Introduction to LaTeX

December 5, 2006

1 Question 1: Search algorithms for 15-puzzle

1.1

Table 1: States expanded

	start10	start12	start20	start30	start40
UCS	2565	Mem	Mem	Mem	Mem
IDS	2407	13812	5297410	Time	Time
A*	33	26	915	Mem	Mem
IDA*	29	21	952	17297	186115

1.2

It is clear that IDA* is the most efficient in terms of time and memory usage, due to it being the only one to be able to calculate past start30.

A* has a very similar time to IDA* up to start20, afterwards, its memory usage blows up and is unable to calculate larger values.

IDS is much slower than the rest, it has a very slow caluclation time but its memory size is contained, as in, it does not blow up like UCS or A*.

UCS is the worst algorithm due to its bad search times but especially due it to its hugh memory usage.

2 Heuristic Path Search

2.1

Table 2: Search Path

	start50		start60		start64	
IDA*	50	14642512	60	321252368	64	1209086782
1.2	52	191438	62	230861	66	431033
1.4	66	116174	82	3673	94	188917
1.6	100	34647	148	55626	162	2358520
Greedy	164	5447	166	1617	184	2174

2.2

```
1  depthlim(Path, Node, G, F_limit, Sol, G2) :-
2      nb_getval(counter, N),
3      N1 is N + 1,
4      nb_setval(counter, N1),
5      % write(Node),nl,   % print nodes as they are expanded
6      s(Node, Node1, C),
7      not(member(Node1, Path)),       % Prevent a cycle
8      G1 is G + C,
9      h(Node1, H1),
10     % F1 is G1 + H1,
11     W is 1.2,
12     F1 is (2-W)*G1 + W*H1,
13     F1 =< F_limit,
14     depthlim([Node|Path], Node1, G1, F_limit, Sol, G2).
```

Line removed is line (10) and the lines added are (11-12). These introduce a new var W, and is used to modify F1 depending on the equation given.

2.3

Refer to table in 2.1

2.4

Discuss tradeoff between speed and quality of solution for these 5 algorithms

3 Maze Search Heuristics

3.1

Manhattan heuristic

$$h(x, y, x_G, y_G) = |x - x_G| + |y - y_G|$$

3.2

3.2.1

Yes. The heuristic is now equal to the actual cost but the only requirement of an admissable heuristic in search problems is that it cannot overestimate the cost of reaching the goal. In fact, we have acheived a perfect heuristic.

3.2.2

No. The Manhattan heuristic is no longer admissable in the case of diagonal movement due to the pythagoras theorem - the root of the two squared sides is longer than the hypothenus.

3.2.3

Chebyshev distance

$$h(x, y, x_G, y_G) = max(|x - x_G|, |y - y_G|)$$

4 Graph Paper Grand Prix

4.1

Table 3: My caption

n	Sequence	Number of actions
1	+-	2
2	+o -	
3	+oo-	
4	++–	
5	++-o-	
6	++o–	
7	++o-o-	6
8	++oo–	
9	+++—	
10	+++-oo-	
11	+++-o–	
12	+++o–	
13	+++o–o-	
14	+++o-o–	
15	+++oo—	
16	++++—-	
17	++++—o-	
18	++++–o–	
19	++++-o—	
20	++++o—-	
21	++++o—o-	