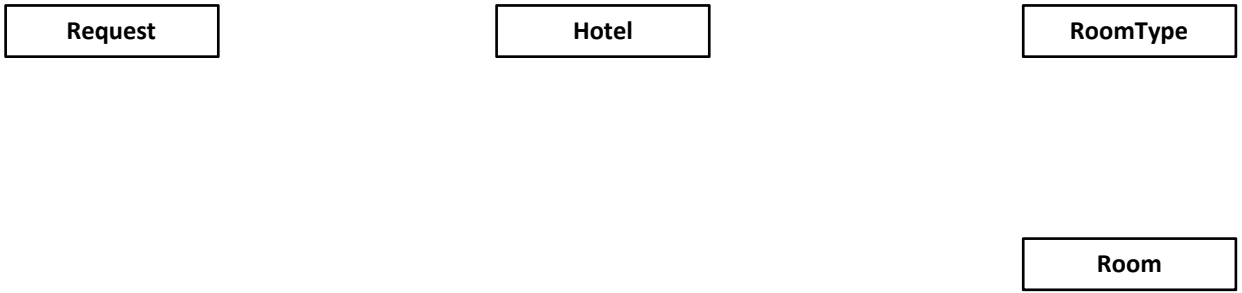

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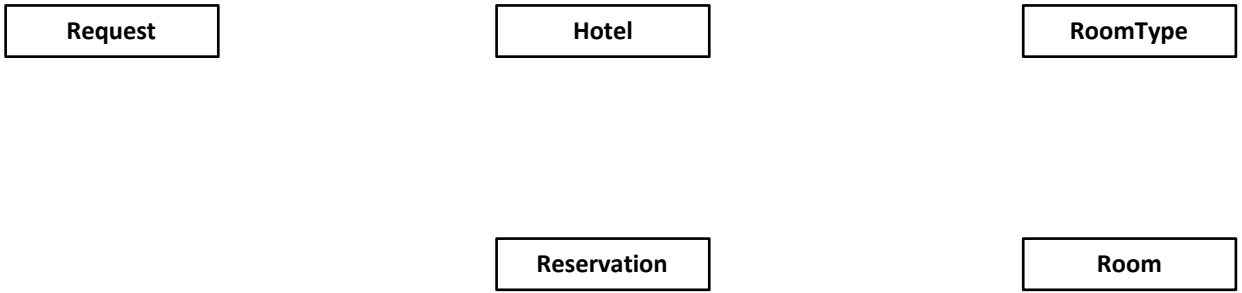

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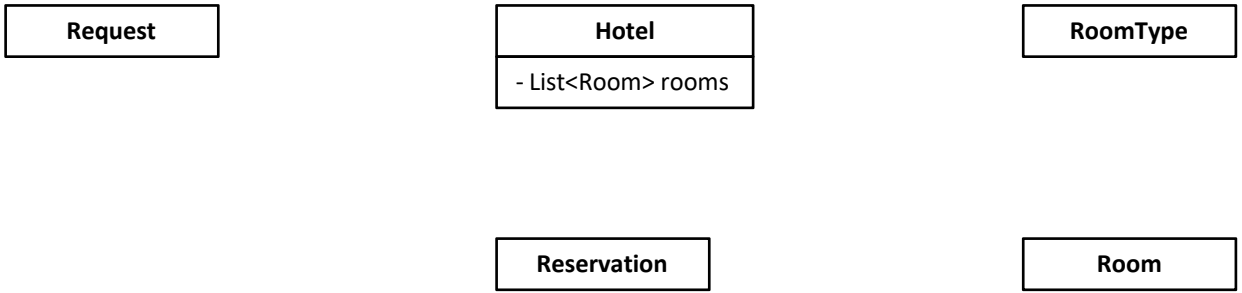

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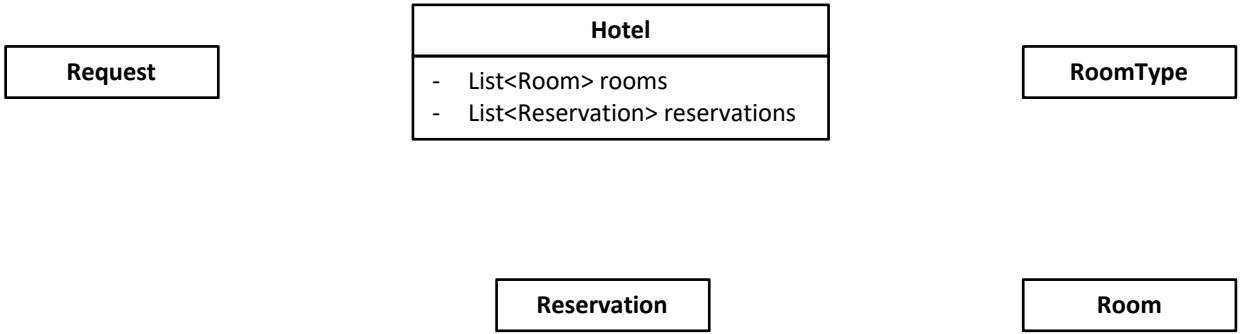

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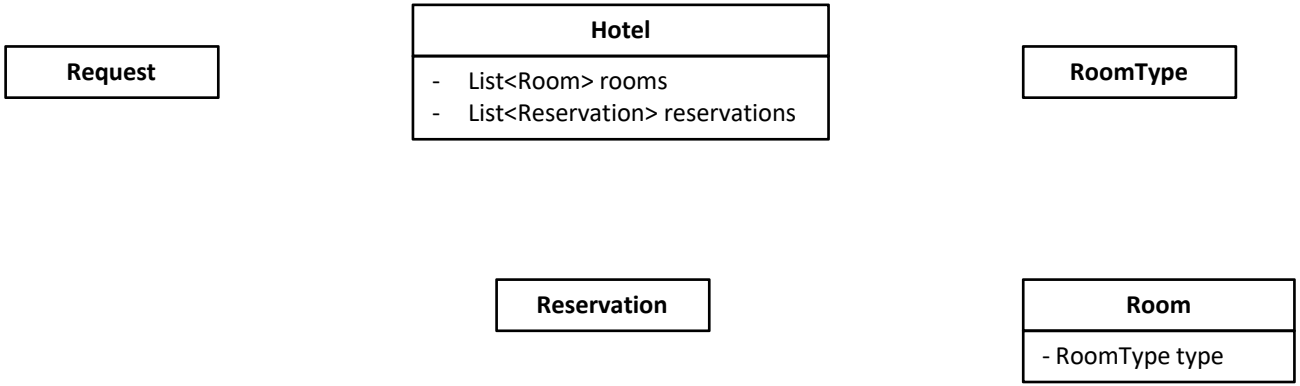

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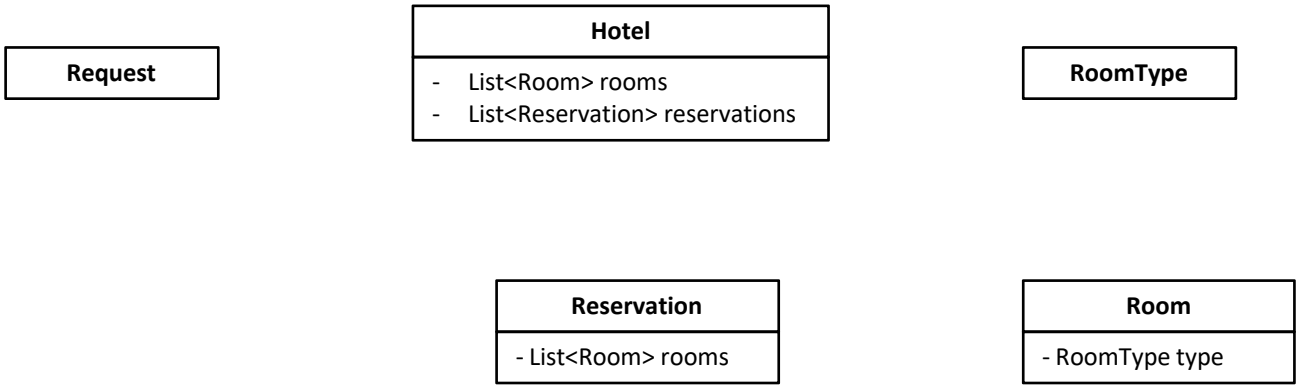

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Use cases

Hotel

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Use cases

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- Search for available rooms

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Use cases

九章算法

Hotel:

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- Search for available rooms
- Make reservation

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Use cases

九章算法

Hotel:

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- Search for available rooms
- Make reservation
- Cancel reservation

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Classes

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Request

Hotel
- List<Room> rooms - List<Reservation> reservations

RoomType

Room
- RoomType type

Reservation
- List<Room> rooms

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Cancel reservation

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Use cases

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Search for available rooms

1: Based on search criteria
2: Go through rooms to check availability
3: list available room types and available count

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Use cases

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Search for available rooms

1: Based on search criteria

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Classes

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Request
- Date startDate

Hotel
- List<Room> rooms - List<Reservation> reservations

RoomType

Room
- RoomType type

Reservation
- List<Room> rooms

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Request
- Date startDate - Date endDate

Hotel
- List<Room> rooms - List<Reservation> reservations

RoomType

Room
- RoomType type

Reservation
- List<Room> rooms

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Request
- Date startDate - Date endDate

Hotel
- List<Room> rooms - List<Reservation> reservations
+ Map<RoomType, int> handleSearchRequest(Request r)

RoomType

Room
- RoomType type

Reservation
- List<Room> rooms

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Search for available rooms

2: Go through rooms to check availability

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Request
- Date startDate - Date endDate

Hotel
- List<Room> rooms - List<Reservation> reservations
+ Map<RoomType, int> handleSearchRequest(Request r)

RoomType

Room
- RoomType type - List<Date> reservations

Reservation
- List<Room> rooms

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Make reservation
Cancel reservation

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Classes

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Request
- Date startDate - Date endDate

Hotel
- List<Room> rooms - List<Reservation> reservations - Map<Room, List<Date>> roomReservations
+ Map<RoomType, int> handleSearchRequest(Request r)

RoomType

Room
- RoomType type

Reservation
- List<Room> rooms

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Cancel reservation

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Request
- Date startDate - Date endDate

Hotel
- List<Room> rooms - List<Reservation> reservations - Map<Room, List<Date>> roomReservations
+ Map<RoomType, int> handleSearchRequest(Request r) - boolean isRequestAvailable(Request r, List<Date> dates)

