Exam Prep 1B

Q1. Search

For this problem, assume that all of our search algorithms use tree search, unless specified otherwise.

(a) For each algorithm below, indicate whether the path returned after the modification to the search tree is guaranteed to be identical to the unmodified algorithm. Assume all edge weights are non-negative before modifications.

(i) Adding additional cost $c > 0$ to every edge weight.

	Yes	No
BFS	○	○
DFS	○	○
UCS	○	○

(ii) Multiplying a constant $w > 0$ to every edge weight.

	Yes	No
BFS	○	○
DFS	○	○
UCS	○	○

(b) **For part (b)**, two search algorithms are defined to be **equivalent** if and only if they expand the same states in the same order and return the same path. **Assume all graphs are directed and acyclic.**

(i) Assume we have access to costs c_{ij} that make running UCS algorithm with these costs c_{ij} equivalent to running BFS. How can we construct new costs c'_{ij} such that running UCS with these costs is equivalent to running DFS?

○ $c'_{ij} = 0$　　○ $c'_{ij} = 1$　　○ $c'_{ij} = c_{ij}$

○ $c'_{ij} = -c_{ij}$　　○ $c'_{ij} = c_{ij} + \alpha$　　○ Not possible

Q2. State Representations and State Spaces

For each part, state the size of a minimal state space for the problem. Give your answer as an expression that references problem variables. Below each term, state what information it encodes. For example, you could write $2 \times MN$ and write "whether a power pellet is in effect" under the 2 and "Pacman's position" under the MN. State spaces which are complete but not minimal will receive partial credit.

Each part is independent. A maze has **height** M **and width** N. A Pacman can move *NORTH, SOUTH, EAST, or WEST*. There is initially a **pellet in every position** of the maze. The **goal is to eat all of the pellets.**

(a) Personal Space

In this part, there are P Pacmen, numbered $1, \dots, P$. Their turns cycle so Pacman 1 moves, then Pacman 2 moves, and so on. Pacman 1 moves again after Pacman P. Any time two Pacmen enter adjacent positions, the one with the lower number dies and is removed from the maze.

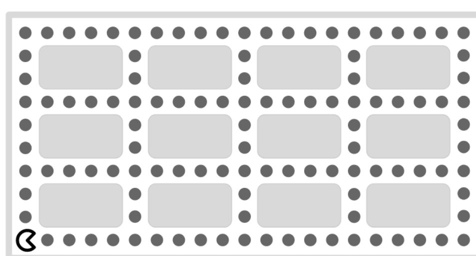
Answer:

(b) Road Not Taken

In this part, there is one Pacman. Whenever Pacman enters a position which he has visited previously, the maze is reset – each position gets refilled with food and the "visited status" of each position is reset as well.

Answer:

(c) Hallways



In this part, there is one Pacman. The walls are arranged such that they create a grid of H hallways **total**, which connect at I intersections. (In the example above, $H = 9$ and $I = 20$). In a single action, Pacman can move from one intersection into an adjacent intersection, eating all the dots along the way. Your answer should only depend on I and H.

(note: H = number of vertical hallways + number of horizontal hallways)

Answer: