DQ5 (L5)

Due 19 Feb at 23:59 **Points** 26 **Questions** 5
Available after 6 Feb at 12:00 **Time limit** None
Allowed attempts Unlimited

Instructions

- This quiz is NOT GRADED. However, it is HIGHLY RECOMMENDED that you use these questions to complement your review of the lecture content.
- The questions are based on content from the Lecture 5a and from part of Chapter 4 of the AIMA (4th Ed.) textbook (i.e., 4.1).

Take the quiz again

Attempt history

	Attempt	Time	Score
KEPT	Attempt 2	2 minutes	26 out of 26
LATEST	Attempt 2	2 minutes	26 out of 26
	Attempt 1	15 minutes	21 out of 26

Submitted 6 Feb at 12:21

Question 1

6 / 6 pts

Determine if the following statement is true or false.

The stochastic hill-climbing algorithm with random restarts and sideways moves is complete.

Assume that the search space is infinite but a solution exists.

True

Correct!

False

False.

Given that f(n) = -h(n) and the hill-climbing algorithm is seeking a global maxima, consider an example problem where one solution exists, but the search space is infinite. With such a problem random restarts have almost no chance of chancing upon the solution.

More specifically, let us assume that there is exactly one solution (e.g., one goal state, reachable in exactly one way in the search space). We may define the probability of finding this solution as f(x) = 1/x, where x is the size of the search space. Given that f(x) in the limit of positive infinity is 0, we may define the probability of finding a solution in some problems (e.g., ones where there is exactly one (or even t, where t is some small positive constant integer) solution in an infinite search space) is 0.

Further, if we assume that all non-goal n have h(n) values that are the same, then the hill-climbing algorithm has no way of working towards a goal (since all successors would have an equal probability of being explored). The algorithm would simply randomly wander the search space.

In the worse case, it would never find the solution.

Question 2

4 / 4 pts

Assume that the steepest ascent hill-climbing algorithm adopting random restarts is applied to a problem where it has a 20% chance of finding a solution, and the expected number of steps taken to find the global maxima is 22, while the expected number of steps taken to reach local maxima is 50.

What is the expected number of steps required for the algorithm to find a solution?

Answer: 222

Answer 1:

Correct!

222

Expected steps = 22 + [(1-0.2)/0.2]*50 = 222.

Question 3

6 / 6 pts

When applying a variant of the hill-climbing algorithm to solve a standard but specific Sudoku puzzle (e.g., the one shown below) as a local search problem, the random restart variant of the algorithm cannot be used as the initial state cannot be random.

	1	2	3	4	5	6	7	8	9
A			3		2		6		
B	9			3		5			1
C			1	8		6	4		
D			8	1		2	9		
E	7								8
F			6	7		8	2		
G			2	6		9	5		
H	8			2		3			9
I			5		1		3		

True or false?

Correct!

False

False.

With such a problem, we could pick each state to be a random allocation of digits to each row (or else each column or each 3*3 box) such that defined digits in the original puzzle are maintained.

For example, given the example puzzle in the question, we could randomly allocate the digits {2,4,6,7,8,9} into row I (since {1,3,5} are already present), and then do the same for each of the rows above to form a random initial complete-formulation state.

We may have many such randomly defined initial states, and thus, may utilise the hill-climbing algorithm with random restarts.

Question 4

5 / 5 pts

Assume that the description below applies to local search problems where *b* is finite and *m* is infinite. You should also assume that a solution exists.

Complete the descriptions of the steepest-ascent hill-climbing and beam search algorithms by filling in the blanks.

When applying the steepest-ascent hill-climbing algorithm to a local search problem, assume that we wish to use a heuristic h (such that h is similarly applicable to informed search) as the evaluation function.

Specifically, we have f(n) = [-h(n)] .

Steepest-ascent hill-climbing: upon initialisation, by using f, the algorithm would generate a certain number of states in each iteration. The number of states generated is [b] . From among these states it then performs the goal test on a selected quantity of states equaling [1] state(s), which it will store, before moving to the next iteration.

Beam search (k states): upon initialisation, by using f, the algorithm would generate a certain number of states in each iteration. The number of states generated is [kb]. From among these states it then performs the goal test on a selected quantity of states equaling [k] state(s), which it will store, before moving to the next iteration.

Answer 1:

Correct! -h(n)

Answer 2:

Correct! b

Answer 3:

Correct! 1

Answer 4:

Correct! kb

orrect answer bk

orrect answer b*k

orrect answer k*b

orrect answer b.k

orrect answer k.b

Answer 5:

Correct! k

Note the given answers.

Question 5

5 / 5 pts

Generally speaking, beam search is essentially the same as executing *k* parallel instances of hill-climbing with random restarts.

True or false?

True

Correct!

False

Let the successors for a current state n under hill-climbing be S_n.

Under *k* parallel instances of hill-climbing, suppose that the successors under consideration are thus S_1, S_2, ..., S_k. The *k* states chosen for the next iteration would be:
{ min_h(S_1) , min_h(S_2) , ..., min_h(S_k) }

However, under beam search, it would be:
{ the top *k* states among $S_1 \cup S_2 \cup ... \cup S_k$ ranked based on ascending h values }