RoomType

Room
- RoomType type

Reservation
- List<Room> rooms

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Request
- Date startDate - Date endDate

Hotel
- List<Room> rooms - List<Reservation> reservations - Map<Room, List<Date>> roomReservations
+ Map<RoomType, int> handleSearchRequest(Request r) - boolean isRequestAvailable(Request r, List<Date> dates)

RoomType

Room
- RoomType type - Boolean available

Reservation
- List<Room> rooms

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Request
- Date startDate - Date endDate

Hotel
- List<Room> rooms - List<Reservation> reservations - Map<Room, List<Date>> roomReservations
+ Map<RoomType, int> handleSearchRequest(Request r) - boolean isRequestAvailable(Request r, List<Date> dates)

RoomType

Room
- RoomType type - Boolean available
+ boolean isAvailable()

Reservation
- List<Room> rooms

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Search for available rooms

3: list available room types and counts

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Request
- Date startDate - Date endDate

Hotel
- List<Room> rooms - List<Reservation> reservations - Map<Room, List<Date>> roomReservations
+ Map<RoomType, int> handleSearchRequest(Request r) - boolean isRequestAvailable(Request r, List<Date> dates)

RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

Reservation
- List<Room> rooms

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Make reservation
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Request
- Date startDate - Date endDate

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

Reservation
- List<Room> rooms

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Search for available rooms
Make reservation
Cancel reservation

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Use cases

九章算法

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Make reservation

1: Add RoomType and number of rooms in a request 2: Send request to Hotel
3: If there is enough room left, confirm the reservation
4: If there isn’t enough room left, throw exception

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Use cases

九章算法

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Make reservation

1: Add RoomType and number of rooms in a request

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Classes

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Request
- Date startDate - Date endDate

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

Reservation
- List<Room> rooms

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Search for available rooms
Make reservation
Cancel reservation

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Request
- Date startDate - Date endDate

Reservation
- List<Room> rooms

ReservationRequest

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

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Cancel reservation

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Request
- Date startDate - Date endDate

Reservation
- List<Room> rooms

ReservationRequest
- Date startDate - Date endDate

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

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Make reservation
Cancel reservation

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Request
- Date startDate - Date endDate

Reservation
- List<Room> rooms

ReservationRequest
- Date startDate - Date endDate - Map<RoomType, int> roomsNeeded

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

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Make reservation

2: Send request to Hotel

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Request
- Date startDate - Date endDate

Reservation
- List<Room> rooms

ReservationRequest
- Date startDate - Date endDate - Map<RoomType, int> roomsNeeded

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

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Cancel reservation

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Request
- Date startDate - Date endDate

Reservation
- List<Room> rooms

ReservationRequest
- Date startDate - Date endDate - Map<RoomType, int> roomsNeeded

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

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Make reservation

3: If there is enough room left, confirm the reservation

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Request
- Date startDate - Date endDate

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

Reservation
- List<Room> rooms - Date startDate - Date endDate

ReservationRequest
- Date startDate - Date endDate - Map<RoomType, int> roomsNeeded

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Make reservation

4: If there isn’t enough room left, throw exception

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Request
- Date startDate - Date endDate

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

Reservation
- List<Room> rooms - Date startDate - Date endDate

ReservationRequest
- Date startDate - Date endDate - Map<RoomType, int> roomsNeeded

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NotEnoughRoomForReservationException

Use cases
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Make reservation
Cancel reservation

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Challenge

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Search for available rooms

1: Based on search criteria
2: Go through rooms to check availability
3: list available room types and room count

Make reservation

1: Add RoomType and number of rooms in a request
2: Send request to Hotel 3: If there is enough room left, confirm the reservation
4: If there isn't enough room left, throw exception

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Challenge

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```
Map<RoomType, List<Room>> map = new HashMap<>();

for(Entry<Room, List<Date>> entry : roomReservations.entrySet())
{
    Room r = entry.getKey();
    List<Date> roomBooked = entry.getValue();

