CSCI 4511/6511 - Exam Prep - Propositional Logic

Instructions:
This is ungraded exam prep to be completed as an in-class exercise.

1 Propositional Logic

Medium Rare

Suppose a diner serves hamburgers to its customers. Concerning this, you know these things to be true:

- There exist two customers (A and B), three hamburgers (X, Y, and Z), and one chef (Otis).
- Any hamburger can be cooked to the following temperatures:
  1. Rare
  2. Medium
  3. Well Done
- The above temperatures are *in order,* such that a raw burger can be cooked more to achieve rare, medium, or well; a medium burger can be cooked more to achieve well, etc.
- A hamburger cannot be "uncooked" - a rare burger cannot be made raw, etc.
- The chef can cook hamburgers
- The chef can give hamburgers to customers
- Customers can give hamburgers to the chef
- Customers never give each other hamburgers
- Cooking a hamburger or giving someone a hamburger takes time
  - For this problem, discretize time to arbitrary values, $t = 0$, $t = 1$, etc.
  - One time "step" is required for *each* of these changes
    - If a customer were to give a hamburger to a chef to be cooked more, it would take one time step for the customer to be given to the chef, one more time step for the hamburger to be cooked, and one more time step for the hamburger to be given back to the customer

1.1 What Is Time?

Create propositional variables representing:

- Each hamburger's temperature at time 0, 1 and 2
- Who (Otis, customer A, customer B) has each hamburger at times 0, 1 and 2

1.2 What Is Knowledge?

1.2.1

Create a logical sentence that describes what temperature hamburger X can be at time 1 if it is rare at time 0

1.2.2

Create a logical sentence that describes who can have hamburger X at time 1 customer B has the hamburger at time 0.

1.2.3

Create a logical sentence that describes how a hamburger cannot be cooked by a customer

1.3 Everything

Encode the following in a knowledge base (create logical sentences that, when conjoined, form the KB):

- Who can have a hamburger at time $t + 1$ given who has the hamburger at time t
- What temperature a hamburger can be at time $t+1$ given what temperature the hamburger is at time t
- Who can cook a hamburger and who cannot cook a hamburger

1.4 Query

1.4.1

Write a logical sentence that describes customer A having a medium hamburger at time 0 and having a rare hamburger at time 1

1.4.2

Does the knowledge base entail this query?

1.4.3

Does the knowledge base entail the inverse of this query?

1.4.4

Is this logical sentence *possible?* Defend your answer with propositional logic.

Intentionally blank.

This is the back of the exam prep.