

SISTEMAS DE INTELIGENCIA ARTIFICIAL (72.27)

TP1

MÉTODOS DE BÚSQUEDA

Grupo 1
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Ejercicio 1 - 8 Puzzle



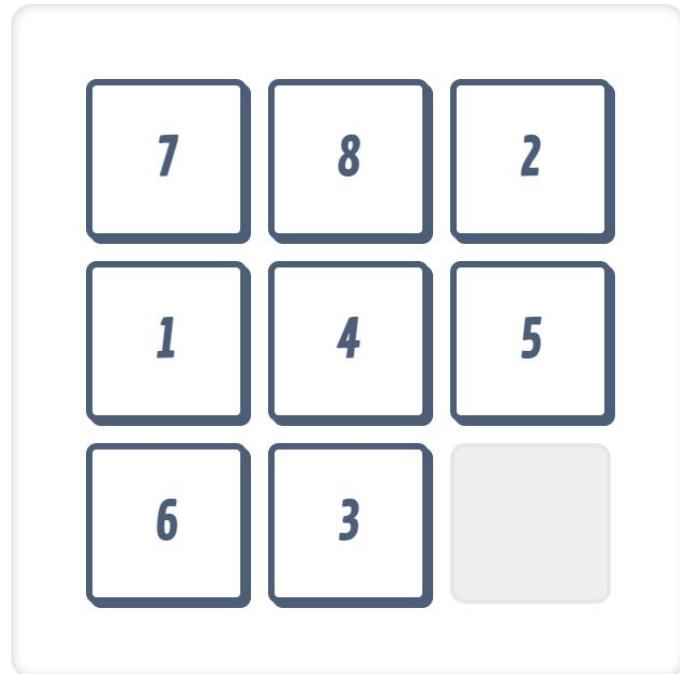
Preguntas

- ¿Qué estructura de estado utilizarían?
- Al menos 2 heurísticas admisibles no-triviales
- ¿Qué métodos de búsqueda utilizarán, con qué heurística, y por qué?



Estructura de estado

- ❖ Clase para las piezas (1-8)
- ❖ Clase para el vacío





Heurísticas



Heurística 1

Suma de todas las distancias manhattan entre la pieza y donde se supone que debería estar posicionada

Heurística 2

Multiplicación entre H1 y la distancia manhattan entre la pieza y el vacío

Heurística 3

Cantidad de piezas en lugar incorrecto



Métodos de búsqueda

- ❖ Algoritmo A* con Heurística de Distancia Manhattan

- ❖ Algoritmo Iterative Deepening A* (IDA*) con Heurística de Distancia Manhattan



Ejercicio 2 - Sokoban



Estructura de estado

- Posición de las paredes
- Posición del jugador
- Posición del objetivo
- Posición de la/s caja/s
- Posición de los deadlocks



Métodos de búsqueda

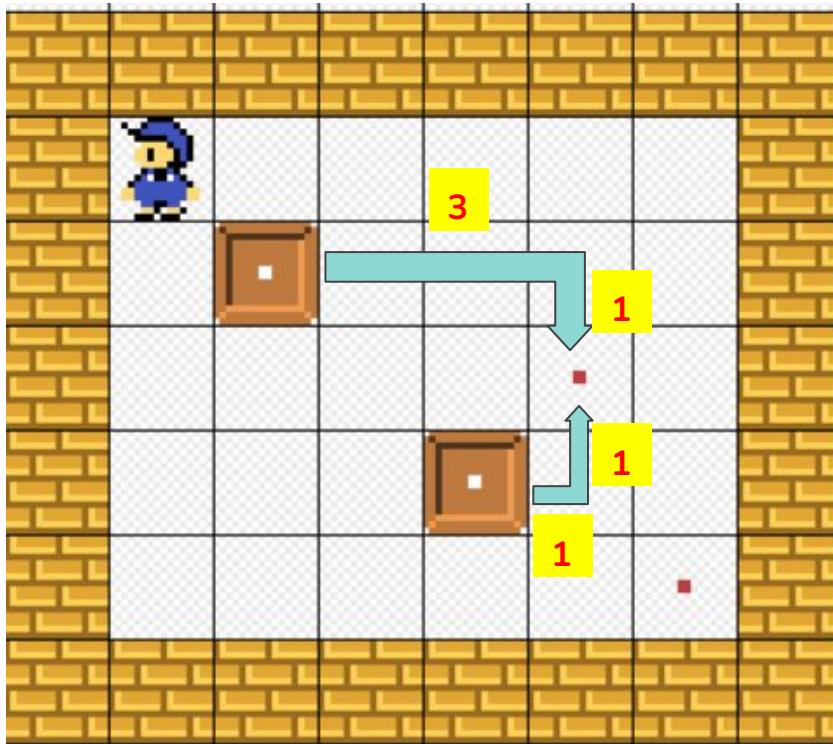
- DFS
- BFS
- LocalGreedy
- GlobalGreedy
- A*
- IDDFS



Heurísticas

- Manhattan
- Improved Manhattan

Manhattan

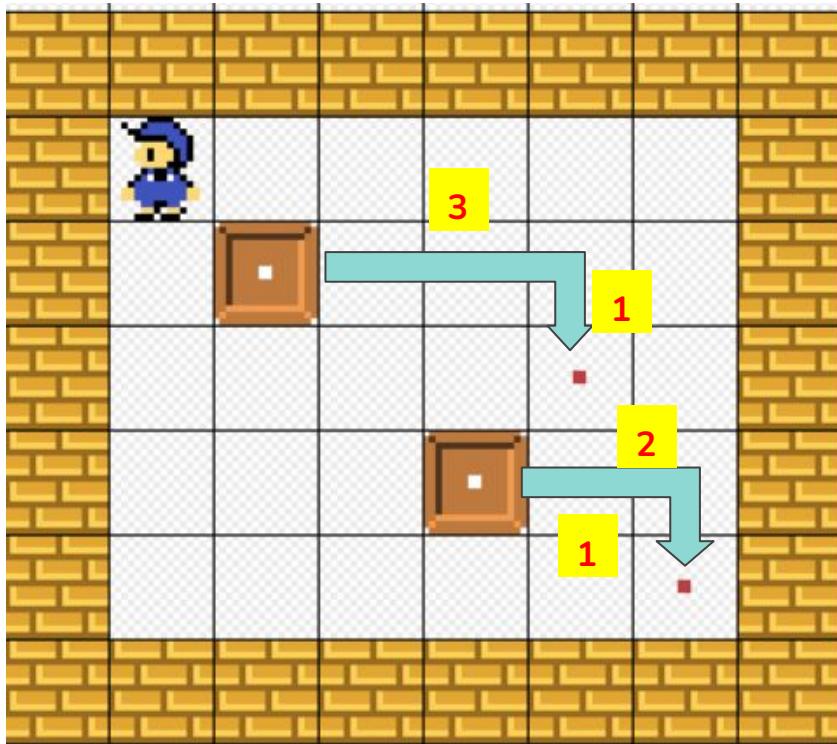


Sumatoria de $\Delta X + \Delta Y$ entre las cajas y su objetivo más cercano

Ejemplo :

$$\text{Valor} = (3+1) + (1+1) = 6$$

Improved Manhattan

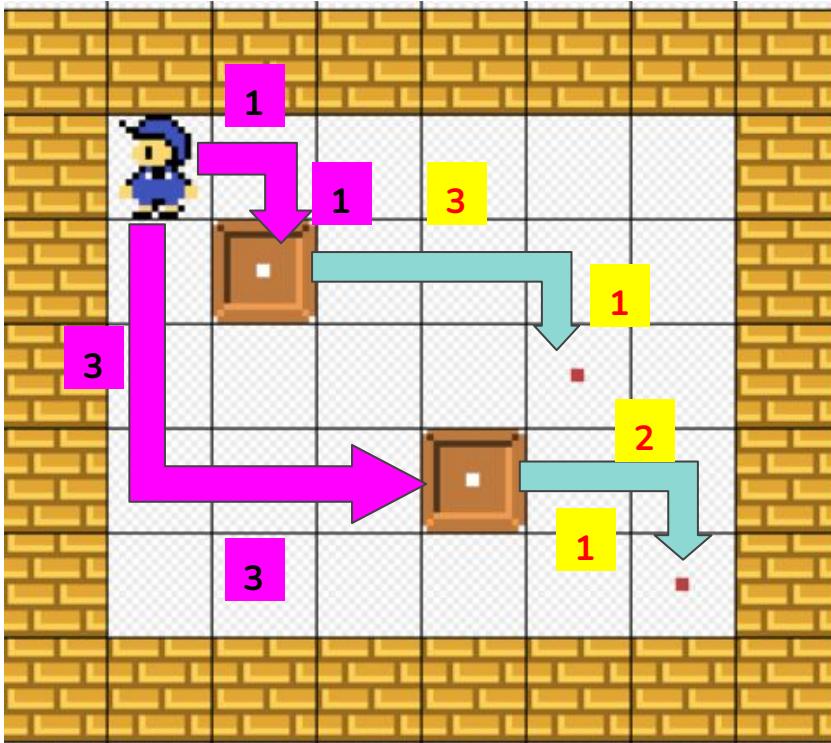


Sumatoria de $\Delta X + \Delta Y$ entre las cajas y su objetivo más cercano sin repetir un mismo objetivo

Ejemplo :

$$\text{Valor} = (3+1) + (2+1) = 7$$

Heurística no admisible



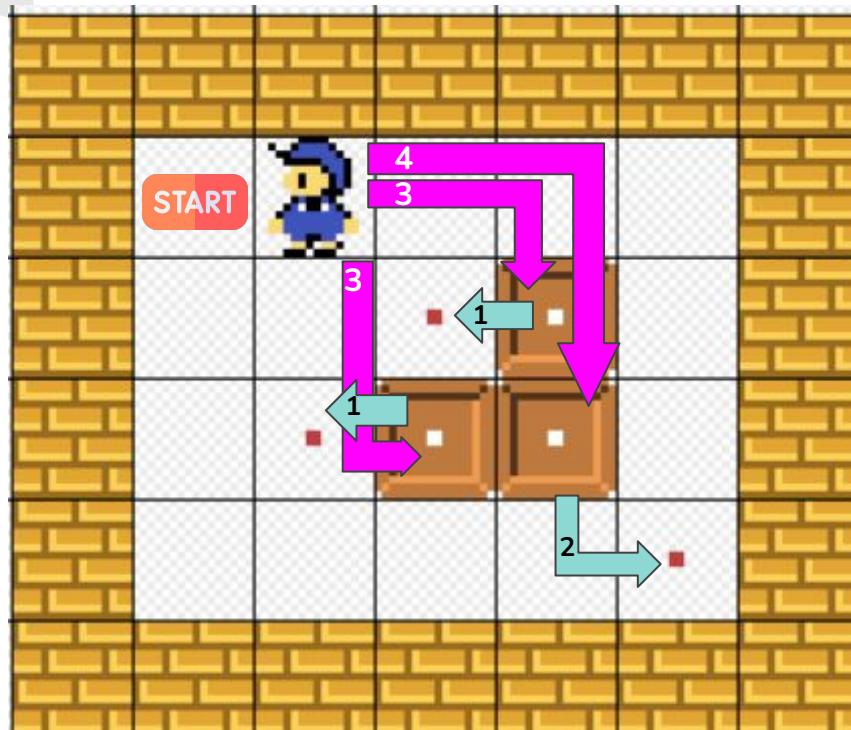
Sumatoria de $\Delta X + \Delta Y$ entre las cajas y el jugador y las cajas y su objetivo más cercano, sin repetir un mismo objetivo

Ejemplo :

Valor =

$$[(3+3) + (2+1)] + [(1+1) + (3+1)] = 15$$

Heurística no admisible



Al ejecutar el algoritmo A* con uno de nuestros mapas, el primer paso que se toma es el siguiente

$$\text{Valor Heurística} = (3+1) + (3+1)+(4+2) = 14$$

Sin embargo el problema se resuelve en 11 pasos, por lo que la heurística sobreestima el costo, convirtiéndola en inadmisible



Heurísticas - Análisis

Manhattan:

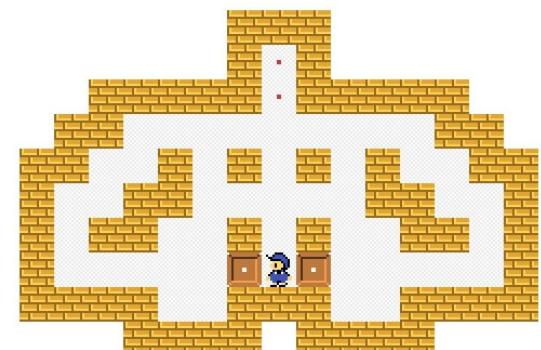
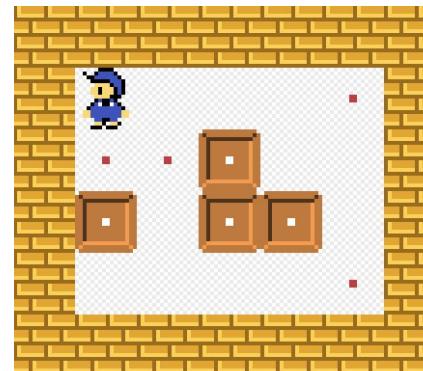
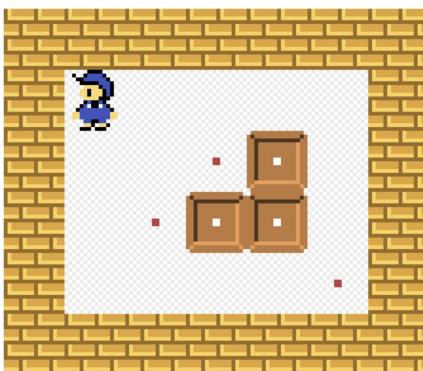
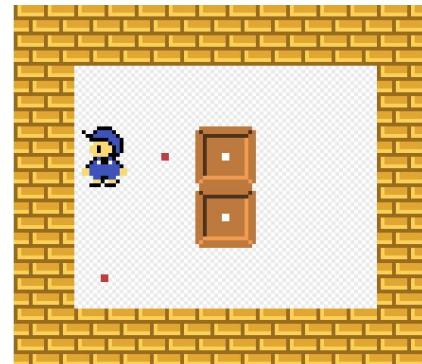
Al ser la distancia mínima de todas las cajas al objetivo más cercano, se necesitará mínimamente recorrer esa distancia para dejar cada caja en un objetivo (siempre y cuando se prohíba mover dos cajas de un único movimiento)

Improved Manhattan:

Al calcular la combinación de mínimas distancias para dejar en objetivos distintos a cada caja, mínimamente se tendrá que recorrer esa distancia para dejar cada caja en un objetivo distinto

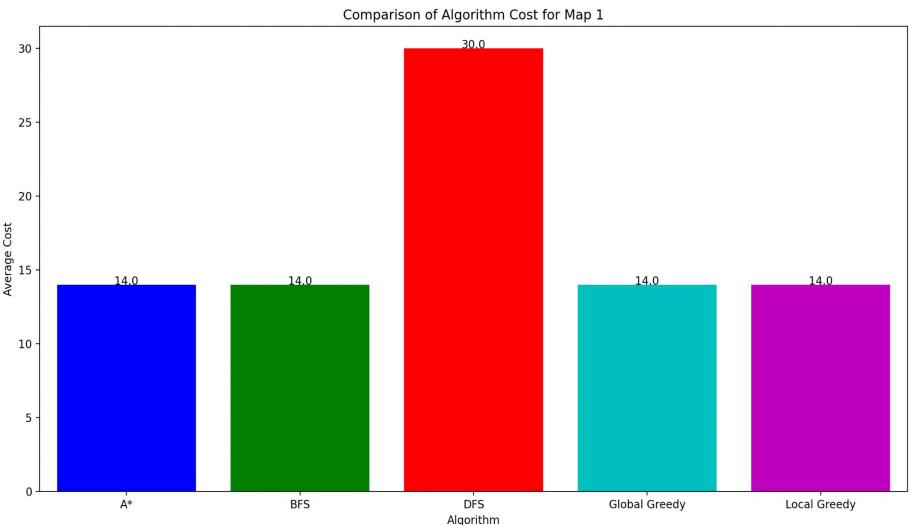
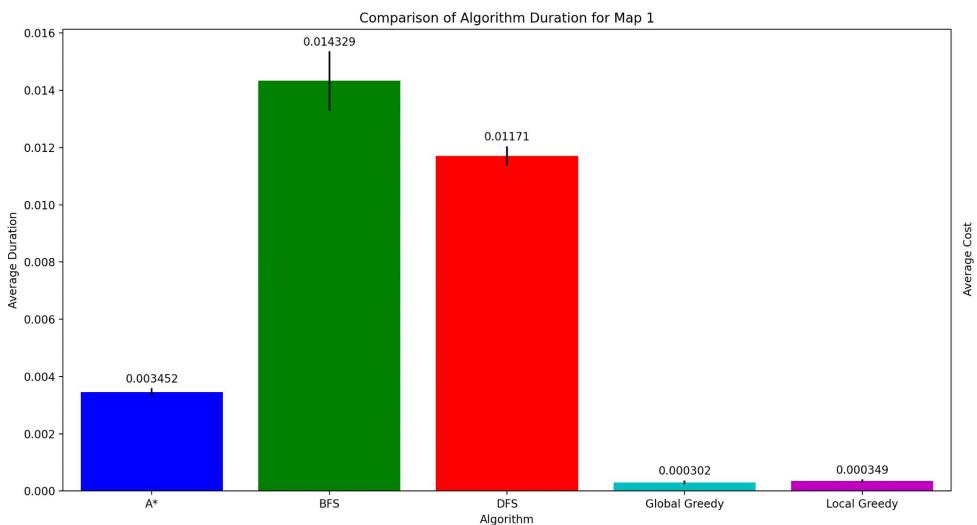


Mapas



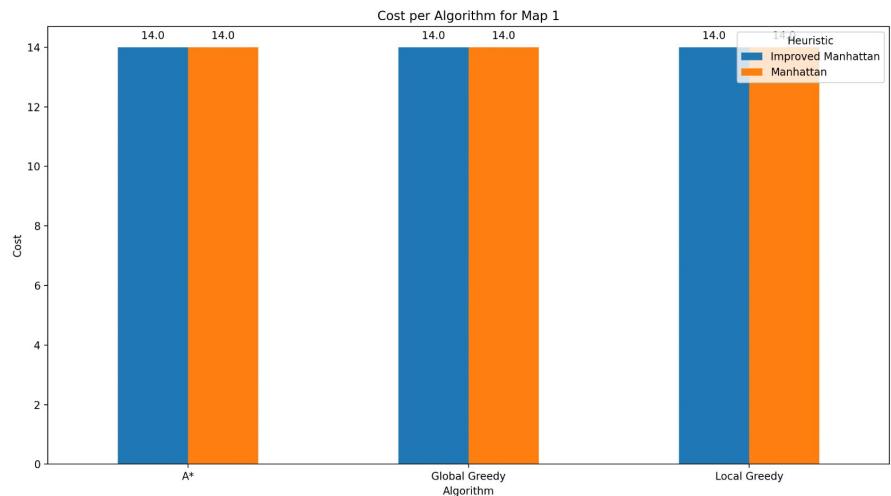
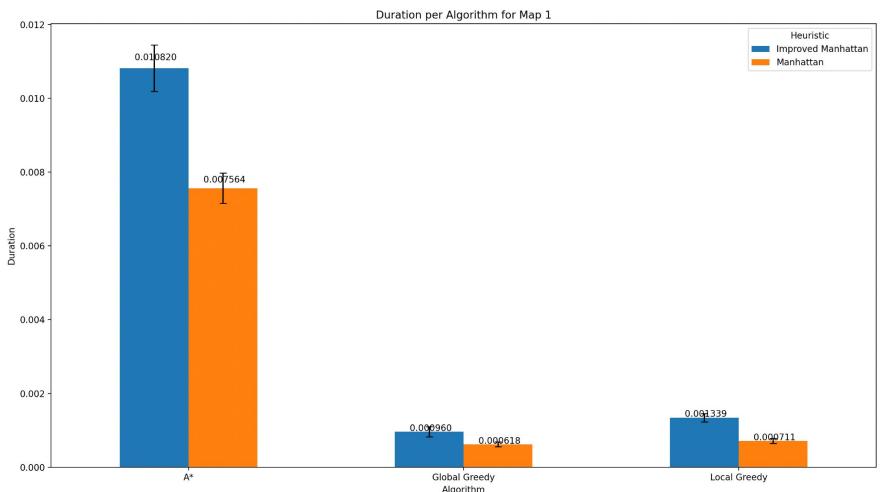


Costo vs Duración - Mapa 1



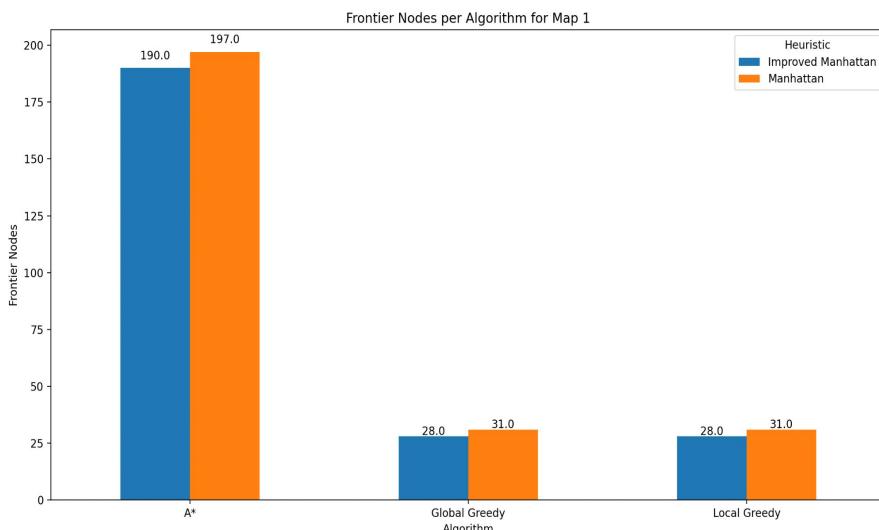
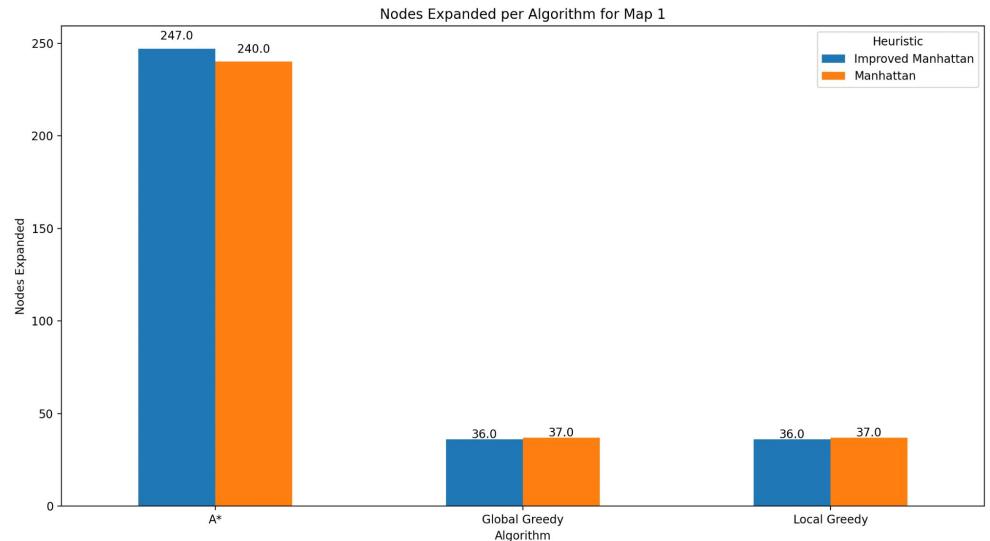