    if(isRequestAvailable(roomBooked))
    {
        if(map.containsKey(r.getRoomType()))
        {
            List<Room> roomList = map.get(r.getRoomType());
            roomList.add(r);
            map.put(r.getRoomType(), roomList);
        }
        else
        {
            List<Room> roomList = new ArrayList<>();
            roomList.add(r);
            map.put(r.getRoomType(), roomList);
        }
    }
}
```

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Challenge

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- Map<RoomType, List<Room>> map

- Go through rooms to check availability
- If there is enough room left, confirm the reservation
- If there isn't enough room left, throw exception

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Challenge

- LRU Cache

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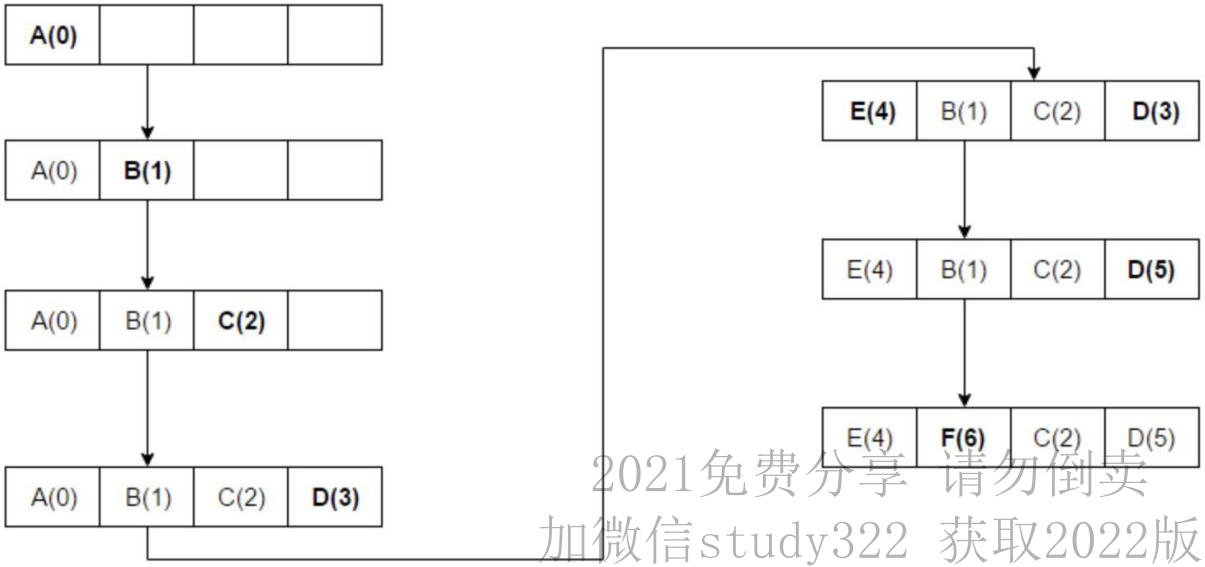
The access sequence for the below example is A B C D E D F.



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Challenge

- LRU Cache

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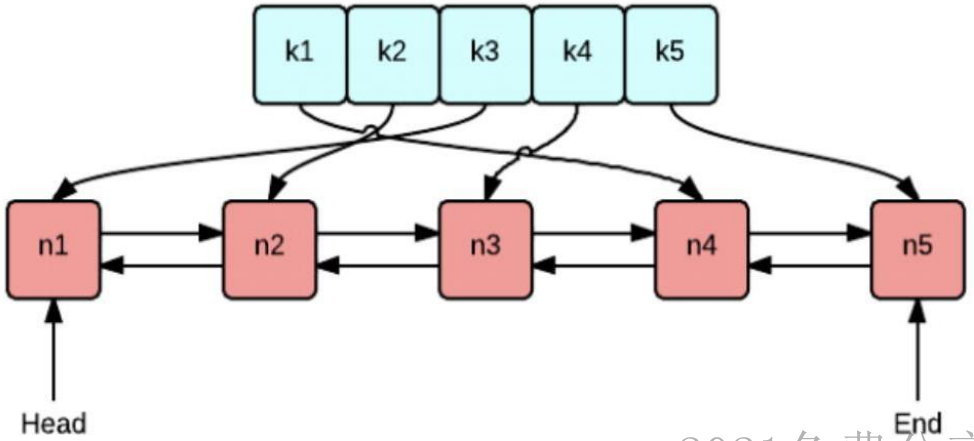

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Challenge

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```
class LRUCache extends LinkedHashMap<Request, Map<RoomType, List<Room>>>
{
    private int capacity;

    public LRUCache(int capacity)
    {
        super(capacity);
        this.capacity = capacity;
    }

   @Override
   protected boolean removeEldestEntry(Map.Entry<Request, Map<RoomType, List<Room>>> eldest){
      return size() > this.capacity;
   }
}
```

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Classes

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Request
- Date startDate - Date endDate

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

Reservation
- List<Room> rooms - Date startDate - Date endDate

ReservationRequest
- Date startDate - Date endDate - Map<RoomType, int> roomsNeeded

NotEnoughRoomForReservationException

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Make reservation
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Use cases

九章算法

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Cancel reservation

1: Hotel system takes a reservation, and cancel it.

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Classes

九章算法

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Request
- Date startDate - Date endDate

Reservation
- List<Room> rooms - Date startDate - Date endDate

ReservationRequest
- Date startDate - Date endDate - Map<RoomType, int> roomsNeeded

NotEnoughRoomForReservationException

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

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Use cases
Search for available rooms
Make reservation
Cancel reservation

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Classes – Final view

九章算法

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Request
- Date startDate - Date endDate

Reservation
- List<Room> rooms - Date startDate - Date endDate

ReservationRequest
- Date startDate - Date endDate - Map<RoomType, int> roomsNeeded

NotEnoughRoomForReservationException

<<Enumeration>> RoomType
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Room
- RoomType type - Boolean available
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Use cases
Search for available rooms
Make reservation
Cancel reservation

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Hotel Reservation in Action

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OOD 面向对象设计

九章算法

```java
// Search for available rooms
// Steps:
//  - Gather search criteria
//  - Go through rooms to get available rooms
//  - Return in:
//      Single Room : 20
//      Double Room : 10
Map<RoomType, Integer> handleSearchRequest(Request request)
{
  Map<RoomType, Integer> searchResult = new HashMap<>();
  for (Room room : rooms)
  {
    List<Date> schedule = roomReservations.get(room);
    if (isRequestAvailable(request, schedule))
    {
      RoomType roomType = room.getType();
      if(searchResult.containsKey(roomType))
      {
        int availableCount = searchResult.get(roomType);
        searchResult.put(roomType, availableCount + 1);
      }
      else
      {
        searchResult.put(roomType, 1);
      }
    }
  }
  return searchResult;
}
```

