Restaurant Reservation System (RRS)

CS2340: Objects & Design
Course Project: Summer 2024 Semester

Version History

Version	Date	Notes
0	May 23, 2024	Initial release

Problem Motivation

The following is a text description of the system you are being tasked to develop. The system requirements – explicit and implicit – are included this document, and they need to be identified and reflected in your system (i.e., source code), and in the associated design documents as required by the assignment instructions.

There are many great restaurants in our Atlanta area, but nothing takes the joy out of eating out more than an overly long wait before dining. There are several websites that assist customers in making reservations – for example, OpenTable is a well-known website that has characteristics like the system you'll be tasked to develop. It is a good idea to look at their website, especially if you don't have any experience with these kinds of systems:

https://www.opentable.com/
Your goal is to develop a system that can be used to track customers making reservations and dining at different restaurants, where those restaurants serve different menu items that use different ingredients. This is the simplest "single sentence" expression of the problem, and the description in the Problem Requirements Section below will include more of the important details that must be factored into your design.

Problem Description

The primary intent for your system is to track customers making and (eventually) completing reservations at different restaurants. This is usually a "win-win" for both parties: the customers will enjoy a wonderful meal and dining experience, and the owners of the restaurant gain the money and customer support that they need to stay in business, and hopefully flourish. **In these first few paragraphs, we will discuss the key motivations and the "reservation process" in general. In the following paragraphs, we will provide more details for the most important concepts in this problem domain.**

The goal of the reservation system is to help facilitate customers finding and securing reservations at the restaurants of their choice. **The ideal flow of the reservation process might be viewed in this way:**

- A customer searches for a restaurant that interests them.
- The customer identifies a restaurant of interest, and then searches for available dates and times for dining with a party of a certain size.
- The restaurant might offer credits to the customers for dining at their location, where the number of credits might vary based on the specific dates, times, and other circumstances.
- The customer selects and proposes a reservation at a specific date and time.
- The restaurant confirms the reservation and allocates the resources in advance to ensure that the reservation can be met successfully when the customer's party arrives.
- A customer's party arrives with the intent to dine at a specific restaurant.

- The restaurant greets customers and their parties when they arrive at their location.

- The restaurant must confirm and seat a customer's party if that customer has a proper reservation.
- The restaurant must check their planned reservations if the customer does not have a reservation (i.e., a "walk-in" party); and, if the seats are available, then the restaurant must also seat the walk-in party.
- The customer's party orders certain items from the available menu selections and then pays the bill(s).
- The restaurant provides the previously offered credits to the customer if – and only if – they arrived within an acceptable window (e.g., 30 minutes before or 15 minutes after) of the established reservation.

This is the "idealized" reservation process that you must use when developing your Restaurant Reservation System. There are some subtleties here: for example, credits are awarded to help motivate customers to return, which also helps restaurants ensure a steadier flow of income.

The single-most important resource in our scenario is people. The people in our system can be divided into two clear but related groups: the customers who dine at the restaurants, and the owners who manage those restaurants. There are other groups of important people – for example, chefs, hosts, wait staff, etc. – but won't require any details about these groups. All people – customers and owners – must have distinct identifiers. People must also have first and last names. First names will be required, but some people are so famous (e.g., Beyonce, Zendaya, Sade, Madonna) that they might only have a first name, and so last names will be considered as optional. People also have addresses. For privacy purposes, we will only ask people to provide their city, state, and zip code, and not their full street name and number.

Owners are people who manage, provide resources for, direct, etc. one or more restaurants. Modern owners can fulfill many different roles within a restaurant. For our case, we will consider them as the primary (and sole) person who takes responsibility for the success of the restaurant. An owner can take charge of many different restaurants. The date that an owner begins to manage their first restaurant is an important measurement of their experience in the field. Also, the owner might belong to a restaurant group, where that group works together to unify their efforts to attract and retain customers. For example, in Atlanta there is a group named Fifth Group that includes restaurants like South City Kitchen, Lure, Ecco and Alma de Cocina.

As part of the ownership process, various levels of government require restaurants to acquire different licenses to certify that they are prepared to provide their services in a safe manner. There are many different types of licenses that might need to be earned, including – but not limited to – business licenses, certificates of occupancy, food service licenses, building & employee health permits, liquor licenses, music licenses, and even dumpster placement permits. Licenses are issued by the appropriate authorities, and tied directly to the specific restaurant for which they were granted. We will simplify this process for our system and require you to maintain a "unified license" identifier. A unified license is a long string consisting of pairs of initials representing the type of license followed by the unique numerical identifier for that restaurant. Each license is associated with a specific restaurant and cannot be transferred to another restaurant once granted. Each license is also acquired and assigned to a specific owner. Owners might be associated with multiple unified licenses, but each restaurant will only be associated with one specific unified license.

Restaurants are the "factories of delicious tastes and smells" that seek to attract customers. Restaurants must have unique identifiers along with memorable and catchy names. We also keep track of a restaurant's address – at least the city, state, and zip code – so that we can determine if the restaurant is in a customer's area when the customer is searching for places to dine. At the end of the dining experience, the customer is offered the opportunity to provide a personal review consisting of a numeric score between one (i.e., 1 = worst possible experience) and fifty (i.e., 50 = best possible experience), and feedback as a text-based set of comments providing an explanation for their score, along with other details for a restaurant. Hence, each restaurant has a

rating value that is an integer between one and fifty, inclusive. Customers also use short phases called "tags" to describe the properties of the restaurant that might be attractive to other customers. Customers tend to award higher ratings to restaurants that they have enjoyed. And each restaurant is managed by exactly one owner – no more, no less. Finally, each restaurant has a maximum number of people (i.e., capacity) that it can support at any one time. Your system must track all valid dining requests.