Costo vs Duración - Mapa 1



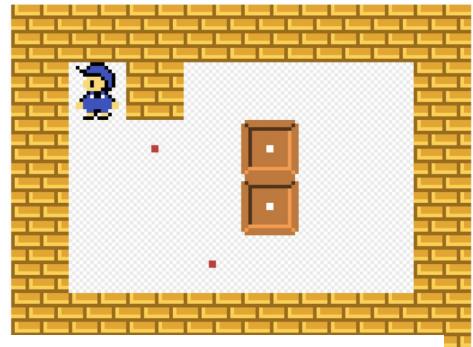


Nodos expandidos vs frontera - Mapa 1

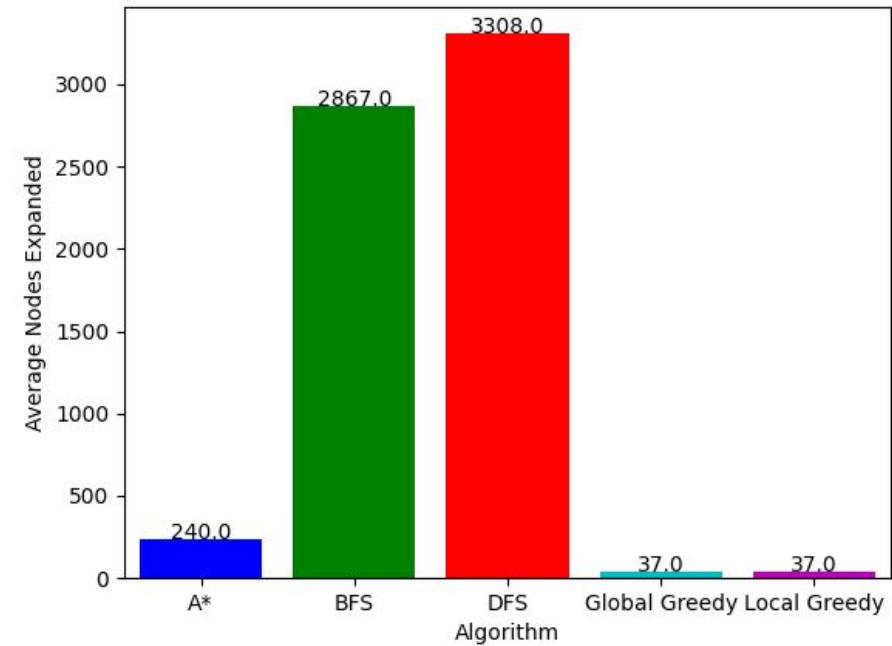




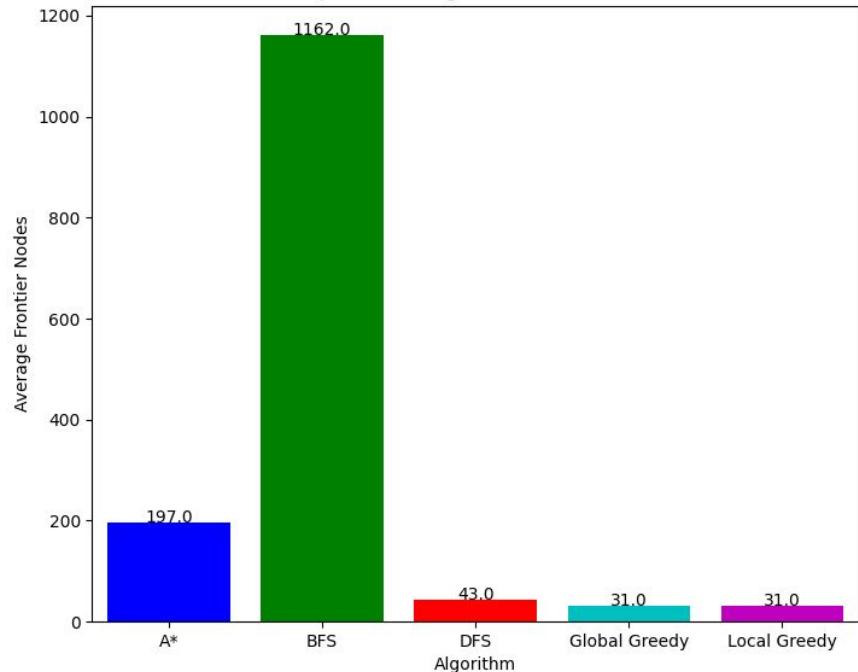
Nodos expandidos vs frontera - Mapa 1



Comparison of Algorithm Nodes Expanded

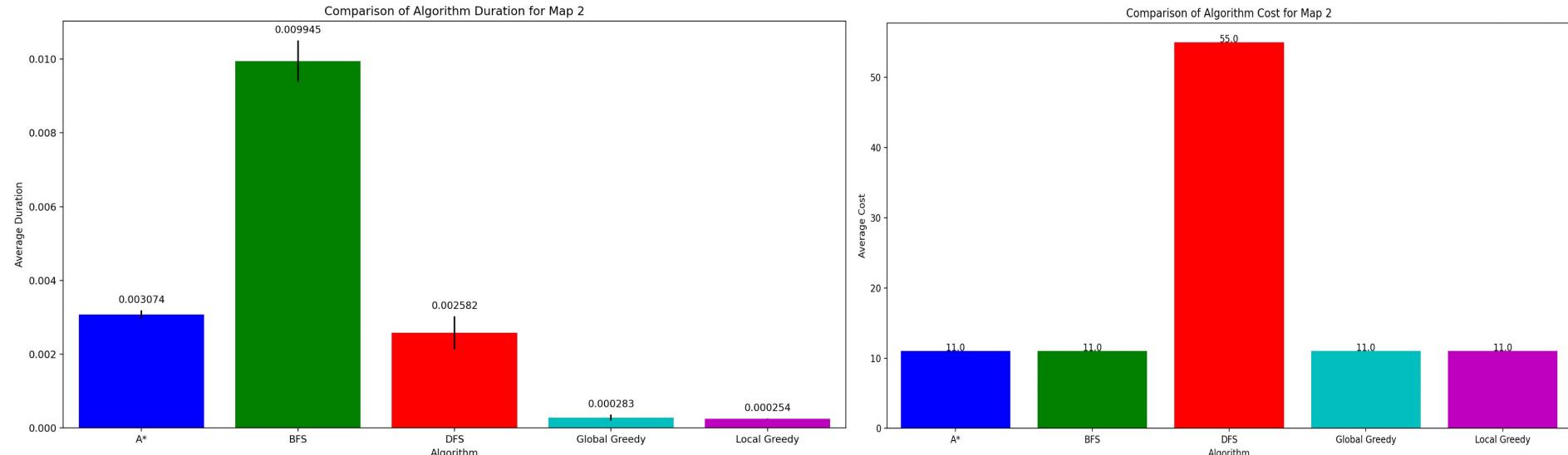
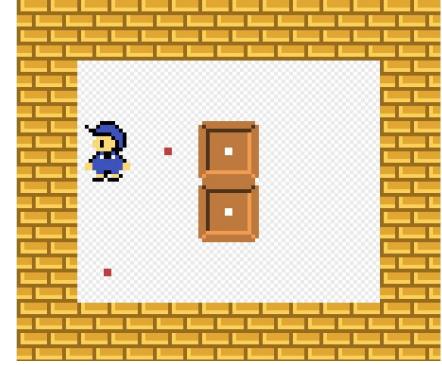


Comparison of Algorithm Frontier Nodes



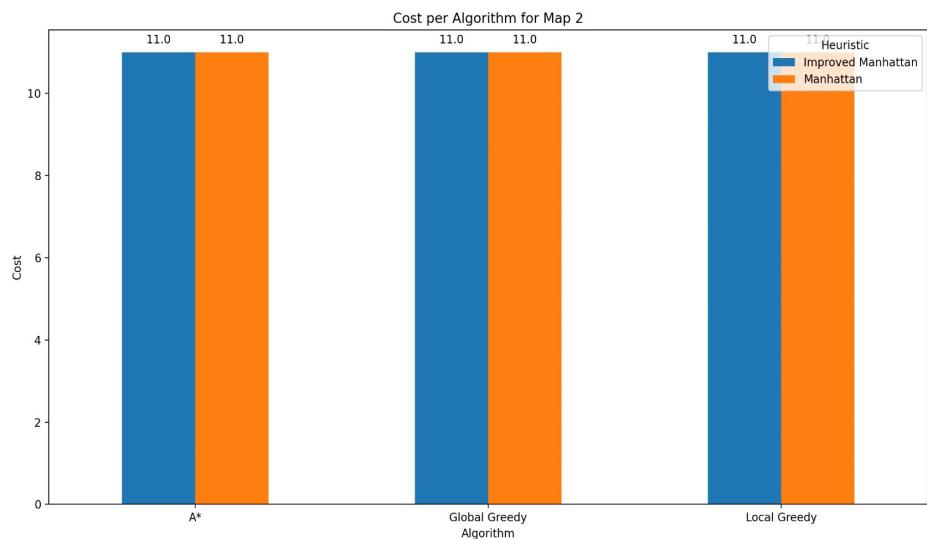
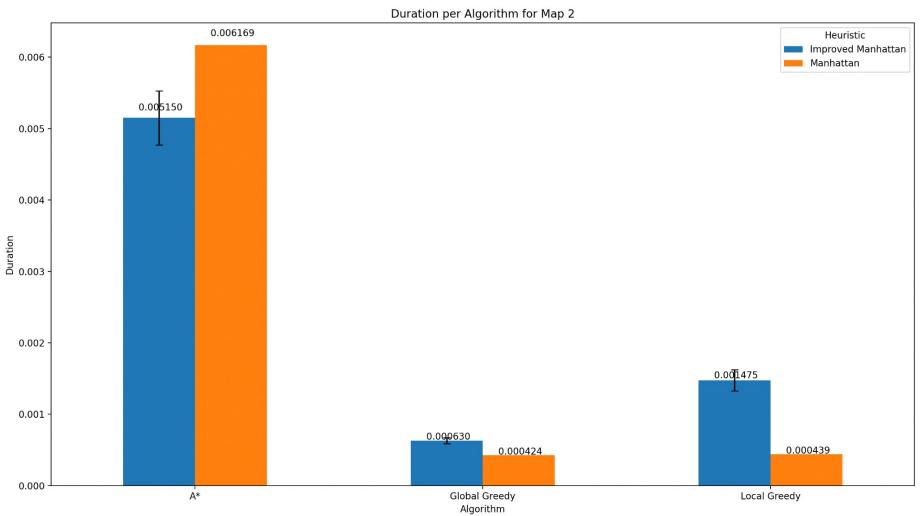
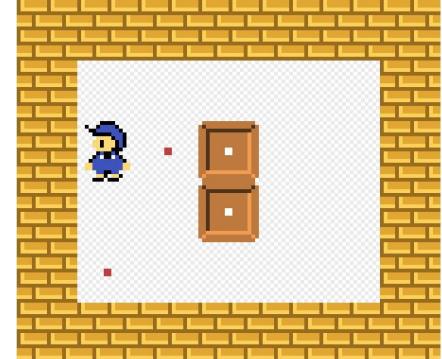


Costo vs Duración - Mapa 2



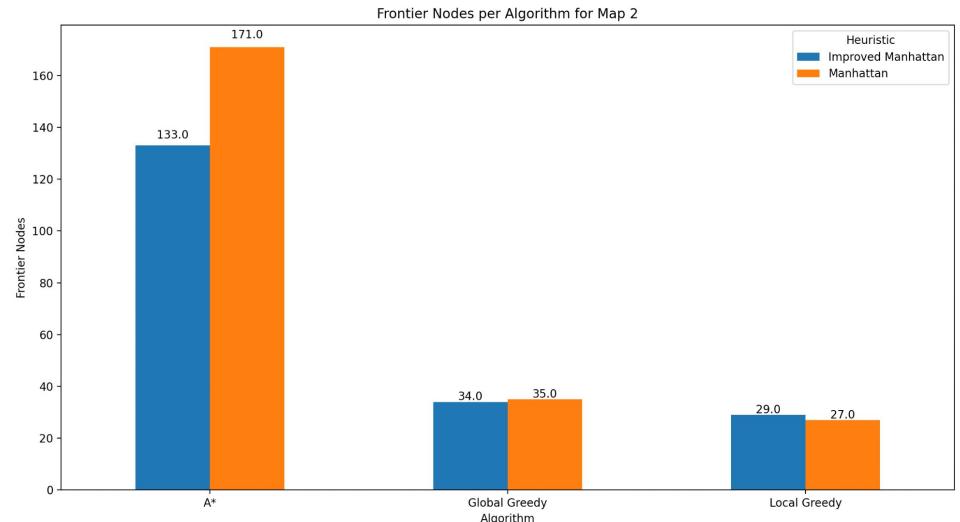
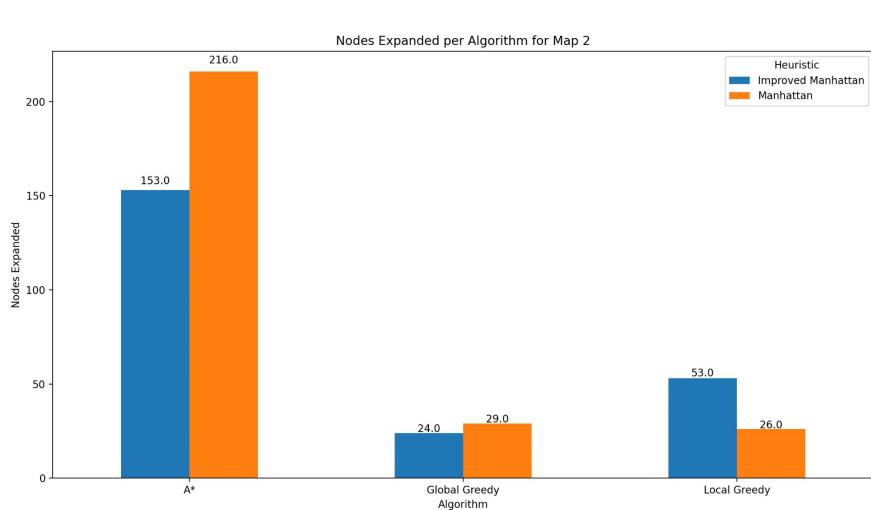
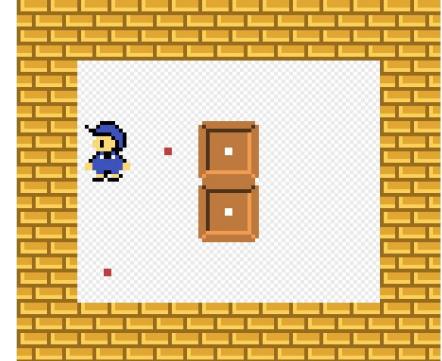