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OOD 面向对象设计


```java
// Make reservation
// Steps:
//  - Gather reservation criteria
//  - Go through rooms to get available rooms
//  - If there are available rooms, confirm reservation and update rooms
//  - If not, throw exception
Reservation makeReservation(ReservationRequest request) throws NotEnoughRoomException
{
  HashMap<RoomType, Integer> roomsNeeded = request.getRoomsNeeded();
  Reservation reservation = new Reservation(request);
  for (Room room : rooms)
  {
    RoomType type = room.getType();
    int count = roomsNeeded.get(type);
    if(roomsNeeded.containsKey(type) && count > 0)
    {
      List<Date> schedule = roomReservations.get(room);
      if (isRequestAvailable(request, room))
      {
        reservation.addRoom(room);
        count --;
        roomsNeeded.put(type, count);
      }
    }
  }
  for (Map.Entry<RoomType, Integer> entry : roomsNeeded.entrySet())
  {
    if (entry.getValue() > 0)
    {
      throw new NotEnoughRoomException("For type: " + entry.getKey() +
        ", need " + entry.getValue() + " more rooms.");
    }
  }
  return reservation;
}
```

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OOD 面向对象设计

九章算法

```java
// Cancel reservation
// Steps:
//  - Make sure the reservation is valid
//  - Cancel it, and update rooms
void cancelReservation(Reservation reservation) throws InvalidReservationException
{
  if (!validReservation(reservation))
  {
    throw new InvalidReservationException("some reason why it's invalid.");
  }

  for(Room room : reservation.getRooms())
  {
    List<Date> schedule = roomReservations.get(room);
    for(Date date = request.getStartDate(); date < request.getEndDate(); data++)
    {
      schedule.remove(date);
    }
    roomReservations.put(room, schedule);
  }
}
```

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OOD 面向对象设计


```java
// Search for available rooms
// Steps:
//  - Gather search criteria
//  - Go through rooms to get available rooms
//  - Return in:
//      Single Room : 20
//      Double Room : 10
Map<RoomType, Integer> handleSearchRequest(Request request)
{
  Map<RoomType, Set<Room>> cachedResult = cache.get(request);
  Map<RoomType, Integer> result = new HashMap<>();
  for (Map.Entry<RoomType, Set<Room>> entry : cachedResult.entrySet())
  {
    result.put(entry.getKey(), entry.getValue().size());
  }
  return result;
}
```

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OOD 面向对象设计

九章算法

```java
Reservation makeReservation(ReservationRequest request) throws NotEnoughRoomException
{
  Map<RoomType, Integer> roomsNeeded = request.getRoomsNeeded();
  Reservation reservation;

  if(cache.containsKey(request))
  {
    Map<RoomType, Set<Room>> cachedResult = cache.get(request);
    reservation = new Reservation(request);
    for (Map.Entry<RoomType, Integer> entry : roomsNeeded.entrySet())
    {
      RoomType type = entry.getKey();
      Integer count = entry.getValue();
      if (cachedResult.get(type).size() < count)
      {
        throw new NotEnoughRoomException("Not enough rooms");
      }
      else
      {
        while(count > 0)
        {
          Room room = cachedResult.get(type).remove();
          updateSchedule(request, room);
          reservation.addRoom(room);
          count --;
        }
      }
    }
    cache.update(reservation);
  }
  else
  {
    // find result and update cache...
  }
  return reservation;
}
```

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Challenge

面试官：

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Can you extend your design to a booking.com like system?

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Challenge

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

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Challenge

九章算法

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

Search criteria A -> Search() -> List<Result_A> -> Select() -> Search criteria B -> Search() -> List<Result_B> -> Select() -> Receipt

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Challenge

九章算法

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

Search criteria A -> Search() -> List<Result_A> -> Select() -> Search criteria B -> Search() -> List<Result_B> -> Select() -> Receipt

Search criteria A : 10/30 -11/5 Boston

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九章算法

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

Search criteria A -> Search() -> List<Result_A> -> Select() -> Search criteria B -> Search() -> List<Result_B> -> Select() -> Receipt

Search criteria A : 10/30 -11/5 Boston

BookingSystem.Search()

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

Search criteria A -> Search() -> List<Result_A> -> Select() -> Search criteria B -> Search() -> List<Result_B> -> Select() -> Receipt

Search criteria A : 10/30 -11/5 Boston

BookingSystem.Search()

List<Result_A>: Hotel_1, Hotel_2,…

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九章算法

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

Search criteria A -> Search() -> List<Result_A> -> Select() -> Search criteria B -> Search() -> List<Result_B> -> Select() -> Receipt

Search criteria A : 10/30 -11/5 Boston BookingSystem.Search() List<Result_A>:

Hotel_1, Hotel_2,…

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BookingSystem.Select()

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

Search criteria A -> Search() -> List<Result_A> -> Select() -> Search criteria B -> Search() -> List<Result_B> -> Select() -> Receipt

Search criteria A : 10/30 -11/5 Boston

Search criteria B : 10/30 -11/5

BookingSystem.Search()

List<Result_A>: Hotel_1, Hotel_2,…

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BookingSystem.Select()

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

Search criteria A -> Search() -> List<Result_A> -> Select() -> Search criteria B -> Search() -> List<Result_B> -> Select() -> Receipt

