Homework 1
Assigned 1/19/17 Due 1/31/16

Consider the search tree below. For each search strategy below, a) give the goal state found (if none, write “NONE”), b) say whether or not this goal state is optimal, and c) give the order in which the nodes are visited together with the state of the queue at each step of the search as we did in class. New nodes are maintained in the queue *in alphabetical* order whenever the order is indifferent for the search algorithm.

1) Uniform Cost
   a) M
   b) This goal state is optimal
   c)

n	q
-	(A)
A	(C,B,D)
C	(B,H,D,G)
B	(H,D,E,F,G)
H	(D,M,E,N,F,G)
D	(M,E,J,N,I,F,G)
M	(E,J,N,I,F,G)

2) Greedy
   a) P
   b) This goal state is not optimal
   c)

n	q
-	(A)
A	(D,C,B)
D	(I,J,C,B)
I	(J,C,B)
J	(P,C,B)
P	(C,B)

3) A*:
   a) M
   b) This goal state is optimal
   c)

n	q
-	(A)
A	(C,D,B)
C	(H,D,B,G)
H	(M,D,B,G,N)
M	(D,B,G,N)

4) Depth First
   a) K
   b) This goal state is not optimal
   c)

n	q
-	(A)

A	(B,C,D)
B	(E,F,C,D)
E	(F,C,D)
F	(C,D)
C	(G,H,D)
G	(K,L,H,D)
K	(L,H,I)

5) Beam w/ beam width=3:

a) P

b) The goal state is not optimal

c)

n	q
-	(A)
A	(D,C,B)
D	(I,J,C)
I	(J,C)
J	(P,C)
P	(C)

6) Hill-Climbing

a) None

b) The goal state is not found

c)

n	q
-	(A)
A	(D)
D	(I)
I	()

7. Using the search tree above, specify the values for each of the following. Write UNDEF if the value does not exist.

a) f(A) =3

b) f(M)=5

c) g(C)=1

d) g(F)=8

e) h(J)=2

f) f(K)=10

8. Define *admissible*. Be brief.

1) The search will find a goal, if there exists a goal.

2) If there are multiple goals, the search will find the optimal one with lowest cost.

9.Two admissible A* searches A1 and A2 have heuristic functions h1 and h2 respectively. h1 is more informed than h2.

a)What does this mean?

It means that for all none-goal nodes n, $h_1(n) > h_2(n)$.

b)What guarantees follow from this?

It guarantees that the searching algorithm is not going to search more.

10. For each case below, say whether constrained convex optimization may be directly applied. Answer “Yes” “No” or “Impossible to say” Briefly explain your answer.

Function	Domain
a) $x^3 - 3x^2 - x - 12$	$1.5 \le x \le 5.5$

Answer: Yes, because this function is convex on $1.5 \le x \le 5.5$, since f”=6(x-1)>0 on $1.5 \le x \le 5.5$.

b) $x^3 - 3x^2 - x - 12$	$-1.5 \le x \le 1.5$

Answer: No, because this function is partly concave on $-1.5 \le x \le 1.5$, since f”=6(x-1)<0 when $-1.5 \le x \le 1$.

c) $x^2 + 5y^4 + 10$	$1.5 \le x^2 + y^2 \le 5.5$

Answer: Yes, because this function is convex on $1.5 \le x^2 + y^2 \le 5.5$, since $H_f = (2, 0 ; 0 , 60y^2)$ and it’s positive definite on the above interval, when y is not equal to 0. When y=0, the function degrades to $x^2 + 10$, which is also convex.