Hw4

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Problem 1

1

$h(B)$ - admissible $\iff$ $(h \geq 0) \cap (h-$ lower bound of real H) $h(B) = cost(B, G) = \frac{1}{2} \implies h(B) \in [0; \frac{1}{2}] -$ admissible range

2

Iter	OPEN	$f = g + h$	g	h	CLOSED
1	$B^{(A)}$	100.5	$\frac{1}{2}$	100	$A^{(\emptyset)}$
	$C_1^{(A)}$	1	1	0	
2	$B^{(A)}$	100.5	$\frac{1}{2}$	100	$A^{(\emptyset)}$, $C_1^{(A)}$
	$C_2^{(C_1)}$	1.5	1.5	0	
3	$B^{(A)}$	100.5	$\frac{1}{2}$	100	$A^{(\emptyset)}$, $C_1^{(A)}$, $C_2^{(C_1)}$
	$C_3^{(C_2)}$	$\frac{7}{4}$	$\frac{7}{4}$	0	
4	$B^{(A)}$	100.5	$\frac{1}{2}$	100	$A^{(\emptyset)}$, $C_1^{(A)}$, $C_2^{(C_1)}$, $C_3^{(C_2)}$
	$C_4^{(C_3)}$	$\frac{15}{8}$	$\frac{15}{8}$	0	
5	$B^{(A)}$	100.5	$\frac{1}{2}$	100	$A^{(\emptyset)}$, $C_1^{(A)}$, $C_2^{(C_1)}$, $C_3^{(C_2)}$, $C_4^{(C_3)}$
	$C_5^{(C_4)}$	$\frac{31}{16}$	$\frac{31}{16}$	0	

3

$$lim_{i\to\infty} f(C_i) = lim_{i\to\infty}(g(C_i) + h(C_i)) = lim_{i\to\infty}(g(C_i)) =$$
$$lim_{i\to\infty} \sum_{j=0}^{i} (\frac{1}{2})^j = lim_{i\to\infty} \frac{1 - (\frac{1}{2})^{(i+1)}}{1 - \frac{1}{2}} = lim_{i\to\infty} 2(1 - (\frac{1}{2})^{(i+1)}) = 2$$

4

The search will not find G, because on every iteration the search select the node with the smallest value of f = g + h. Since the single way to achive G is threw the B, and f(B) = 100.5, which is greater than 2. And for every of C_i, $f(C_i) < 2$, the search will chose C_i over B every time.

5

The inadmissable range of $h(B)$ is defined as $h(B) \in (\frac{1}{2}, \infty)$. So, to get G eventually, we have to have

$$g(B) + h(B) < 2 \iff \frac{1}{2} + h(b) < 2 \iff h(b) < \frac{3}{2}.$$

Thus, $h(b) \in (\frac{1}{2}, \frac{3}{2})$ - inadmissalbe range, which allows to get G.

6

Admissability of h is sufficient but not necessary condition for A* to find a goal state.
It is sufficient based on a proof in the class.
It is not necessary, since I showed in previous task that inadmissable value of h still allows A* to find a goal state.

Problem 2

Iteration Number	y	z	Current Point	T	p
1	3	0.102	2	1.800	0.574
2	1	0.223	3	1.620	0.291
3	1	0.504	1	1.458	1.000
4	4	0.493	1	1.312	0.102
5	2	0.312	1	1.181	0.429
6	3	0.508	2	1.063	0.390
7	4	0.982	2	0.957	0.124
8	3	0.887	2	0.861	0.313

Problem 3

1

In total the number of states corresponds to the number of permutration of n positions, which is n!

2

We can do a swap for $n-1$ positions. Then the size of neighborhood is $n-1$. That is, the covered by neighborhood fraction is $\frac{n-1}{n!}$

3

In the data table $n = 112511$. To caclucate the $n!$ in scientific notation consider

$$log_{10}(n!) = \sum_{i=1}^{n} log_{10}(i) \implies n! = 10^{\sum_{i=1}^{n} log_{10}(i)}$$

$$\sum_{i=1}^{112511} log_{10}(i) = 519455.01716 \implies n! = 1 * 10^{519455}.$$

That is, $c = 1$, $d = 519455$.

4

D = 10km. Worst total distance = $(n+1) * 10$km = 1125120km = 2.92LD = 3LD

5

D = 10^{-2} km. Best totatl distance = $(n+1)*D = 1125.12$km

6

v = 25mph = 40.2336kmph. Time in best total distance = $\frac{1125.12}{40.2336}$ = 27.9hrs $\approx$ 28hrs $>$ 24hrs. Thus, inspector is not able to finish a job in the best case during the day. Thus, inspector is not able to finish a job during the day in any other case.