Search criteria A : 10/30 -11/5 Boston

BookingSystem.Search()

List<Result_A>: Hotel_1, Hotel_2,…

BookingSystem.Select()

Search criteria B : 10/30 -11/5

Hotel_1.Search()

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

Search criteria A -> Search() -> List<Result_A> -> Select() -> Search criteria B -> Search() -> List<Result_B> -> Select() -> Receipt

Search criteria A : 10/30 -11/5 Boston

BookingSystem.Search()

List<Result_A>: Hotel_1, Hotel_2,…

BookingSystem.Select()

Search criteria B : 10/30 -11/5

Hotel_1.Search()

List<Result_A>: RoomType_1, …

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Challenge

九章算法

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Search criteria -> Search() -> List<Result> -> Select() -> Receipt

Search criteria A -> Search() -> List<Result_A> -> Select() -> Search criteria B -> Search() -> List<Result_B> -> Select() -> Receipt

Search criteria A : 10/30 -11/5 Boston

BookingSystem.Search()

List<Result_A>: Hotel_1, Hotel_2,…

BookingSystem.Select()

Search criteria B : 10/30 -11/5

Hotel_1.Search()

List<Result_A>: RoomType_1, …

BookingSystem.Select()

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Clarify

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Clarify

What

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Search criteria A

List<Result_A>

Search criteria B

List<Result_B>

Receipt

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What

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Search criteria A

List<Result_A>

Search criteria B

List<Result_B>

Receipt

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What

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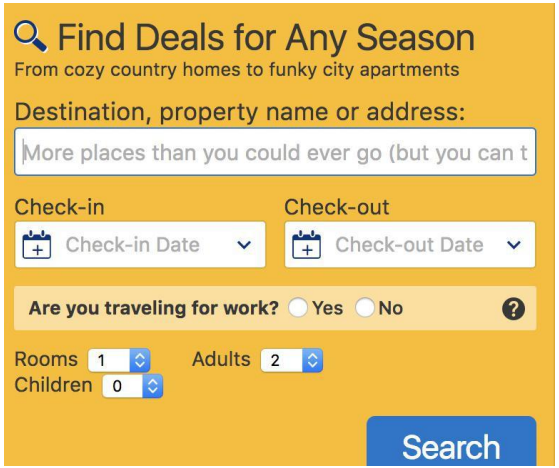

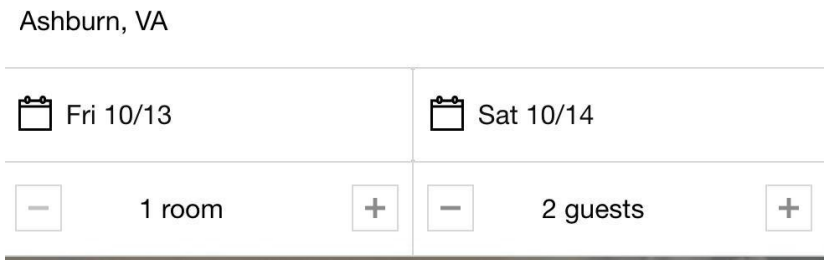

What are the search criteria for booking system ?

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针对本题：

用Start Date, End Date, Group size, City

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How

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Search()

Select()

Search()

Select()

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How

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Search()

Select()

Search()

Select()

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九章算法

How

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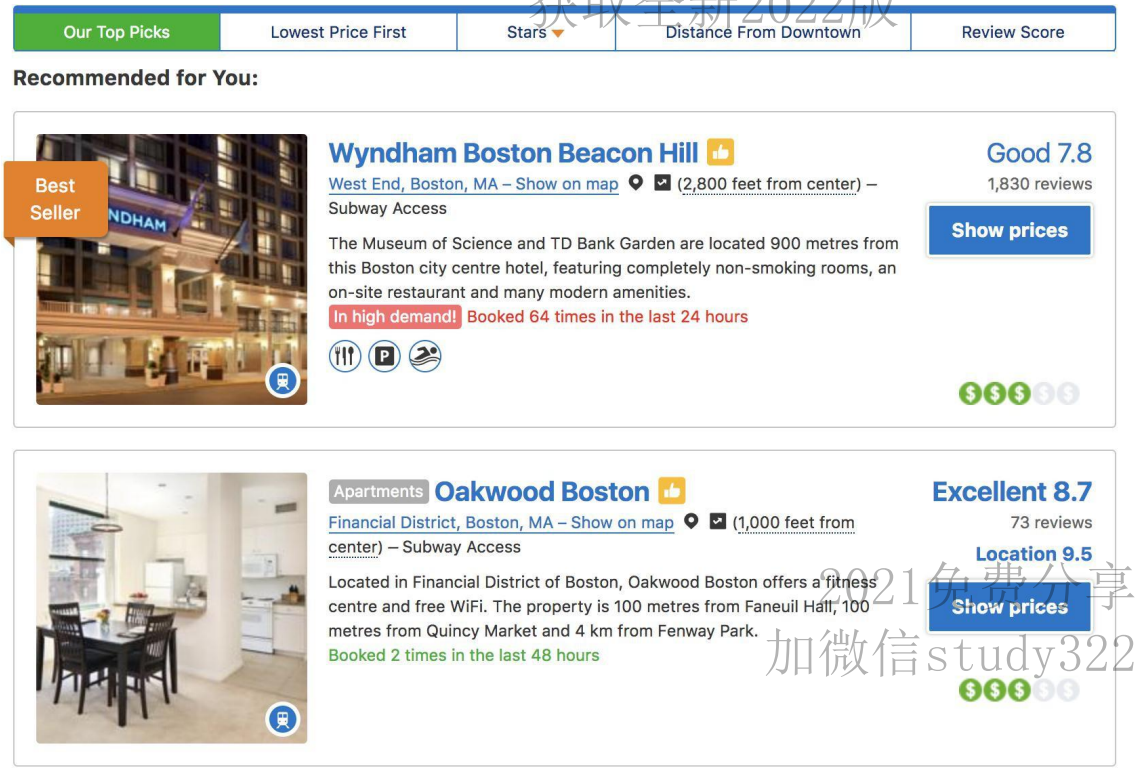