Costo vs Duración - Mapa 2



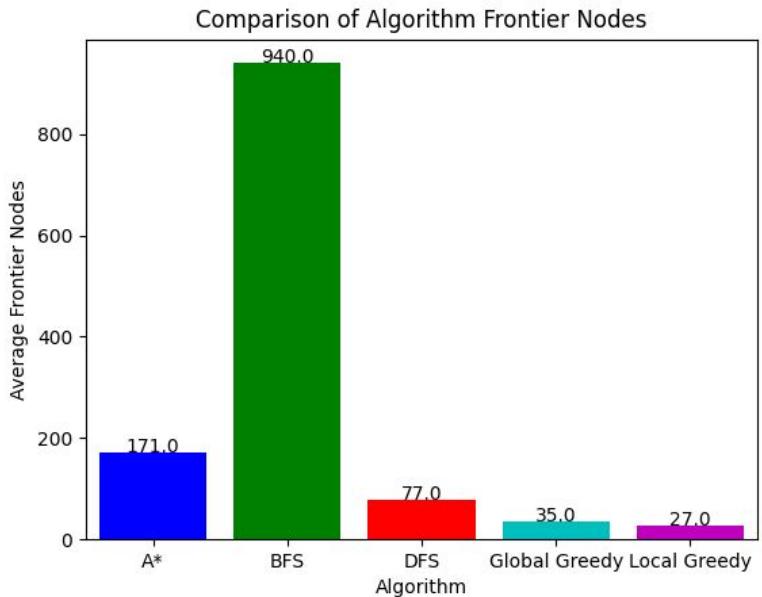
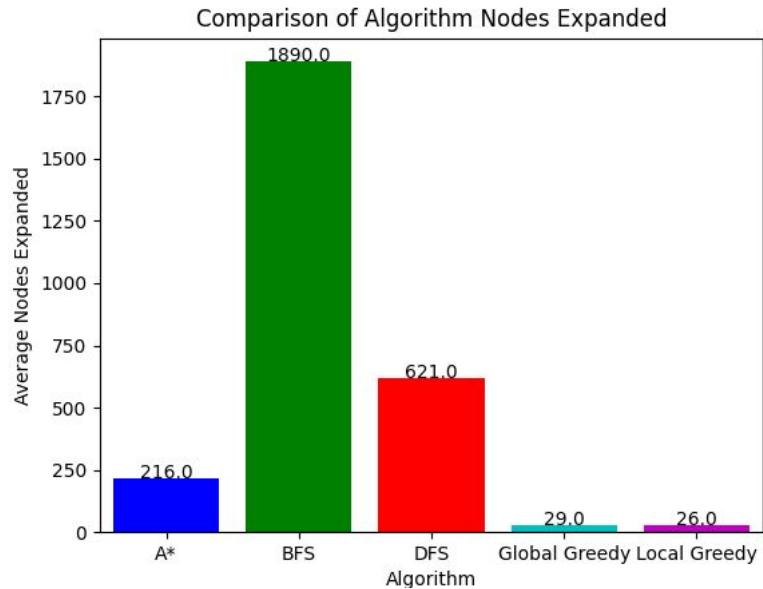


Nodos expandidos vs frontera - Mapa 2



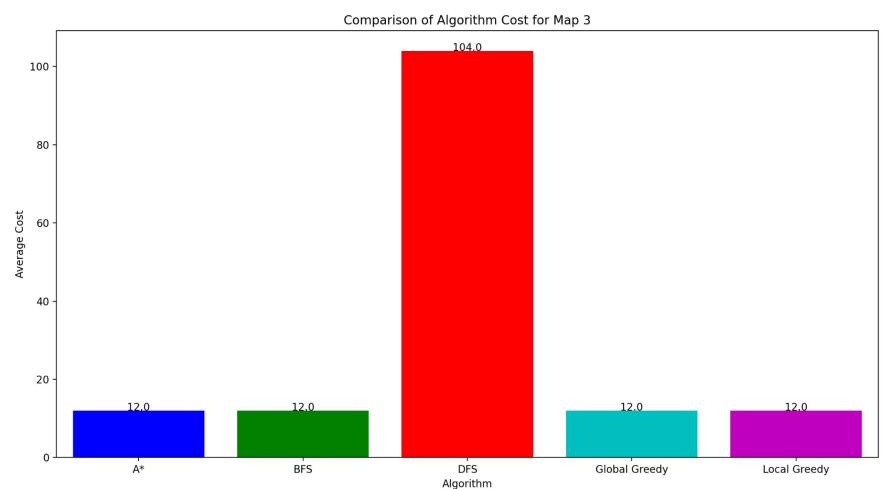
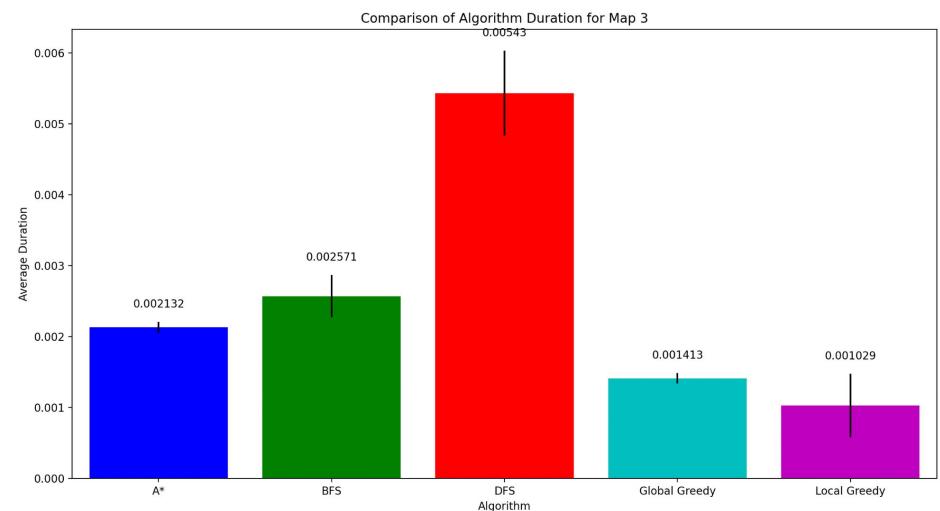
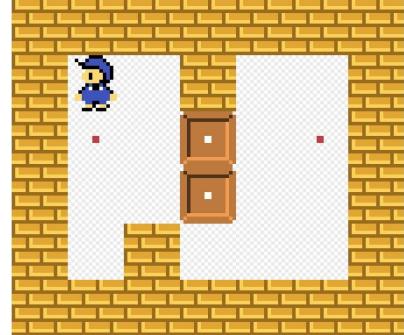


Nodos expandidos vs frontera - Mapa 2



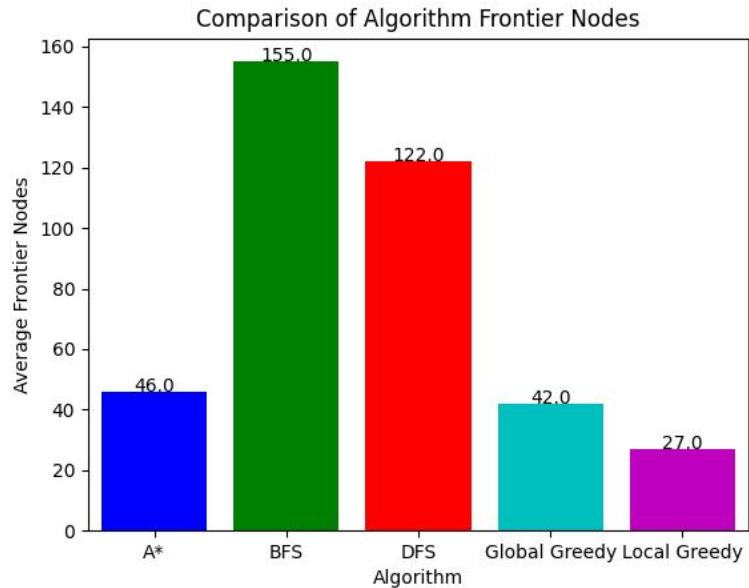
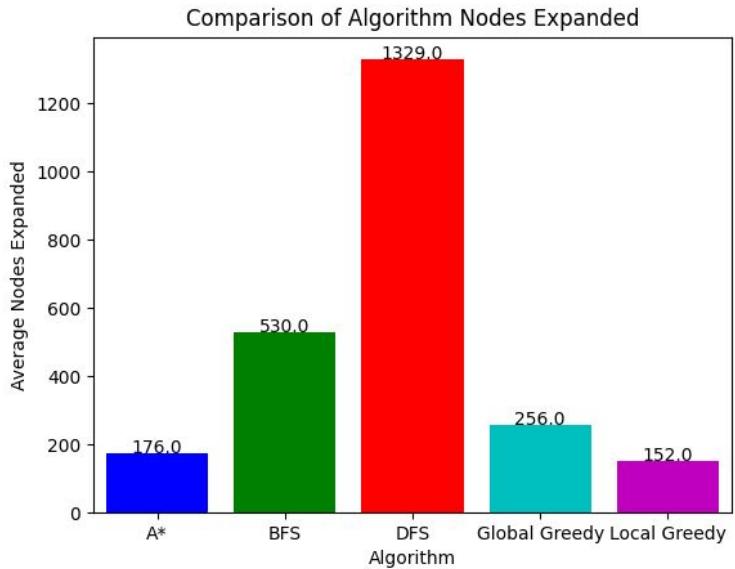
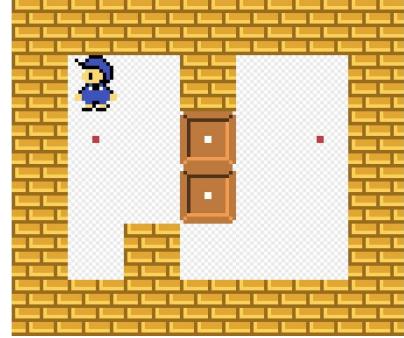


