CS132: Software Engineering
HW3: Model checking

In previous lectures, we introduced model checking as a technique to verify whether a system satisfies our requirements. And we introduced a timed-automata-based model checking tool called UPPAAL. In this homework, we will practice how to use UPPAAL to check whether a system satisfies our requirements.

Ensuring customer satisfaction in a restaurant

As a manager in a restaurant, the last thing you want to see is unhappy customers due to late service of food and even leave the restaurant without eating. You would like to set up maximum response time for servers and chefs to maintain customer happiness and you want to use UPPAAL to check whether the new protocol works.

Note: The unit of time periods specified in your UPPAAL model is <u>minutes</u>.

The customer model

You want to develop a customer model to cover behaviors of various customers, not just one customer. A customer calls the server within 5min after he/she got seated. The customer waits for server to order for him/her and will get angry when the server does not respond in time. Different customers have different patience. The minimum waiting time before he/she gets angry is 2min and the maximum time is 6min. After getting angry, the customer may leave if the server fails to show up. The minimum time for the customer to leave after getting angry is 1min and the maximum time is 5min. After the server order for the customer, the chef need time to prepare for food. The customer may also get angry if food is not served in time. The minimum waiting time before the customer gets angry is 11min and the maximum time is 14min. After getting angry, the customer may leave if food is still not served. The minimum time for the customer to leave after getting angry is 1min and the maximum time is 5min. After food is served, the customer will eat the food.

Note: You don't need to consider recurring customers. Meaning you only need to model customer behavior for **<u>one</u>** visit to the restaurant.

The server model

A server is ready to be called. The minimum time to respond to customer's call is 1min. The maximum time is something that we want to know.

The chef model

A chef waits for server's order and serves food when the food is ready. The minimum time for preparing food is 5min. The maximum time is something that we want to know.

Model Checking

You should set the maximum response time for both the server and the chef, such that the following properties hold:

1. The customer should never leave without eating

2. The customer always eventually eats
3. The customer should never be angry

To make the problem easier, we assume the following events which will be communication channels among the customer, the server and the chef:

- Customer sends CallWaiter event to server, and receives Order and Serve events from the server and the chef, respectively.
- Server sends Order event to both customer and chef, and receives CallWaiter event from customer.
- Chef sends Serve event to customer, and receives Order event from server.

Submission

Model the system including the customer, the server and the chef and fill in the maximum response time for the server and the chef. Specify the properties in UPPAAL and check whether your maximum response time satisfy those properties. The deadline of this homework is Apr. 30th at 23:59. Please submit a .zip file on Blackboard which contains:

- “CS132_HW3_YourName.xml”: The UPPAAL system file
- “CS132_HW3_YourName.q”: