



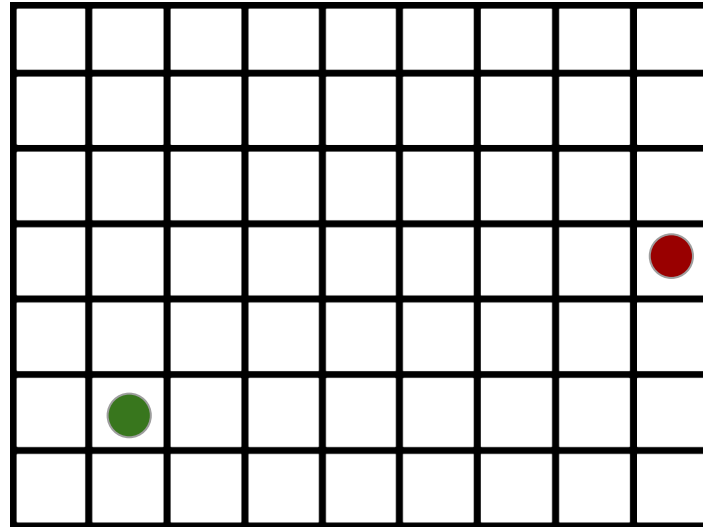
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A\*

...

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Sistemas Inteligentes

Algoritmo de búsqueda, utilizado para encontrar la distancia más corta entre dos puntos.



El algoritmo utiliza la siguiente función de evaluación:

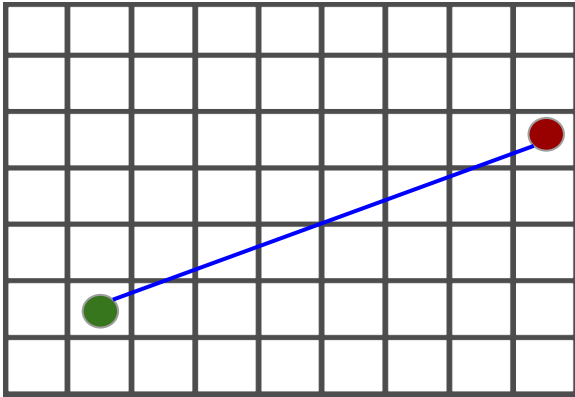
$$f(n) = g(n) + h(n) \quad (1)$$

**$g(n)$**  es el coste actual desde el nodo inicial al nodo  $n$ .

**$h(n)$**  es el coste estimado (heurística) desde el nodo actual al nodo final.

Utilizando la distancia Manhattan como  $g(n)$ , la distancia Euclidiana como  $h(n)$ .

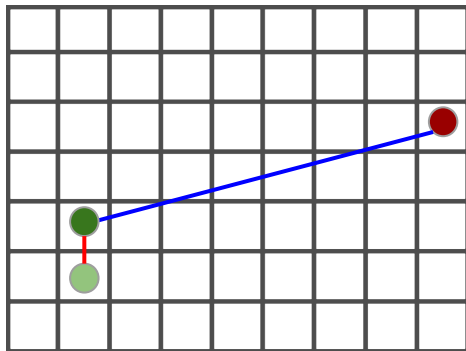
Y si solo se puede mover en cuatro direcciones: N, S, O, E (cuatro conectados):



$$f(n) = g(n) + h(n)$$

$$h'(n) = \sqrt{(8-1)^2 + (4-1)^2} = 7.61$$

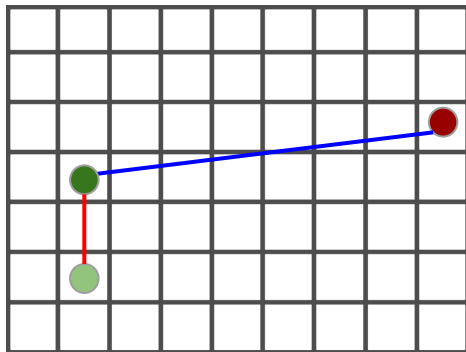
$$f(n) = 0 + 7.61 = 7.61$$



$$f(n) = g(n) + h(n)$$

$$h'(n) = \sqrt{(8-1)^2 + (4-2)^2} = 7.3$$

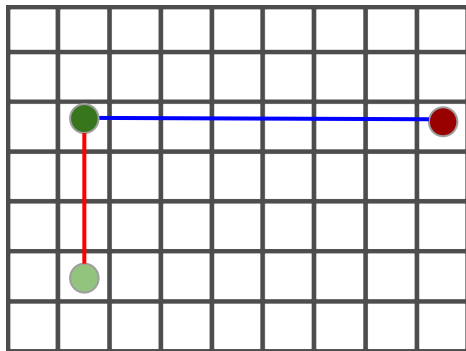
$$f(n) = 1 + 7.3 = 8.3$$



$$f(n) = g(n) + h(n)$$

$$h'(n) = \sqrt{(8-1)^2 + (4-3)^2} = 7.1$$

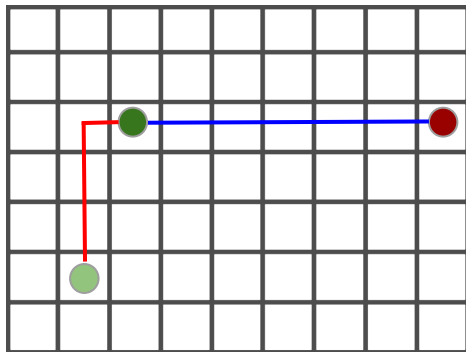
$$f(n) = 2 + 7.1 = 9.1$$



$$f(n) = g(n) + h(n)$$

$$h'(n) = \sqrt{(8-1)^2 + (4-4)^2} = 7$$

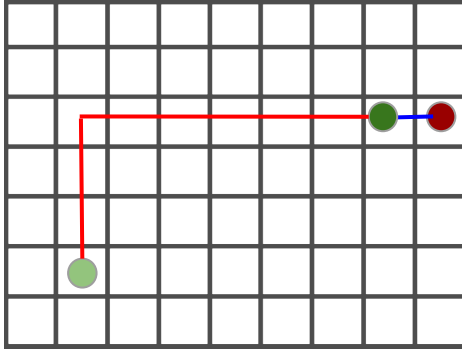
$$f(n) = 3 + 7 = 10$$



$$f(n) = g(n) + h(n)$$

$$h'(n) = \sqrt{(8-2)^2 + (4-4)^2} = 6$$

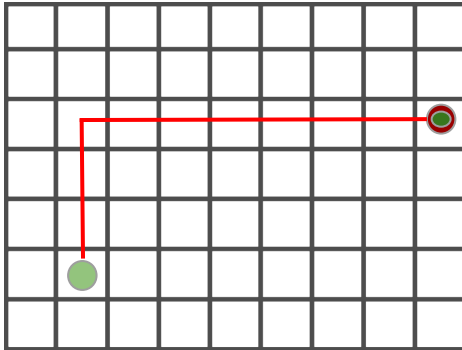
$$f(n) = 4 + 6 = 10$$



$$f(n) = g(n) + h(n)$$

$$h'(n) = \sqrt{(8-7)^2 + (4-4)^2} = 1$$

$$f(n) = 9 + 1 = 10$$

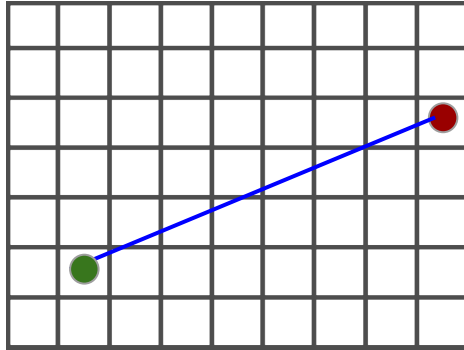


$$f(n) = g(n) + h(n)$$

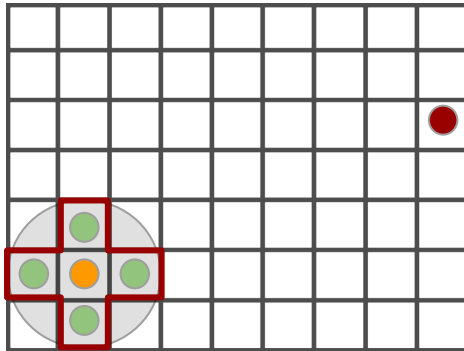
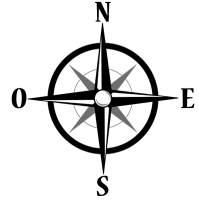
$$h'(n) = \sqrt{(8-8)^2 + (4-4)^2} = 0$$

$$f(n) = 10 + 0 = 10$$

# A\* Funcionamiento



$$f(i) = 0 + 7.61 = 7.61$$



$$f(i-n) = 1 + 7.3 = 8.3$$

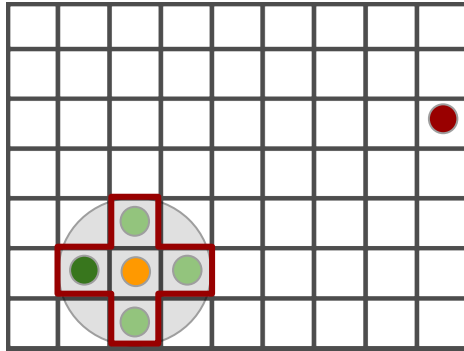
$$f(i-s) = 1 + 8.1 = 9.1$$

$$f(i-e) = 1 + 6.7 = 7.7$$

$$f(i-o) = 1 + 8.5 = 9.5$$



# A\* Funcionamiento

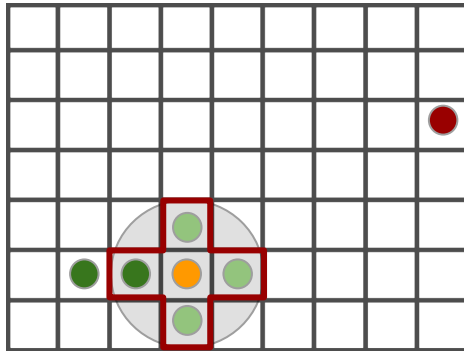
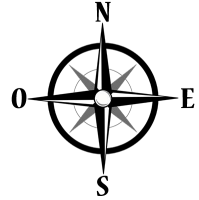


$$f(i-e-n) = 2 + 6.3 = 8.3$$

$$f(i-e-s) = 2 + 7.2 = 9.2$$

$$f(i-e-e) = 2 + 5.8 = 7.8$$

$$f(i-e-o) = 2 + 7.61 = 9.61$$



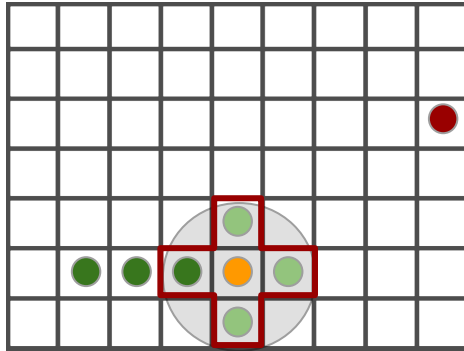
$$f(i-e-e-n) = 3 + 5.4 = 8.4$$

$$f(i-e-e-s) = 3 + 6.4 = 9.4$$

$$f(i-e-e-e) = 3 + 5 = 8$$

$$f(i-e-e-o) = 3 + 6.7 = 9.7$$

# A\* Funcionamiento

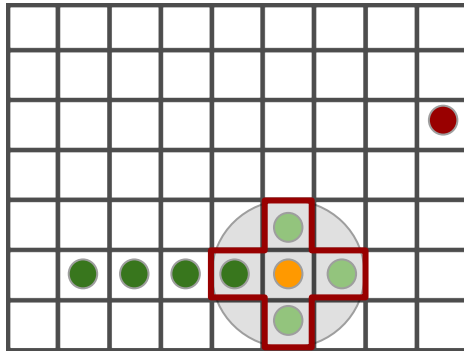
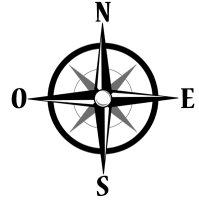