Costo vs Duración - Mapa 3



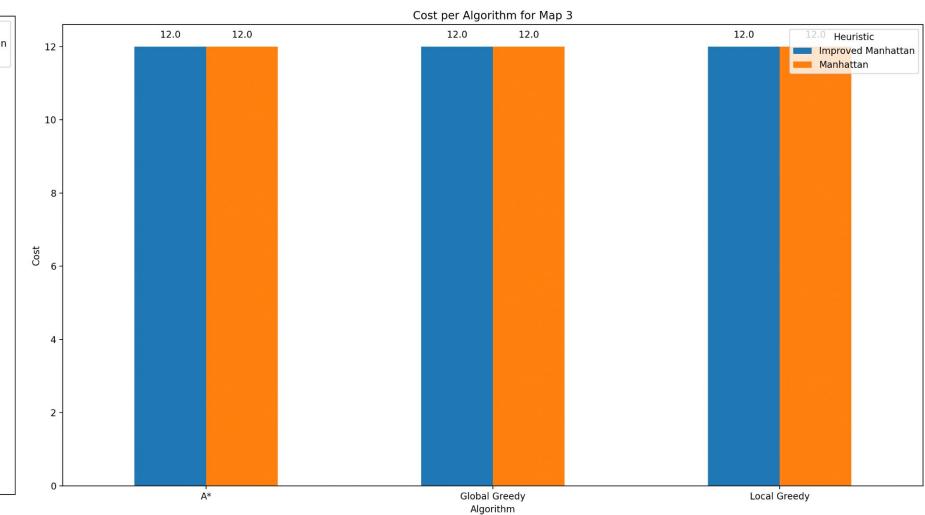
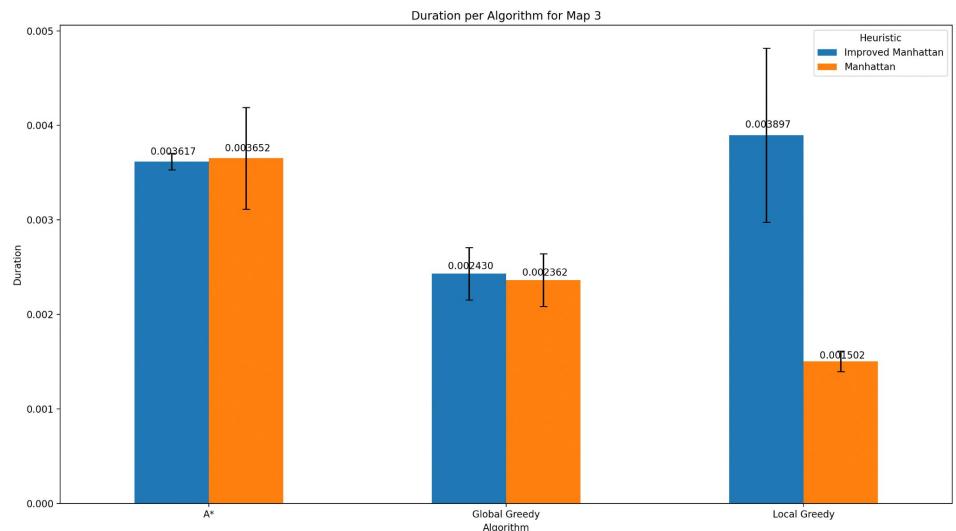
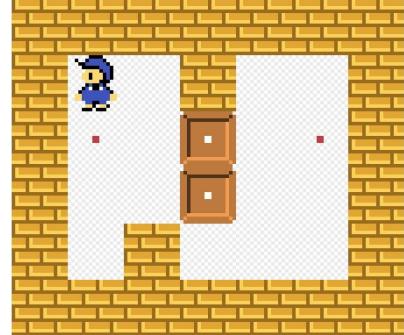


Nodos expandidos vs frontera - Mapa 3



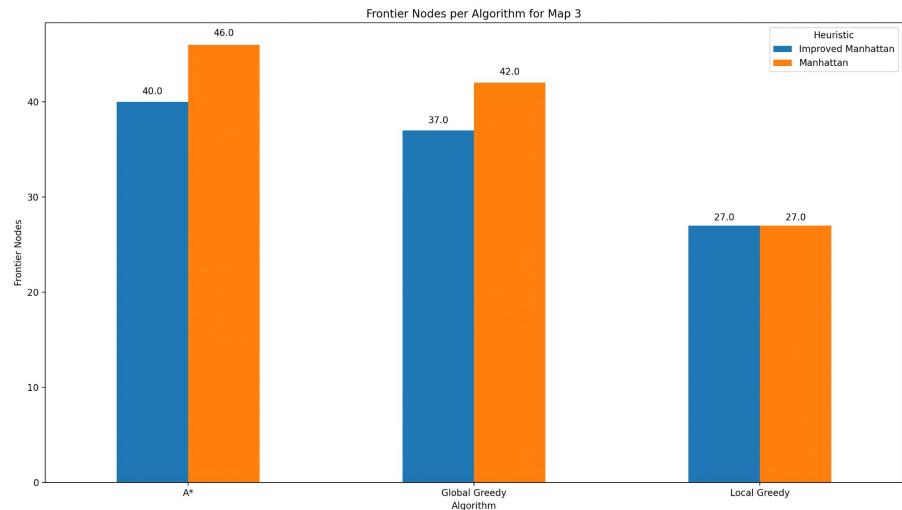
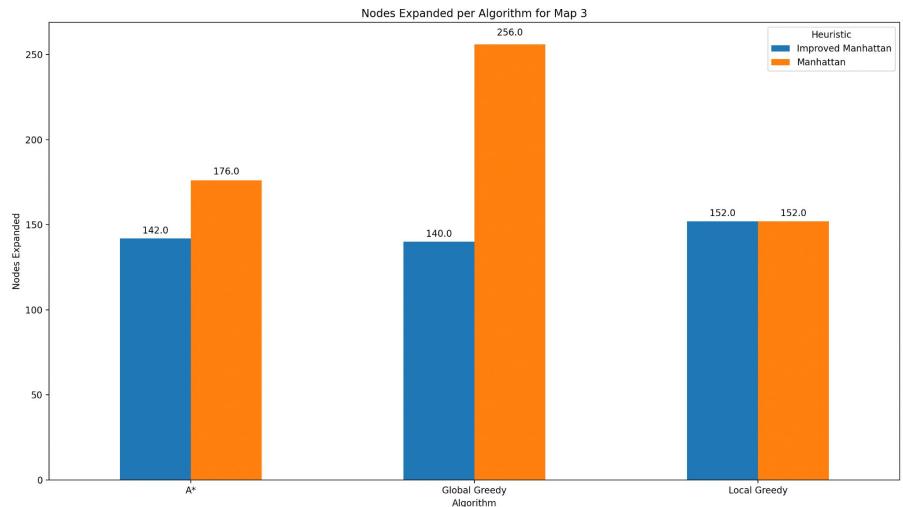
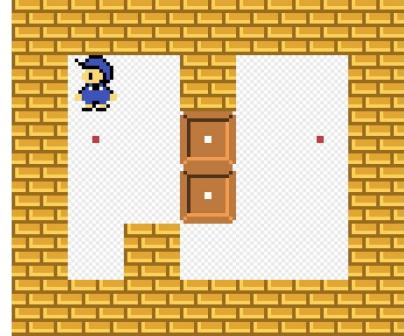


Costo vs Duración - Mapa 3



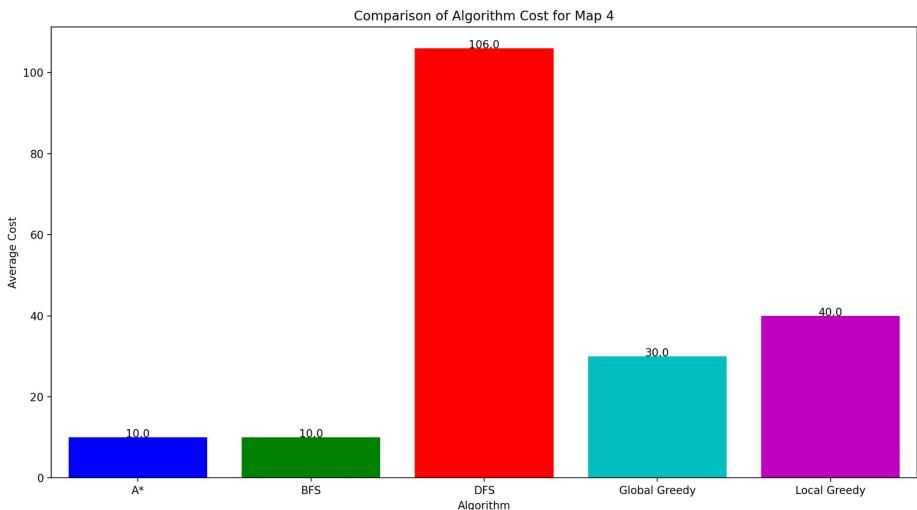
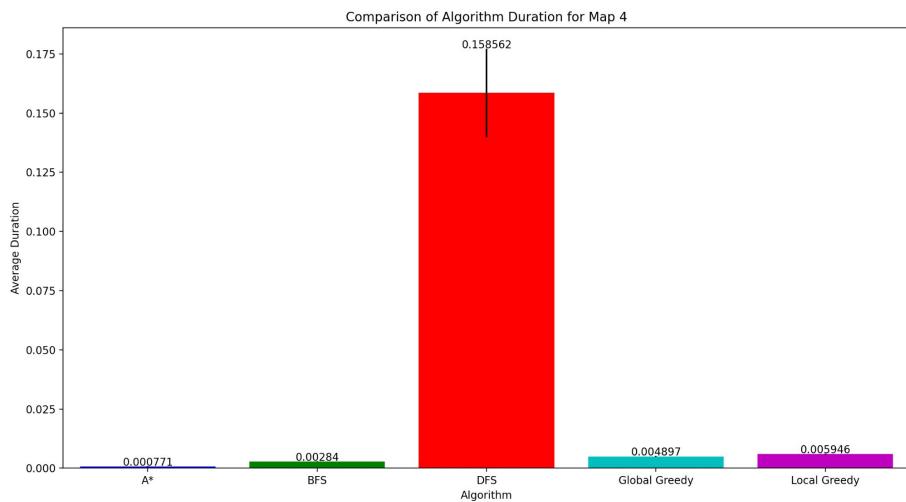
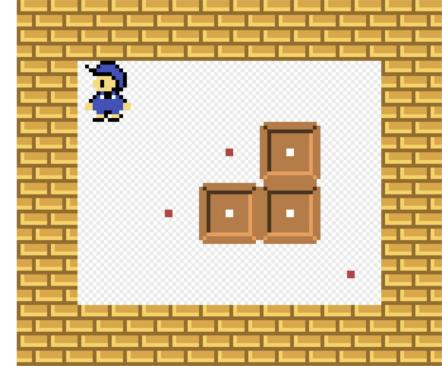


Nodos expandidos vs frontera - Mapa 3



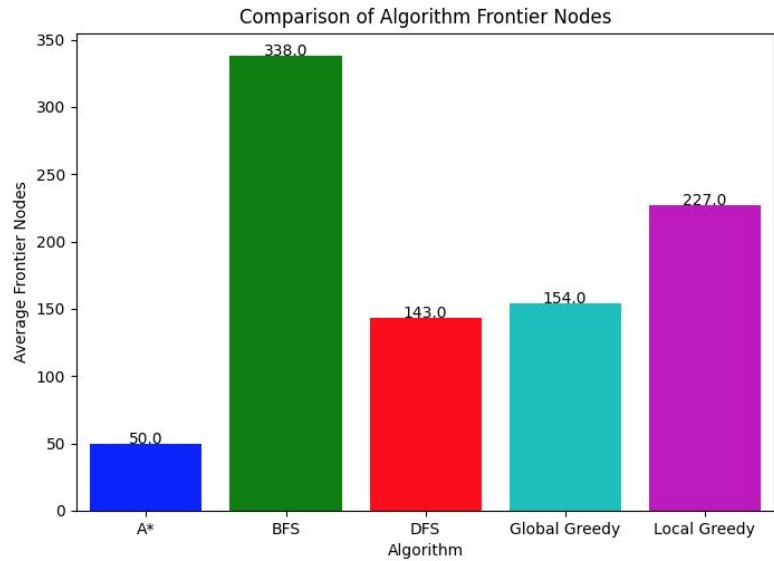
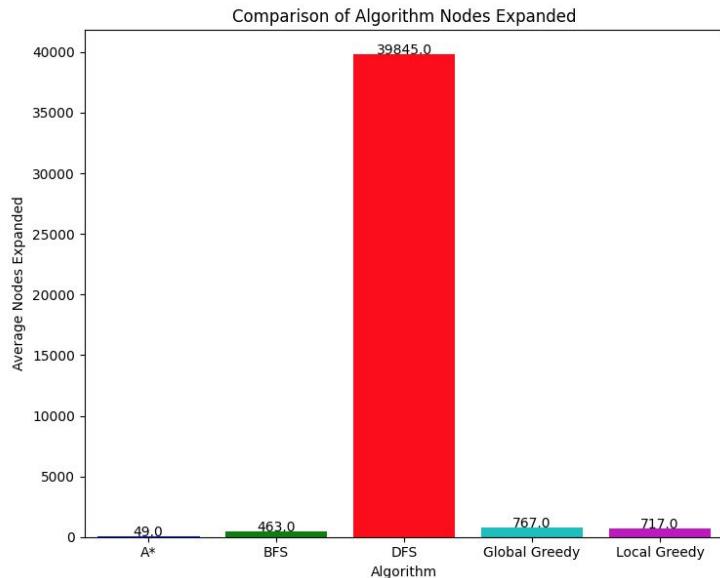
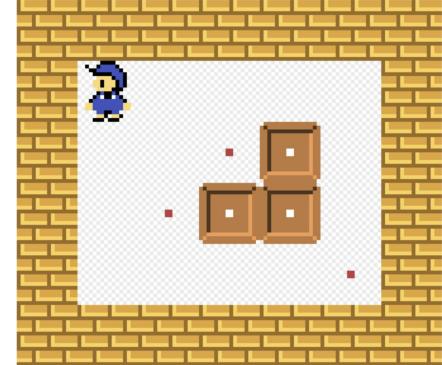


Costo vs Duración - Mapa 4



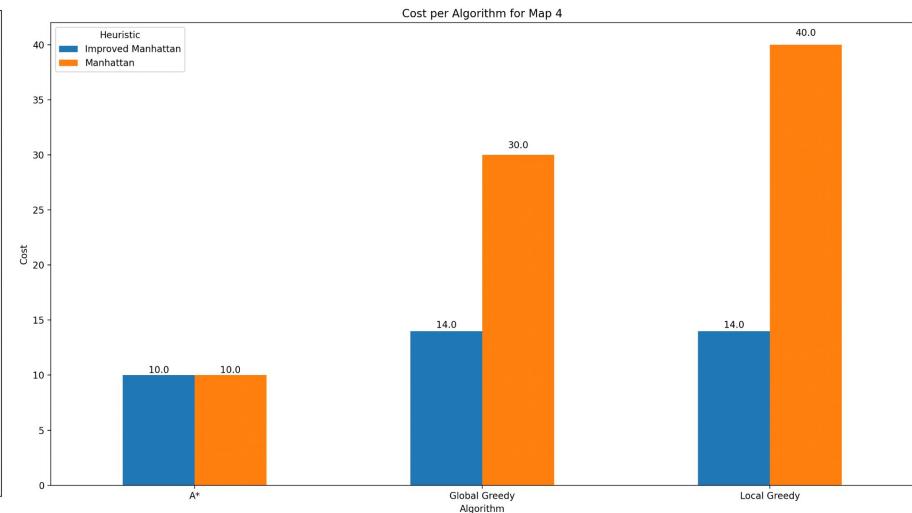
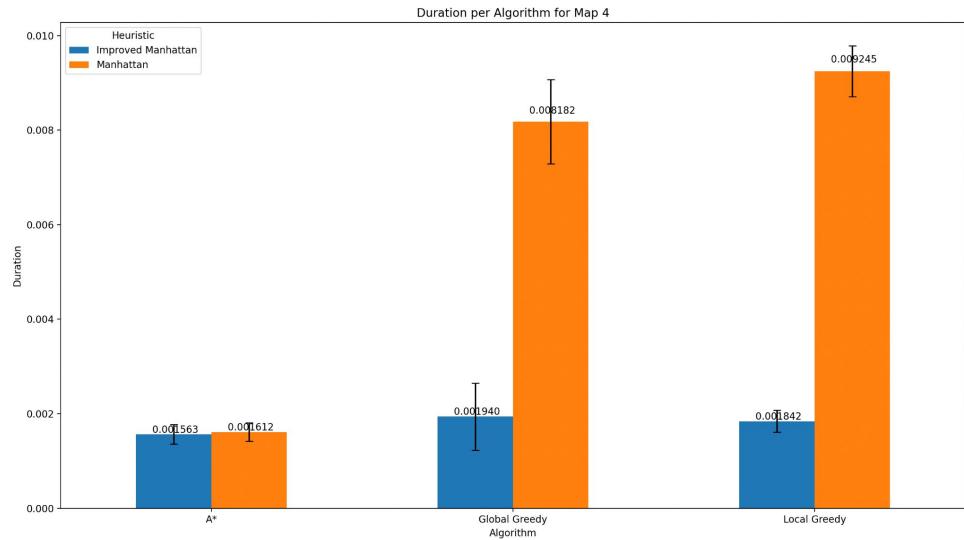
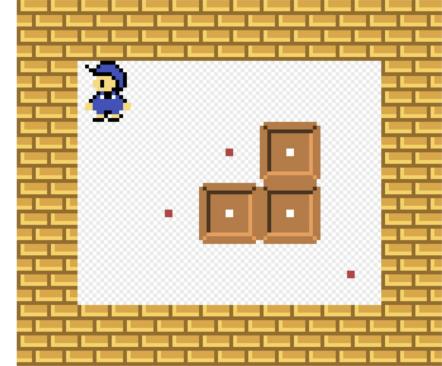


Nodos expandidos vs frontera - Mapa 4



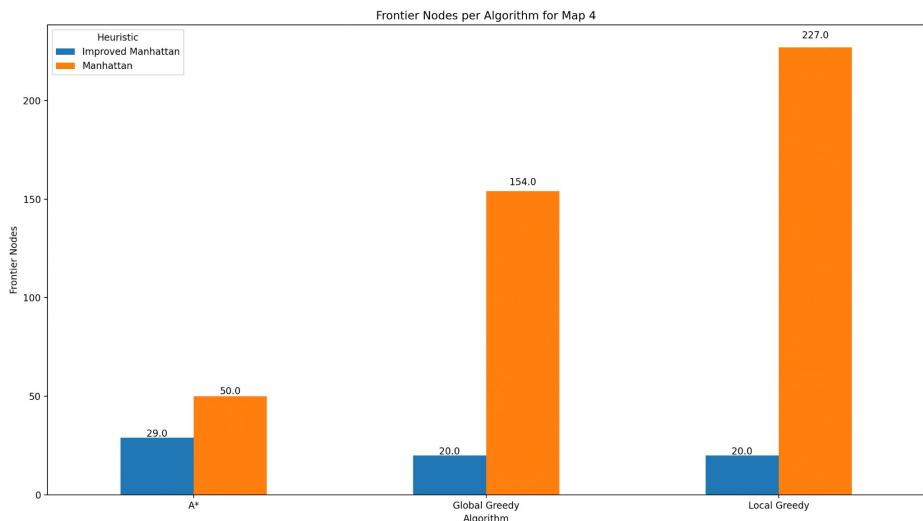
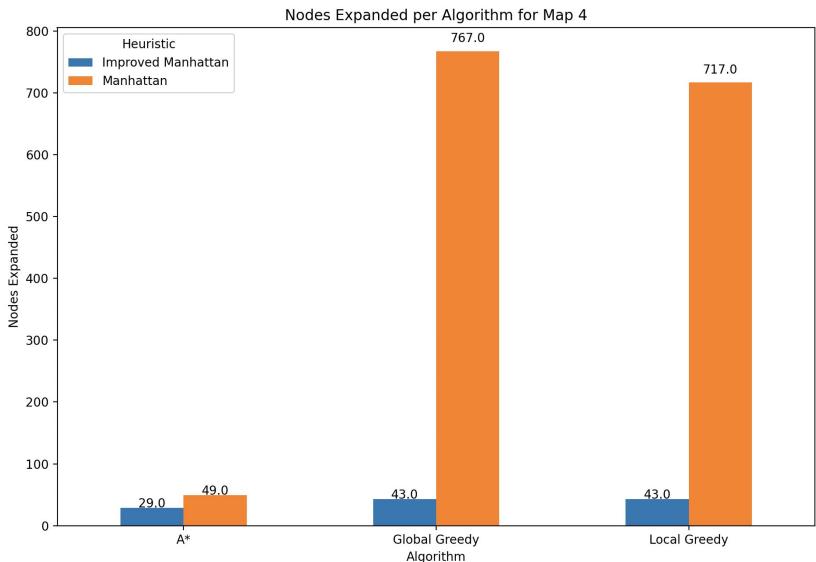
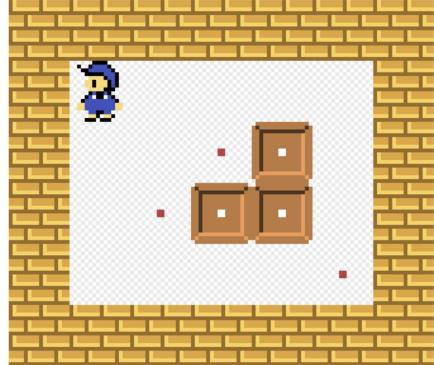


Costo vs Duración - Mapa 4



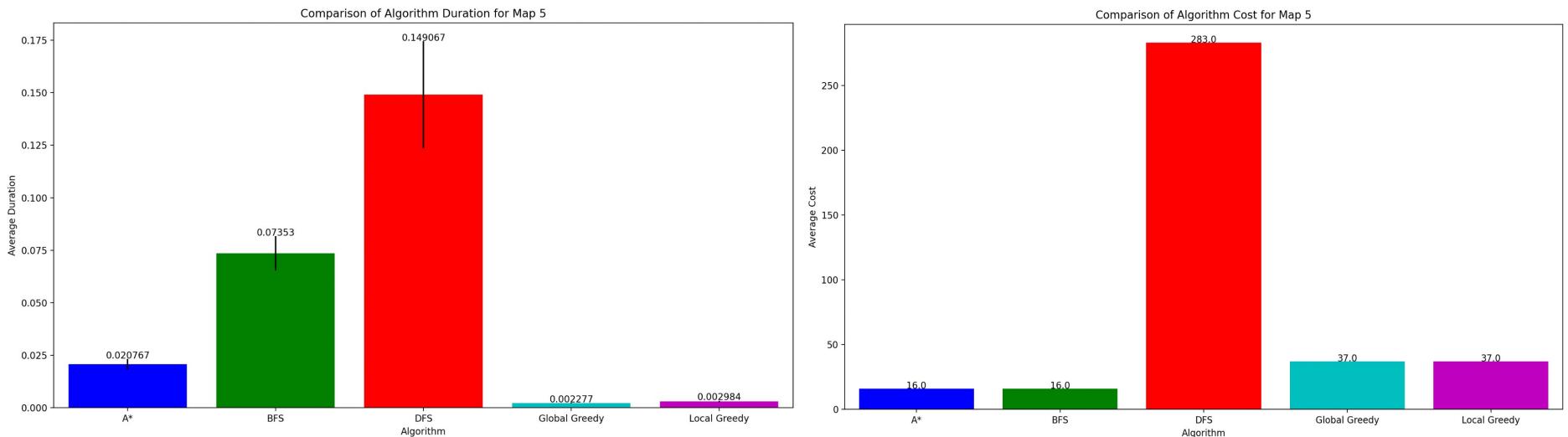
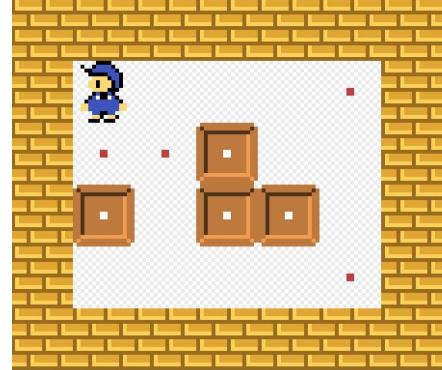


Nodos expandidos vs frontera - Mapa 4



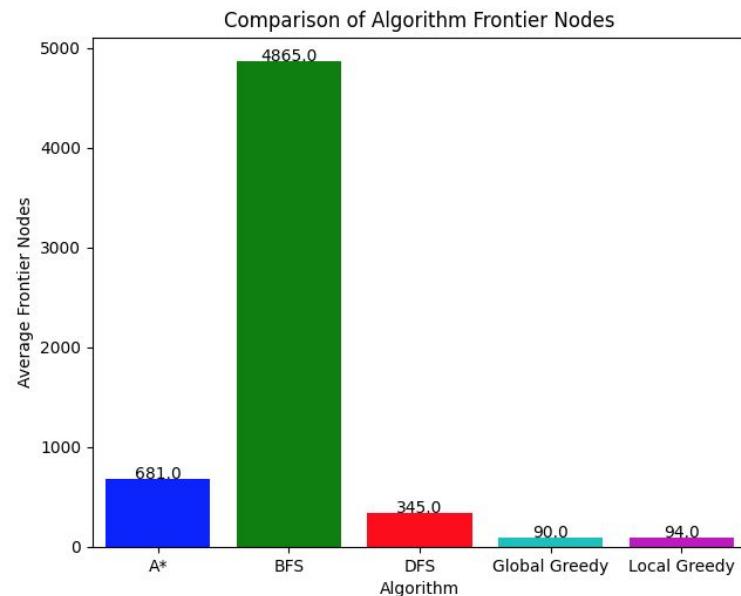
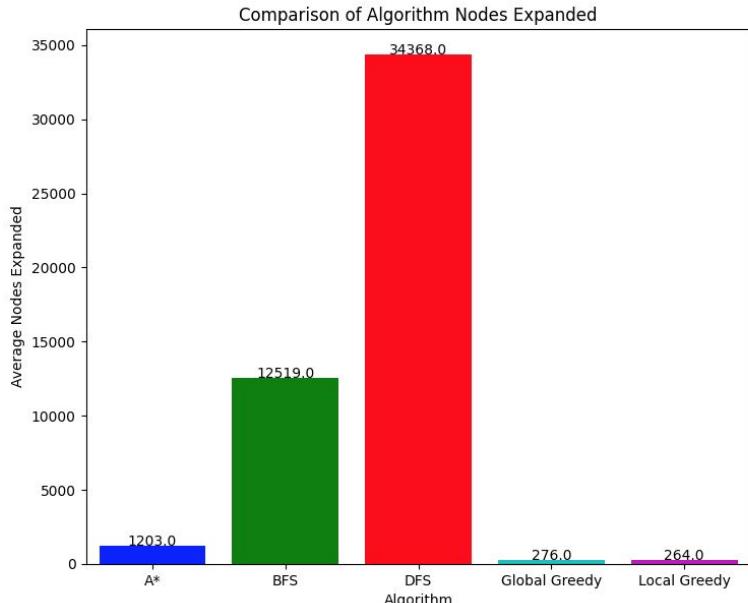
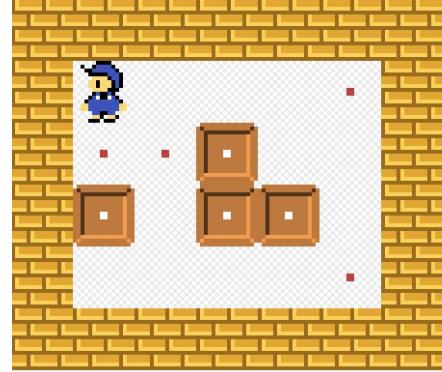


Costo vs Duración - Mapa 5



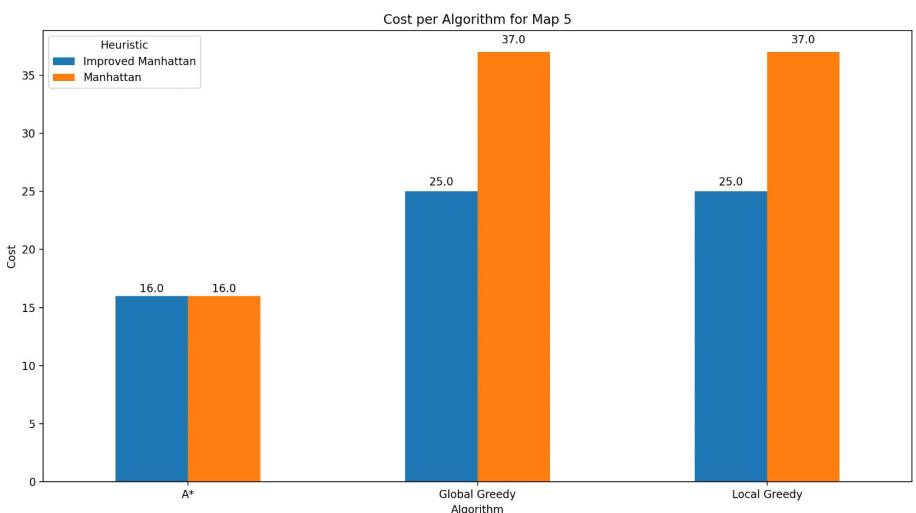
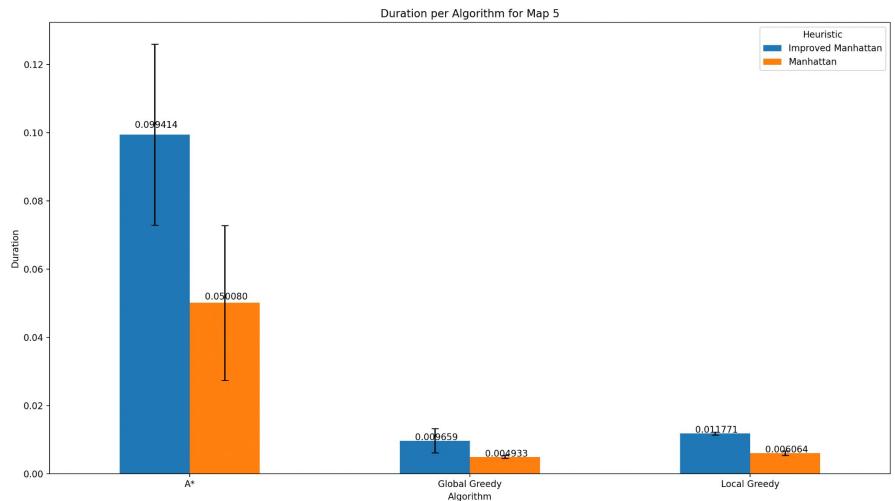
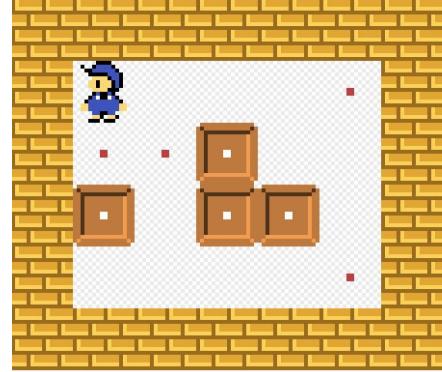


Nodos expandidos vs frontera - Mapa 5



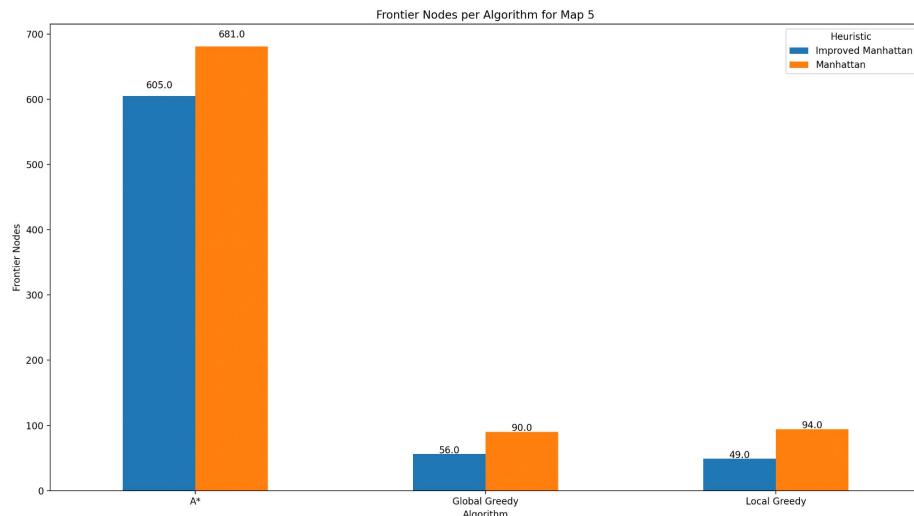
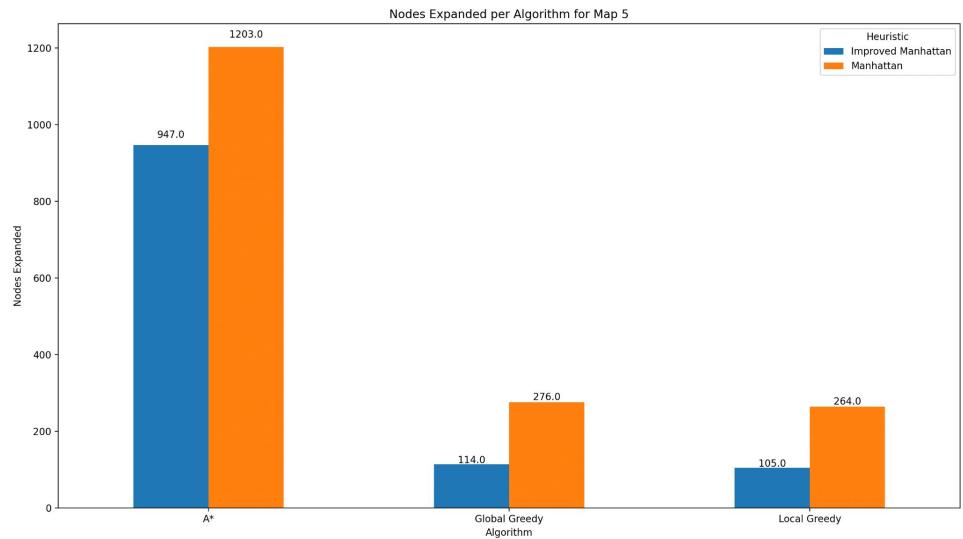
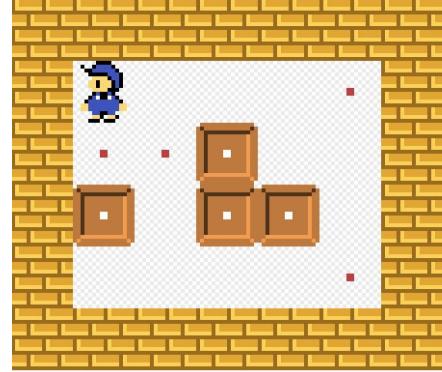


Costo vs Duración - Mapa 5



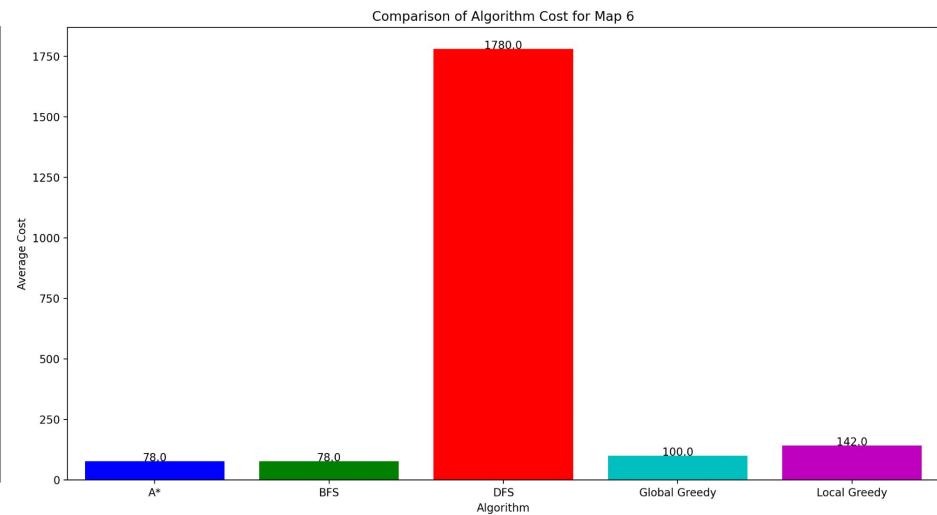
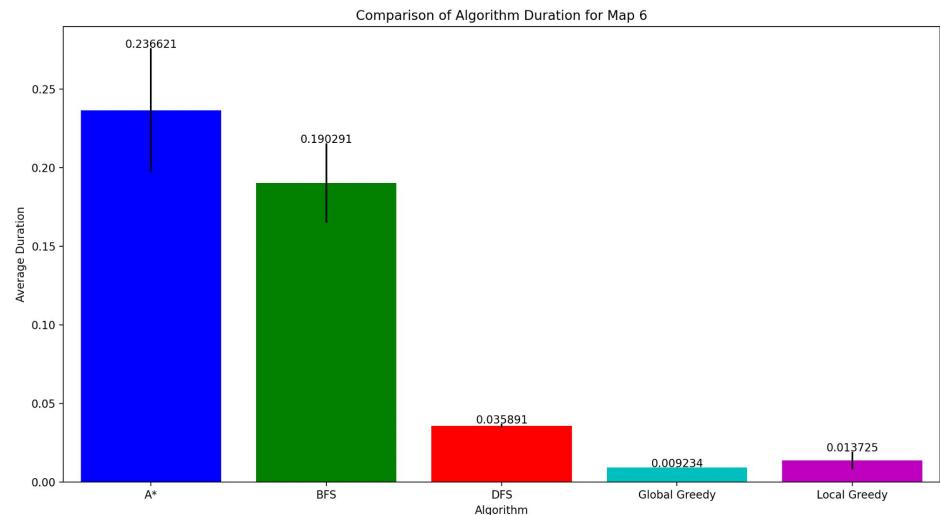
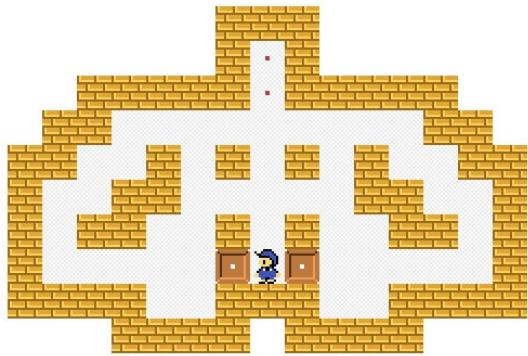


Nodos expandidos vs frontera - Mapa 5



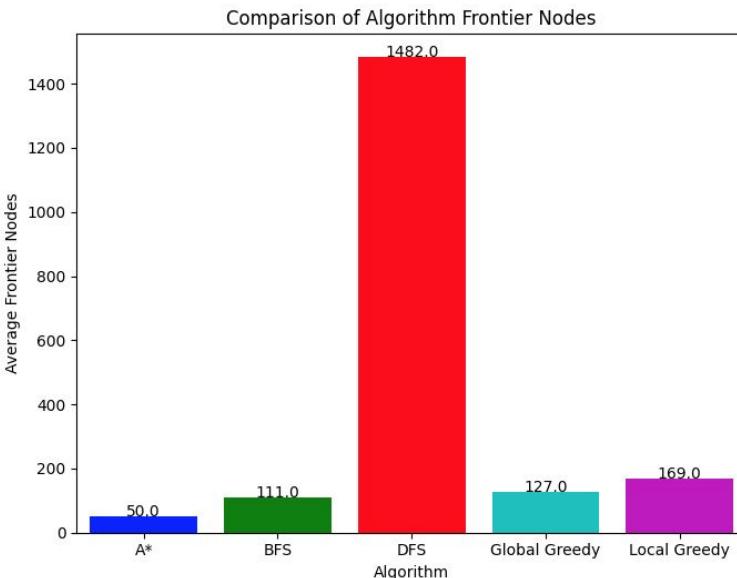
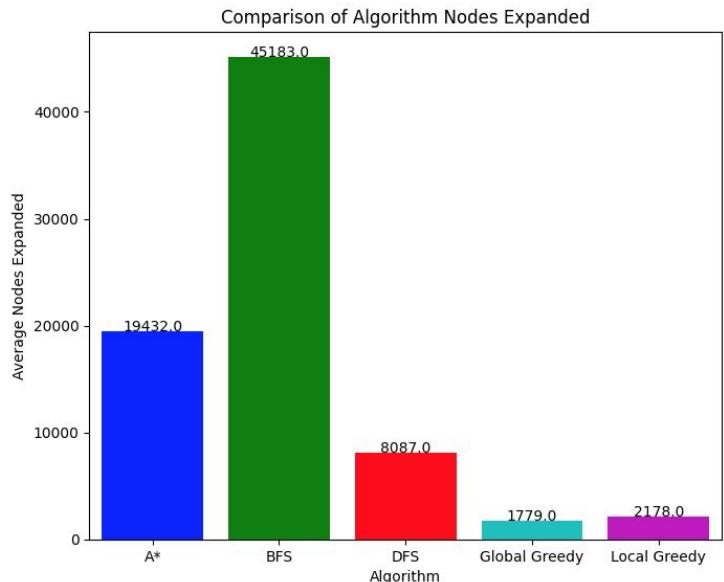
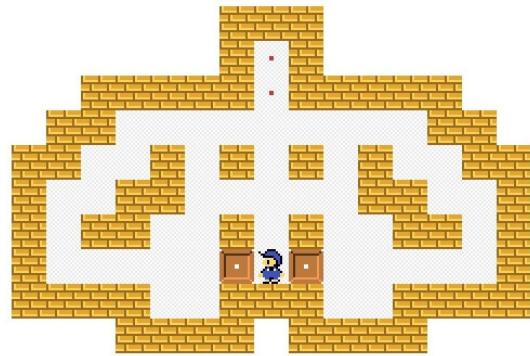


Costo vs Duración - Mapa 6



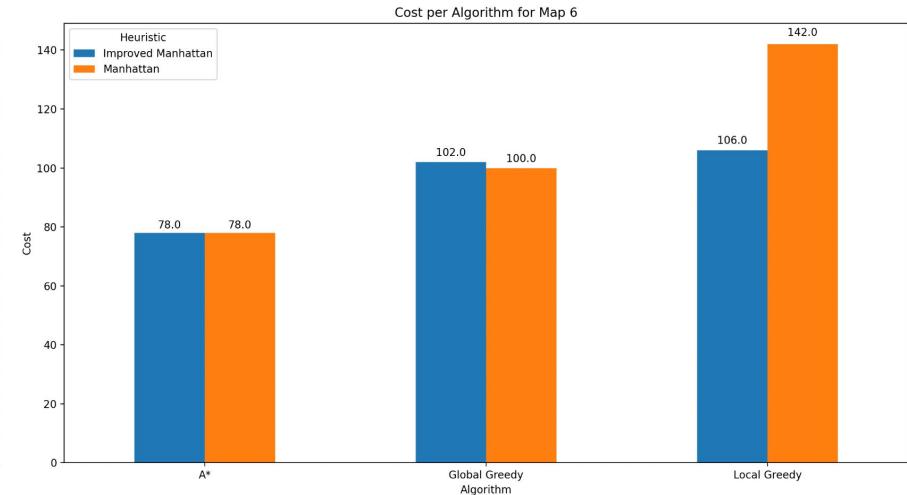
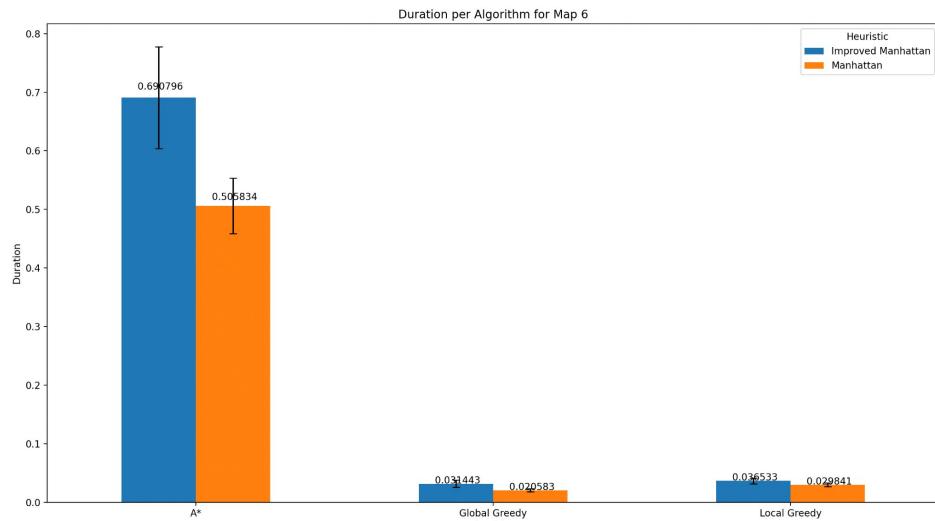
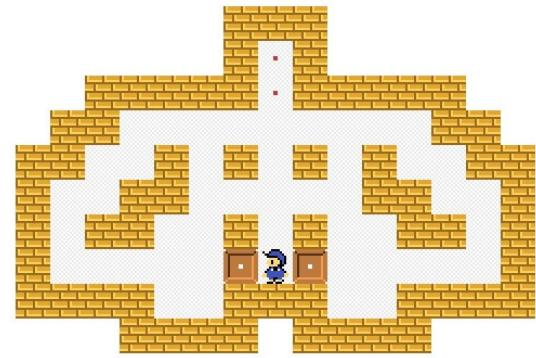


Nodos expandidos vs frontera - Mapa 6



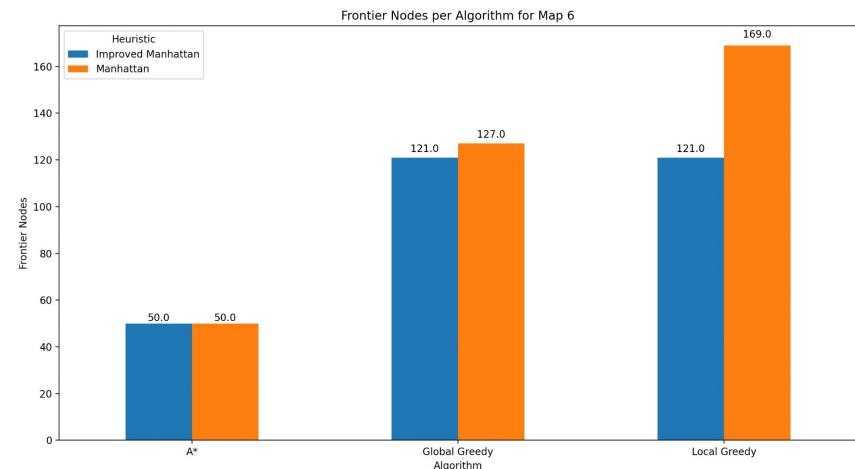
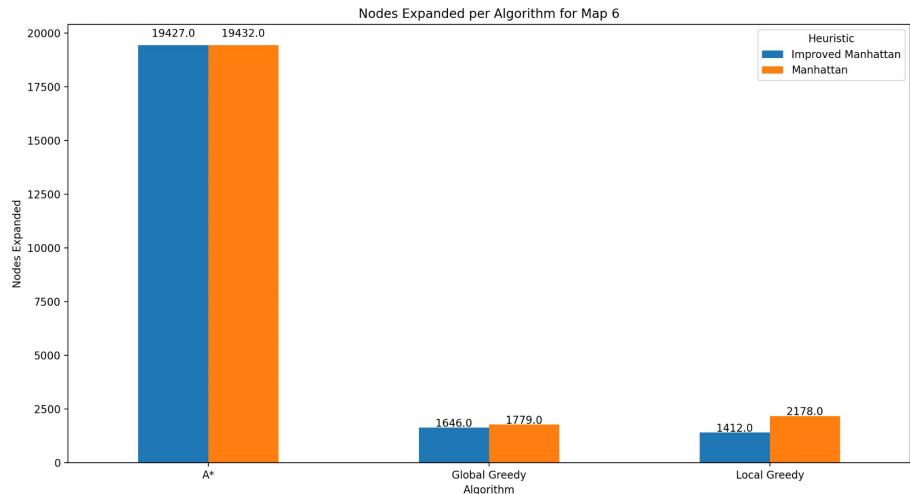


Costo vs Duración - Mapa 6



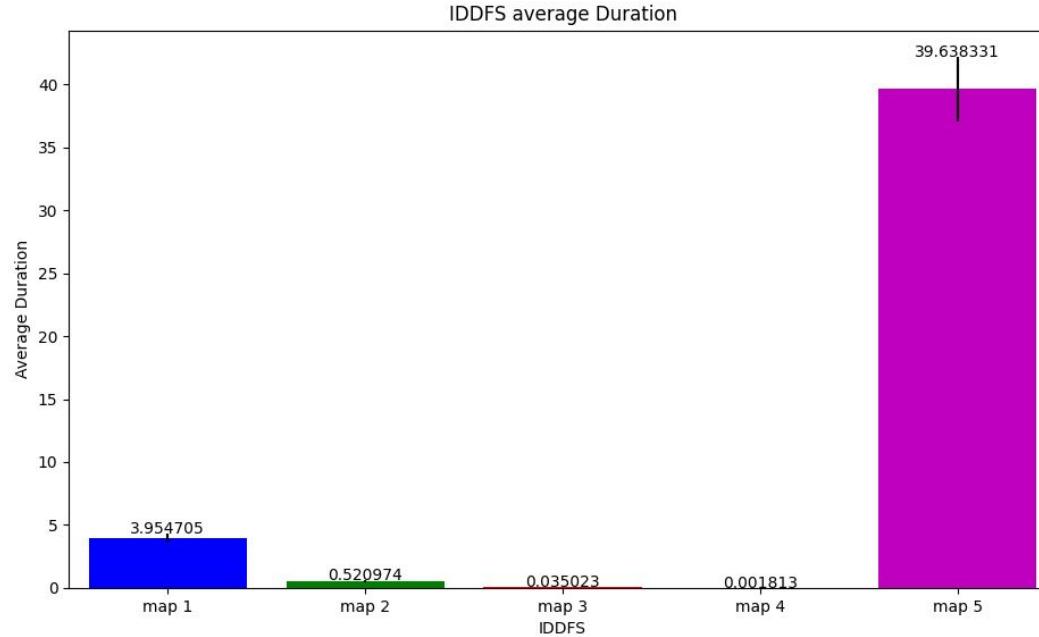


Nodos expandidos vs frontera - Mapa 6





Costo vs Duración (IDDFS)



Costo de la solución óptima: 14 11 12 10 16

Gracias!