CSE 643 Sec A

Homework Assignment 1:

Container Loading Problem using AI Search

Problem Description
You are tasked with modeling and solving a container loading problem for a ship departing from a port. Containers are stored in a yard and need to be loaded onto the ship under the following constraints:

1. Destination constraint: Containers must be arranged so that those to be unloaded at earlier destinations are, *as far as possible*, not blocked by containers destined for later ports. (Include your assumptions on how this is modelled, e.g, destination order as integers.)
2. Balance constraint: The ship must not become too imbalanced; heavy loads must not accumulate excessively on one side. (Include your assumptions on how this will be handled.)

The goal is to find a loading plan that respects these constraints and optimizes an objective function that minimizes yard-to-ship loading time and unloading time at each destination while maintaining acceptable levels of imbalance on the ship.

Tasks
1. Model the Problem
- Define the formal problem representation (states, actions, constraints).
- Specify how an instance of the problem is described (input format: containers, weights, destinations, yard configuration, ship layout).
- Clearly articulate the objective function you propose to optimize and (vs) constraints on feasible solutions.

2. Design and Implement a Solution
- Choose a search algorithm (e.g., A*, heuristic search, simulated annealing, etc.).
- Be creative: use algorithms beyond those covered in class, but e.g. in the prescribed book(s).
- Code an environment for the container problem as well as the algorithms chosen.
- Demonstrate the algorithm on at least one non-trivial example instance.
- Analyse the problem and solution approach by testing on increasingly larger random instances.

3. Presentation & Video Explanation
- Prepare a presentation deck (5–8 slides) summarizing:
- Problem formulation
- Input representation
- Objective function
- Assumptions being made (IMPORTANT)
- Algorithm choice, data structures used, and justification.
-Results and analysis: e.g. how does the actual running time grow with size, impact of heuristics, quality of solutions obtained etc.?

Submission
- Upload your CODE and PDF deck on ICAPP, and present it to the AI grader, answering questions as you present.
Be sure to give breaks so that questions are asked and answered.

IMPORTANT:
(Be sure to **RECORD a video** (5–7 minutes) of the submission. The **platform does NOT** do this *yet*, **you** need to record your screen and using a tool of your choice, upload it to a shared location and save the link on the platform via the 'save video link' button that will show up once you have ended your presentation by pressing the *end* button.)