- 哪些Hotel可以被放进List里？
- 按照什么顺序排序？

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九章算法

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针对本题：

- 在同样的City就能放进List里
- Hotel在List里的顺序不重要

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九章算法

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针对本题：

- 在同样的City就能放进List里
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Core object

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Request
- Date startDate - Date endDate

Reservation
- List<Room> rooms - Date startDate - Date endDate

ReservationRequest
- Date startDate - Date endDate - Map<RoomType, int> roomsNeeded

NotEnoughRoomForReservationException

<<Enumeration>> RoomType
SINGLE DOUBLE

Room
- RoomType type - Boolean available
+ boolean isAvailable()

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Use cases
Search for available rooms
Make reservation
Cancel reservation

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Core object

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Request
- Date startDate
- Date endDate

<<Enumeration>>
RoomType
SINGLE DOUBLE

Room
- RoomType type
- Boolean available

+ boolean isAvailable()

Reservation
- List<Room> rooms
- Date startDate
- Date endDate

BookingSystem

ReservationRequest
- Date startDate
- Date endDate
- Map<RoomType, int> roomsNeeded

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NotEnoughRoomForReservationException

Use cases
- Search for available rooms
- Make reservation
- Cancel reservation

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Core object

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Request
- Date startDate
- Date endDate

<<Enumeration>>
RoomType
SINGLE DOUBLE

Room
- RoomType type
- Boolean available

+ boolean isAvailable()

Reservation
- List<Room> rooms
- Date startDate
- Date endDate

BookingSystem

ReservationRequest
- Date startDate
- Date endDate
- Map<RoomType, int> roomsNeeded

SearchHotelRequest

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NotEnoughRoomForReservationException

Use cases
- Search for available rooms
- Make reservation
- Cancel reservation

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Core object

九章算法

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Request
- Date startDate
- Date endDate

<<Enumeration>>
RoomType

SINGLE DOUBLE

Room
- RoomType type
- Boolean available

+ boolean isAvailable()

Reservation
- List<Room> rooms
- Date startDate
- Date endDate

BookingSystem

- List<Hotel> hotels

ReservationRequest
- Date startDate
- Date endDate
- Map<RoomType, int> roomsNeeded

SearchHotelRequest

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NotEnoughRoomForReservationException

Use cases

Search for available rooms

Make reservation

Cancel reservation

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Use cases

- BookingSystem

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Use cases

- BookingSystem

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- Search for hotels

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Use cases

九章算法

- BookingSystem

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- Search for hotels
- Make reservation

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Use cases

- BookingSystem

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- Search for hotels
- Make reservation
- Cancel reservation

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- Date endDate
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SearchHotelRequest

NotEnoughRoomForReservationException

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Use cases

Search for available rooms

Make reservation

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Classes

- Search for hotels

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- Based on request (start date + end date + city + group size)
- Check for all hotels in this city
- For such hotels, if this is enough capacity for group size during dates
- List all hotels that satisfy above criteria

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Classes

- Search for hotels

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- Based on request (start date + end date + city + group size)

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Reservation
- List<Room> rooms
- Date startDate
- Date endDate

BookingSystem

- List<Hotel> hotels

ReservationRequest
- Date startDate
- Date endDate
- Map<RoomType, int> roomsNeeded

SearchHotelRequest
- Date startDate
- Date endDate
- String city
- Int groupSize

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NotEnoughRoomForReservationException

Use cases

Search for available rooms

Make reservation

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Classes

- Search for hotels

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- Based on request (start date + end date + city + group size)
- Check for all hotels in this city

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<<Enumeration>>
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Reservation
- List<Room> rooms
- Date startDate
- Date endDate

BookingSystem

- List<Hotel> hotels

ReservationRequest
- Date startDate
- Date endDate
- Map<RoomType, int> roomsNeeded

SearchHotelRequest
- Date startDate
- Date endDate
- String city
- Int groupSize

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NotEnoughRoomForReservationException

Use cases

Search for available rooms

Make reservation

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Class

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Request
- Date startDate
- Date endDate

<<Enumeration>>
RoomType

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Room
- RoomType type
- Boolean available

+ boolean isAvailable()

Reservation
- List<Room> rooms
- Date startDate
- Date endDate

BookingSystem

- List<Hotel> hotels

ReservationRequest
- Date startDate
- Date endDate
- Map<RoomType, int> roomsNeeded