$$f(i-e-e-e-n) = 4 + 4.5 = 8.5$$

$$f(i-e-e-e-s) = 4 + 5.7 = 9.7$$

$$f(i-e-e-e-e) = 4 + 4.2 = 8.2$$

$$f(i-e-e-e-o) = 4 + 5.8 = 9.8$$



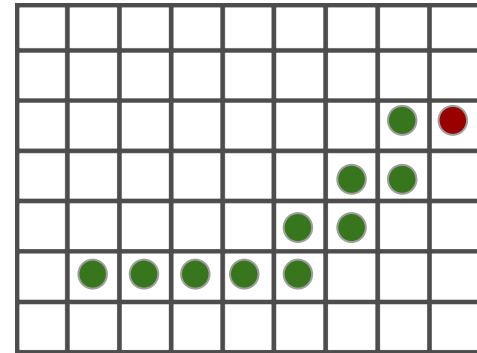
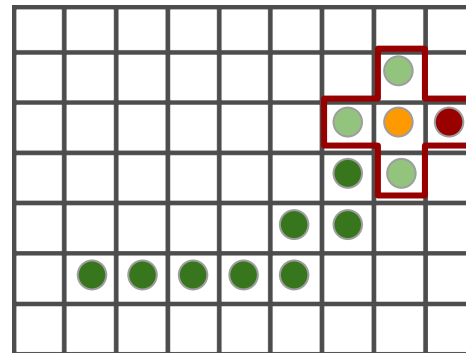
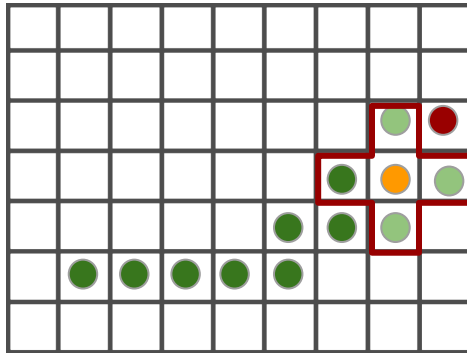
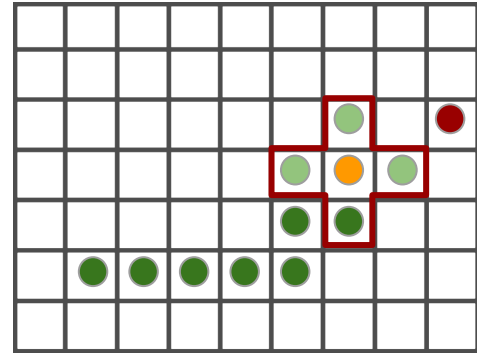
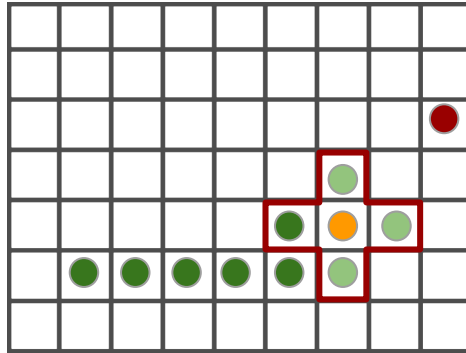
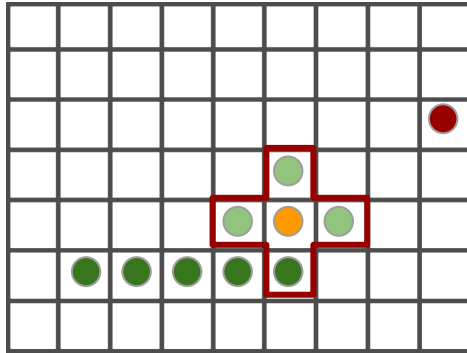
$$f(i-e-e-e-e-n) = 5 + 3.6 = 8.6$$

$$f(i-e-e-e-e-s) = 5 + 5 = 10$$

$$f(i-e-e-e-e-e) = 5 + 3.6 = 8.6$$

$$f(i-e-e-e-e-o) = 5 + 5 = 10$$

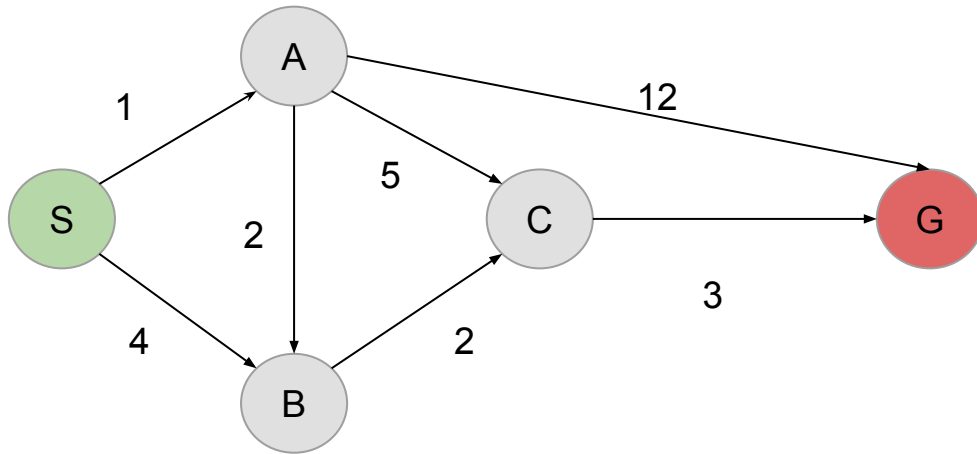
# A\* Funcionamiento



## Ejemplos

<https://qiao.github.io/PathFinding.js/visual/>

# A\* En Árbol



Estado	$h(n)$
S	7
A	6
B	2
C	1
G	0