CS 142: Program design and methodology
Spring Term, 2026

More design problems

Describe how you could solve each of the following problems using data structures we've learned so far. Specify the ADTs (List, Stack, Queue, Iterator, Set, Map, Priority Queue) you would use and how to use them to efficiently support the required operations.

1. Imagine you are a doctor who advises people with prediabetes. The most important part of controlling the disease is analyzing the dependency of the food a patient eats to their blood sugar. To prevent diabetes, a patient should figure out how each food affects their blood sugar. To help them do it, you decided to create the application that stores the name of the food that was eaten by the patient and what was their blood sugar after the consumption. Then, the next time a patient wants to eat this food, they can check how it affects their blood sugar before they eat it. You give them the application and tell them to store the name of the food and values of their sugar levels every time they try to eat something new. What ADT(s) would you use to implement this app?

2. Happy Vet is the busiest vet clinic in town. Everyday they have a lineup of regular health check-ups, however sometimes there are cases that require immediate action. Each vet at Happy Vet has their own tablet that lets them know who their next client is. The tablet has the name of the client, the type of visit needed, emergency or regular, and a description of the help needed. As long as there are no emergencies the vet will see that their next client is a regular health checkup. When there is an emergency they will have to take care of that case first before returning to the regular check-ups. If there is more than one emergency at a time each veterinarian will take the next case that is marked as an emergency before returning to the regular health checkups. If they fall behind on the emergencies then each vet will continue to take the oldest emergency available. If they fall behind on regular checkups they will finish the emergencies and then start in on the oldest regular checkup available. What ADTs would you use to implement this sytem?

3. I need a program that allows me to feed my rats fairly every time it's treat time. The same rat should not be first everytime, so they each need a turn to get fed first. (Basically, if a rat is fed first this time, it moves to the last place on the next feeding and all the other rats move one position earlier.) The exception is that rats who are sick or injured should have priority and should be fed first. The program should read in the rats in alphabetical order by name along with their position in the feeding order last time and whether they are sick or injured. Then it should output the order in which the rats should be fed this time. How would you implement this?

4. You work for a minor league sports team. The team is getting a new mascot. The organization decides to hold a contest where fans submit suggestions for the name of the new mascot. Anyone who chooses to participate must say the name they think the new mascot should have with a brief reasoning for why they think it's a good name. Suggestions would then be sent to a group of panelists who would select their favorite. The contest was much more popular than the team imagined, and they are getting lots of duplicate names. Even if two entries suggest the same name, the panelists would still like to read the multiple arguments different people make for the name. You are in charge of making a program that allows the panelists to look at each name one at a time, together with all the arguments submitted with that name. What ADT(s) would you use to implement this program?

5. You are a director of an American Legion Baseball Tournament and have to set up the end of year baseball tournament for all the teams in your state. Part of this is to maintain statistics for each player such as their number of homeruns, hits, and strikeouts. For pitchers, the system also needs to record wins, losses, innings pitched, and ERA. All of these stats would be tied to a player's name (we assume unique names), with updates happening as the game is played. For example, when a player makes a hit, your system must be able to update this stat.

6. A streamer is currently streaming Mega Man 8-bit Deathmatch online matches and is finding it difficult to choose a character to play as. To solve this issue, the streamer decides to create a program that allows all of his or hers viewers, regardless of their subscription status, to submit character requests. The program will order these character requests and print them to the streamer in the order to play them. The order will mostly be oldest to the newest except that character requests submitted by viewers who are subscribed to the streamer have priority over those submitted by viewers without a subscription. In other words, the list will include character requests submitted by subscribers, in the order of the oldest to the newest, are presented to the streamer, and then character requests from regular viewers, in the order of the oldest to the newest.