SearchHotelRequest
- Date startDate
- Date endDate
- String city
- Int groupSize

NotEnoughRoomForReservationException

Use cases

Search for available rooms

Make reservation

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Classes

九章算法

- Search for hotels

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- Based on request (start date + end date + city + group size)
- Check for all hotels in this city
- For such hotels, if this is enough capacity for group size during dates

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Class

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Request
- Date startDate
- Date endDate

Reservation
- List<Room> rooms
- Date startDate
- Date endDate

<<Enumeration>> RoomType

SINGLE DOUBLE

- Int capacity

Room
- RoomType type
- Boolean available

+ boolean isAvailable()

BookingSystem

- List<Hotel> hotels

ReservationRequest
- Date startDate
- Date endDate
- Map<RoomType, int> roomsNeeded

SearchHotelRequest
- Date startDate
- Date endDate
- String city
- Int groupSize

NotEnoughRoomForReservationException

Use cases

Search for available rooms

Make reservation

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Class

九章算法

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Request
- Date startDate
- Date endDate

Reservation
- List<Room> rooms
- Date startDate
- Date endDate

ReservationRequest
- Date startDate
- Date endDate
- Map<RoomType, int> roomsNeeded

NotEnoughRoomForReservationException

SearchHotelRequest
- Date startDate
- Date endDate
- String city
- Int groupSize

<<Enumeration>>
RoomType

SINGLE DOUBLE

- Int capacity

Room
- RoomType type
- Boolean available

+ boolean isAvailable()

BookingSystem

- List<Hotel> hotels

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Use cases

Search for available rooms

Make reservation

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Classes

- Search for hotels

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- Based on request (start date + end date + city + group size)
- Check for all hotels in this city
- For such hotels, if this is enough capacity for group size during dates
- List all hotels that satisfy above criteria

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Class

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- Date startDate
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BookingSystem

- List<Hotel> hotels

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SearchHotelRequest
- Date startDate
- Date endDate
- String city
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Use cases

Search for available rooms

Make reservation

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Use case

- Make reservation

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- Pick a hotel
- Send reservation request to that hotel

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Class

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SearchHotelRequest
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Use cases

Search for available rooms

Make reservation

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Classes

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- Cancel reservation

- Cancel reservation for a hotel

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Class

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Request
- Date startDate
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Reservation
- Hotel hotel
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- Date endDate

BookingSystem

- List<Hotel> hotels

+ List<Hotel> searchHotel(SearchHotelRequest r)
+ Reservation makeReservation(Hotel h, ReservationRequest r)
+ void cancelReservation(Reservation r)

ReservationRequest
- Date startDate
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Use cases

Search for available rooms

Make reservation

NotEnoughRoomForReservationException

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Class – Final view

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Use cases

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Challenge

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- Can you add payment in your system?

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Challenge

九章算法

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- Can you add payment in your system?

- Need to get price for each reservation
- Need to take a payment method

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Challenge

九章算法

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- Can you add payment in your system?

- Need to get price for each reservation

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Enum code sample

九章算法

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```
public enum RoomType
{
    SINGLE(1, 129),
    DOUBLE(2, 199);

    private int capacity;
    private float price;

    RoomType(int capacity, float price)
    {
        this.capacity = capacity;
        this.price = price;
    }

    public int getCapacity()
    {
        return capacity;
    }

    public float getPrice()
    {
        return price;
    }
}
```

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- List<Hotel> hotels

+ List<Hotel> searchHotel(SearchHotelRequest r)
+ Reservation makeReservation(Hotel h, ReservationRequest r)
+ void cancelReservation(Reservation r)
+ void payByPaypal (Reservation r)

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Use cases

Search for available rooms

Make reservation

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+ void cancelReservation(Reservation r)
+ void payByPaypal (Reservation r)
+ void payByCreditCard (Reservation r)

Use cases

Search for available rooms

Make reservation

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Good practice:

- Strategy Pattern

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Use cases

Search for available rooms

Make reservation

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<<interface>> PaymentStrategy

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+ Reservation makeReservation(Hotel h, ReservationRequest r)
+ void cancelReservation(Reservation r)

<<interface>> PaymentStrategy

+ void pay(Reservation r)

Use cases

Search for available rooms

Make reservation

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BookingSystem
- List<Hotel> hotels
- PaymentStrategy strategy

+ List<Hotel> searchHotel(SearchHotelRequest r)
+ Reservation makeReservation(Hotel h, ReservationRequest r)
+ void cancelReservation(Reservation r)

<<interface>> PaymentStrategy

+ void pay(Reservation r)

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- List<Hotel> hotels
- PaymentStrategy strategy

+ List<Hotel> searchHotel(SearchHotelRequest r)
+ Reservation makeReservation(Hotel h, ReservationRequest r)
+ void cancelReservation(Reservation r)
+ void setStrategy(Payment strategy)

ReservationRequest
- Date startDate
- Date endDate
- Map<RoomType, int> roomsNeeded

SearchHotelRequest
- Date startDate
- Date endDate
- String city
- Int groupSize

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<<interface>>
PaymentStrategy

+ void pay(Reservation r)

Use cases

Search for available rooms

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- List<Hotel> hotels
- PaymentStrategy strategy

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+ Reservation makeReservation(Hotel h, ReservationRequest r)
+ void cancelReservation(Reservation r)
+ void setStrategy(Payment strategy)
+ void makePayment(Reservation r)

ReservationRequest
- Date startDate
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SearchHotelRequest
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PaymentStrategy

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