Most importantly, each restaurant serves at least one menu item, and most serve a collection of one or more items for the customer's enjoyment. Each menu item represents an entrée, soup, salad, side item, dessert, etc. that is offered by the restaurant for a certain (current) price. It's important that we also track the names of the ingredients that are used in each menu item for owner and customer awareness. We will represent the cost of a menu item as an integer. Most currencies allow for the price or cost of an item to be measured with dollars and (fractional) cents, but we will limit our prices to simpler integer values to ensure more consistent testing results.

Customers will search for restaurants that interest them, and then attempt to make reservations for a future date and time. When a customer makes a reservation, they effectively "promise" the restaurant that they will dine there at a certain date and time, and with a party of a certain size (i.e., the total number of people including the customer). In return, the restaurant "promises" the customer that they will receive a certain (integer) number of credits if – and only if – the complete the reservation successfully.

Customers can make multiple reservations with the same restaurants and/or different restaurants, with one key restriction: a customer cannot make two reservations within less than two (2) hours of each other. The reasoning is that a normal reservation will take a minimum of two hours from the time the customer's party arrives, until the time that the meal has finished, and the bill has been paid. Therefore, a customer isn't allowed to "overbook" the reservation system by making two separate reservations within a two-hour window. A customer is allowed to make another reservation at exactly two hours or more before or after any of their other existing reservations. Your system must track all the valid reservation requests.

Once a valid reservation has been made, then it is expected that the customer's party will arrive at the restaurant on that date and time ready to enjoy their dining experience. Because the restaurant has to reserve to appropriate resources to make their dining experience as pleasant as possible, the customer's part needs to arrive on time: more specifically, the customer's party must arrive no more than 30 minutes before – and no more than 15 minutes after – their designated reservation date and time for it to be considered a "successfully completed" reservation, and for the customer who made the reservation to receive the promised credits.

There are few general results based on the timing of when they arrive and a possibly existing reservation:

[A]   *A proper reservation exists in the system, and the arrival time of the customer's party is within the acceptable arrival window*: in this case, this counts as a "successfully completed" reservation, and your system must award the customer the credits that were promised when the reservation was made.

[B]   *A proper reservation exists in the system, but the customer's party does not arrive within the acceptable arrival window*: in this case, this counts as a "failed/missed" reservation, and your system must consider this as a "missed reservation" for that customer instead of awarding the customer credits. Missed reservations are impactful since having too many of them could cause a customer to forfeit all the credits that they have otherwise earned. Also, the status of the restaurant must be rechecked to ensure that there is enough capacity to support the changed dining request.

[C]   *There's no reservation in the system, but the customer's party arrives at a specific date and time anyway*: in this case, we consider the customer's party as being in a "walk-in" status. First, your system must check the status of the existing reservations and other parties currently dining there to ensure that there is available space

to accommodate the request. If there is not enough capacity at the restaurant to support the request, then the customer's party is simply and politely turned away (i.e., request denied), but the customer is not penalized with a "missed reservation." If there is enough capacity to support the request, then it is handled like a "successfully completed" reservation, except that the customer won't receive any credits.

Note that in case [A], the customer's party should definitely be allowed to dine at the restaurant, especially if your system has handled the reservations appropriately. For cases [B] and [C], however, your system must (re-) check the status of the restaurant's capacity and upcoming reservations to determine if the dining request can be supported.

During the dining experience, the customer's party may request different quantities of items from the menu. The items will be offered at the current price for that item at that restaurant, and the sum of those costs will form the bill for that customer for that visit. Your system must represent each customer's current funds (amount of money) that can be used to pay bills, along with the number of the customer's previously missed reservations. A customer's party must not be allowed to order menu items if the customer doesn't have the funds to cover the price.

Users will very likely also request the following kinds of informational queries and capabilities:

- In a similar manner, your system must track each of the valid reservation requests for each customer, where each request includes the credits that will be awarded. With this information, and along with the dining history information that can help determine if a reservation was successfully completed, your system should be able to calculate the total credit earned by that customer.
- When the customers pay their bills at restaurants, the money from these bills become revenue for the restaurant. The owners of the restaurants will want to know how well their restaurants are doing from a financial perspective, so your system should also be able to calculate the total revenue for each restaurant.
- Owners would also like to know how their restaurants are doing from the viewpoint of the customer's experiences. Each restaurant has a current rating, and your system should be able to determine if a specific restaurant is in the "Top Ten" for all restaurants based on its rating and/or revenue.
- Customers seeking new dining experiences will often attempt to make reservations for restaurants that are very busy, especially if they are one of the "Top Ten" restaurants. When searching for a reservation opening, it can be helpful to have an idea of when the restaurant tends to be "less full" (i.e., density) based on the current reservations during a certain timeframe, and the restaurant's capacity. Your system should be able to display this "reservation density" for each restaurant at a given date and time.
- Customers also consider the dishes they prefer when seeking new dining experiences. Knowing that a restaurant serves a well-liked menu item can influence customer reservation decisions, so owners would like to know which menu items are the most popular. Popularity can be calculated in a variety of ways: for example, as the number of restaurants that offer that item, possibly weighted by the cost of the item with the reasoning that the ability to charge a higher price indicates a higher customer demand and willingness to pay. In any event, your system should be able to compute the popularity for a given menu item based on a standard definition.
- Owners will also likely want to know what prices are for different menu items, especially if those items are very popular. Knowing the average (current) costs of an item across the other restaurants will help owners offer competitive prices, and so your system should be able to calculate the average current price for each menu item.