# Assignment 3

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CECS 451 - Jucheol Moon

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## 1 Exercise 3.14

Which of the following are true and which are false? Explain your answers.

### 1.1 Problem A

Depth-first search always expands at least as many nodes as A* search with an admissible heuristic.

**False**. Depth-first search can expand less nodes than A* search by finding the solution faster even though A* search is more efficient.

### 1.2 Problem D

Breadth-first search is complete even if zero step costs are allowed.

**True**. Having zero step cost still allows Breadth-first search to complete because it can find the solution in O($b^d$) where b = branching factor and d = finite depth. This disregards efficiency or step cost so having zero step cost doesn't really affect the ability for the search to find a solution

## 2 Exercise 3.25

The **heuristic path algorithm** (Pohl, 1977) is a best-first search in which the evaluation function is

$$f(n) = (2 - w)g(n) + wh(n)$$

Answer the last question only. i.e., What kind of search does this perform for $w = 0$, $w = 1$, and $w = 2$?

$w = 0 : f(n) = 2g(n)$ **Uniform-Cost Search**
$w = 1 : f(n) = g(n) + h(n)$ **A* Search**
$w = 2 : f(n) = 2h(n)$ **Greedy Best-First Search**

# 3 Exercise 4.1

Give the name of the algorithm that results from each of the following special cases:

## 3.1 Problem A

Local beam search with k=1
**Hill Climbing Algorithm / Greedy Local Search**

## 3.2 Problem D

Simulated annealing with T = $\infty$ at all times.
**Hill Climbing Algorithm with Random Walk (Gradient Descent View)**

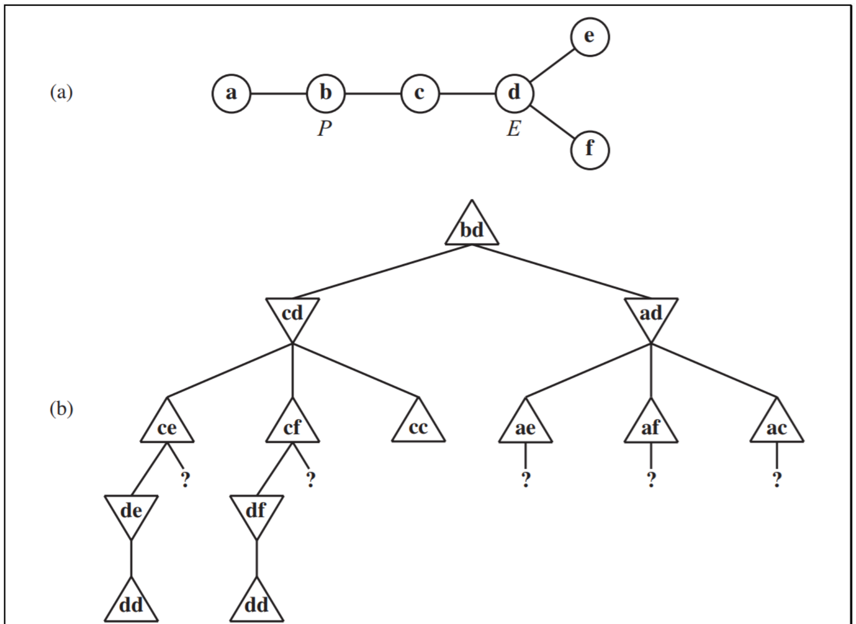



**Figure 5.16** (a) A map where the cost of every edge is 1. Initially the pursuer $P$ is at node **b** and the evader $E$ is at node **d**. (b) A partial game tree for this map. Each node is labeled with the $P, E$ positions. $P$ moves first. Branches marked "?" have yet to be explored.

# 4 Exercise 5.3

Imagine that, in Exercise 3.3, one of the friends wants to avoid the other. The problem then becomes a two-player **pursuit-evasion** game. We assume now that the players take turns moving. The game ends only when the players are on the same node; the terminal payoff to the pursuer is minus the total time taken. (The evader "wins" by never losing.) An example is shown in Figure 5.16.

## 4.1 Problem A

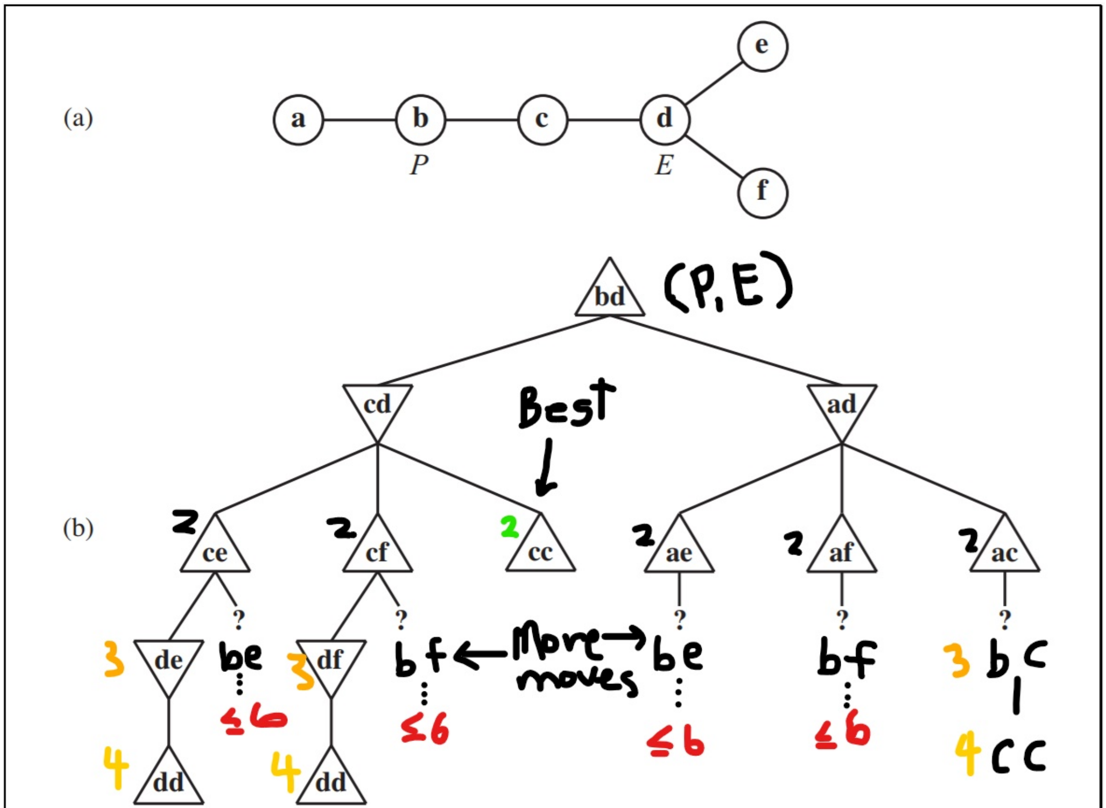
Copy the game tree and mark the values of the terminal nodes.
**Answer on next page**

## 4.2 Problem B

Next to each internal node, write the strongest fact you can infer about its value (a number, one or more inequalities such as "$\geq 14$", or a "?").
**Answer on next page**

### 4.3 Problem C

Beneath each question mark, write the name of the node reached by that branch.
**Answer below**

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