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Assignment 12

Task 1

parent		total costs
	letter	
costs		heuristic

a)

	Open List	Closed List
1	${}_{0}h^{19}_{19}$	
2	${}^{h}_{1}g^{11}_{10}$ ${}^{h}_{20}e^{30}_{10}$ ${}^{h}_{35}d^{45}_{10}$ ${}^{h}_{42}c^{52}_{10}$	h
3	${}^{h}e^{30}$ ${}^{g}_{18}f^{38}_{20}$ ${}^{h}d^{45}$ ${}^{h}c^{52}$	h ${}^{h}g$
4	${}^{g}f^{38}$ ${}^{h}d^{45}$ ${}^{e}c^{52}$	h ${}^{h}g$ ${}^{h}e$
5	${}^{f}_{9}b^{39}_{30}$ ${}^{h}d^{45}$ ${}^{e}c^{52}$	h ${}^{h}g$ ${}^{h}e$ ${}^{g}f$
6	${}^{b}_{0}a^{40}_{40}$ ${}^{h}d^{45}$ ${}^{e}c^{52}$	h ${}^{h}g$ ${}^{h}e$ ${}^{g}f$ ${}^{f}b$
7		h ${}^{h}g$ ${}^{h}e$ ${}^{g}f$ ${}^{f}b$ ${}^{b}a$

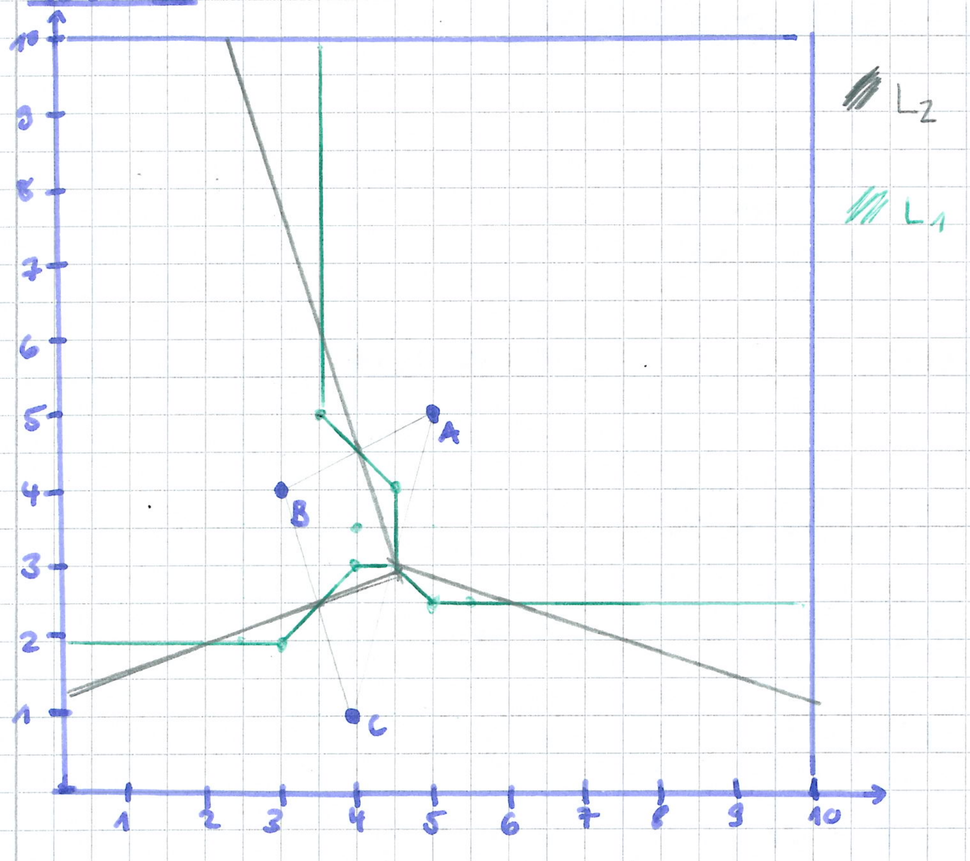
→ Path from h to a over $h \rightarrow g \rightarrow f \rightarrow b \rightarrow a$ with costs $4 \cdot 10 = 40$

b) Not consistent, because heuristic changes more than 10 (from e.g. $e \rightarrow c$)

Not optimistic, because costs changes in heuristic are worse than edge weights (from e.g. d to a: estimate 35, but correct 10!)

Therefore, the implication with finding an optimal path are that the heuristic needs to be consistent (which also implies optimistic).

Task 2



Task 3

$S = (0,0)$ $\quad$ $G = (3,4)$ $\quad$ $O = (2,3)$

attractive force $= d(p,g)^2 = \Delta x^2 + \Delta y^2$ with $\Delta = x(g) - x(p)$

repulsive force $= \dfrac{3}{d(p,o)^2}$

Calculate force at point $(1,1)$:

1) attractive: $\dfrac{\partial af}{\partial x} = 2\Delta x$ $\quad$ $\dfrac{\partial af}{\partial y} = 2\Delta y$

$\Delta x = (3-1) = 2 \curvearrowright = 2 \cdot 2 = 4$ $\quad$ $\Delta y = 4-1 = 3 \curvearrowright = 2 \cdot 3 = 6$ $\Rightarrow \boxed{af = \begin{pmatrix} 4 \\ 6 \end{pmatrix}}$

2) repulsive: in general: $f(x) = \dfrac{g(x)}{h(x)} \Rightarrow f'(x) = \dfrac{h(x) \cdot g'(x) + g(x) h'(x)}{(h(x))^2}$

$\dfrac{\partial rf}{\partial x} = \dfrac{3(2\Delta x)}{(\Delta x^2 + \Delta y^2)^2}$ $\quad$ $\dfrac{\partial rf}{\partial y} = \dfrac{3(2\Delta y)}{(\Delta x^2 + \Delta y^2)^2}$

$\Delta x = (2-1) = 1$ $\quad$ $\dfrac{\partial rf}{\partial x} = \dfrac{3 \cdot 2}{(1+4)^2} = \dfrac{6}{25} \approx \dfrac{1}{5}$ $\quad$ $\dfrac{\partial rf}{\partial y} = \dfrac{12}{25} \approx \dfrac{1}{2}$

$\Delta y = (3-1) = 2$

$\Rightarrow \boxed{rf = \begin{pmatrix} 1/5 \\ 1/2 \end{pmatrix}}$

Force vector at $(1,1)$ is $f = af - rf = \begin{pmatrix} 4 - 1/5 \\ 6 - 1/2 \end{pmatrix} = \boxed{\begin{pmatrix} 19/5 \\ 11/2 \end{pmatrix}}$