

TP2

Algoritmos Genéticos

72.27 - Sistemas de Inteligencia Artificial

Genotipo

Height	Strength	Agility	Expertise	Resistance	Health
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Cruce

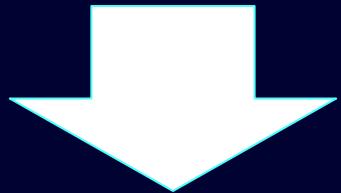
	Height	Strength	Agility	Expertise	Resistance	Health
p1	1.8	35	35	35	35	10
p2	1.5	10	20	30	40	50



c1	1.8	35	35	30	40	50
c2	1.5	10	20	35	35	10

Mutación

	Height	Strength	Agility	Expertise	Resistance	Health
c1	1.8	35	35	30	40	50



c1'	1.8	35	75	30	40	50
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22.82608696, 48.91304348,
19.56521739, 26.08695652,
32.60869565]

Normalización

	Height	Strength	Agility	Expertise	Resistance	Health
c1'	1.8	35	75	30	40	50

$$35 + 75 + 30 + 40 + 50 = 230 \neq 150$$

22.82608696, 48.91304348,
19.56521739, 26.08695652,
32.60869565]

Normalización

	Height	Strength	Agility	Expertise	Resistance	Health
c1'	1.8	35	75	30	40	50

$$a_i'' = a_i' * 150 / \sum(a_j')$$



c1''	1.8	22.83	48.91	19.56	26.09	32.61
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$$22.83 + 48.91 + 19.56 + 26.09 + 32.61 = 150$$

Objetivo

Lograr el mejor fitness.

En caso de fitness similar, se consideran la cantidad de generaciones.

Método de análisis

Trabajando con 25 individuos (que se eligen al principio de cada sección):

1. Elegir mejor método de cruce **C**
2. Elegir mejor método de mutación **M(f)**, fijando **C**
3. Elegir los 2 mejores métodos de selección, **S1 y S2**, fijando **C** y **M(f)**
4. Elegir el mejor método de reemplazo **R**, fijando **C** y **M(f)**, **S1** y **S2**
5. Elegir los 2 mejores métodos de selección en reemplazo, **S3 y S4**, fijando **C**, **M(f)**, **S1** y **S2**, **R**
6. Elegir el mejor método de corte **SC**, fijando **C**, **M(f)**, **S1** y **S2**, **R**, **S3** y **S4**

Siempre se trabajará con 50 iteraciones

Crossover Warrior

Condiciones

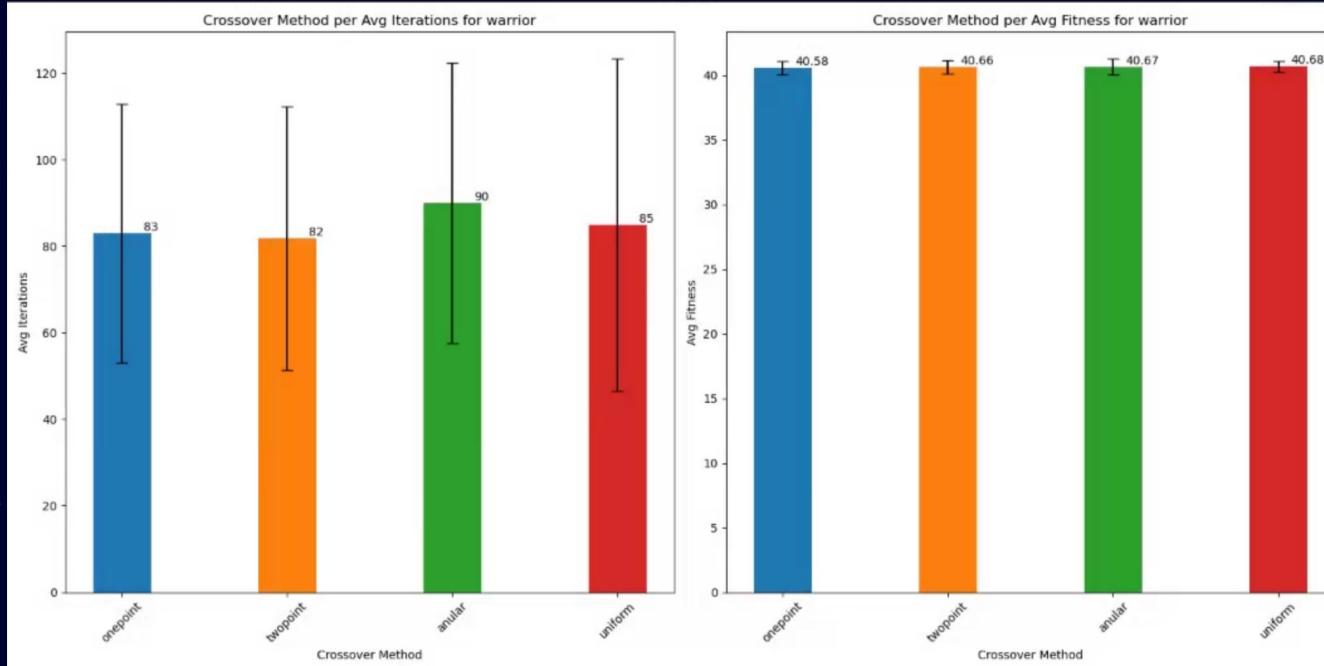
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10, 0.6)

Mutacion: multigen (uniform)

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Crossover Archer

Condiciones

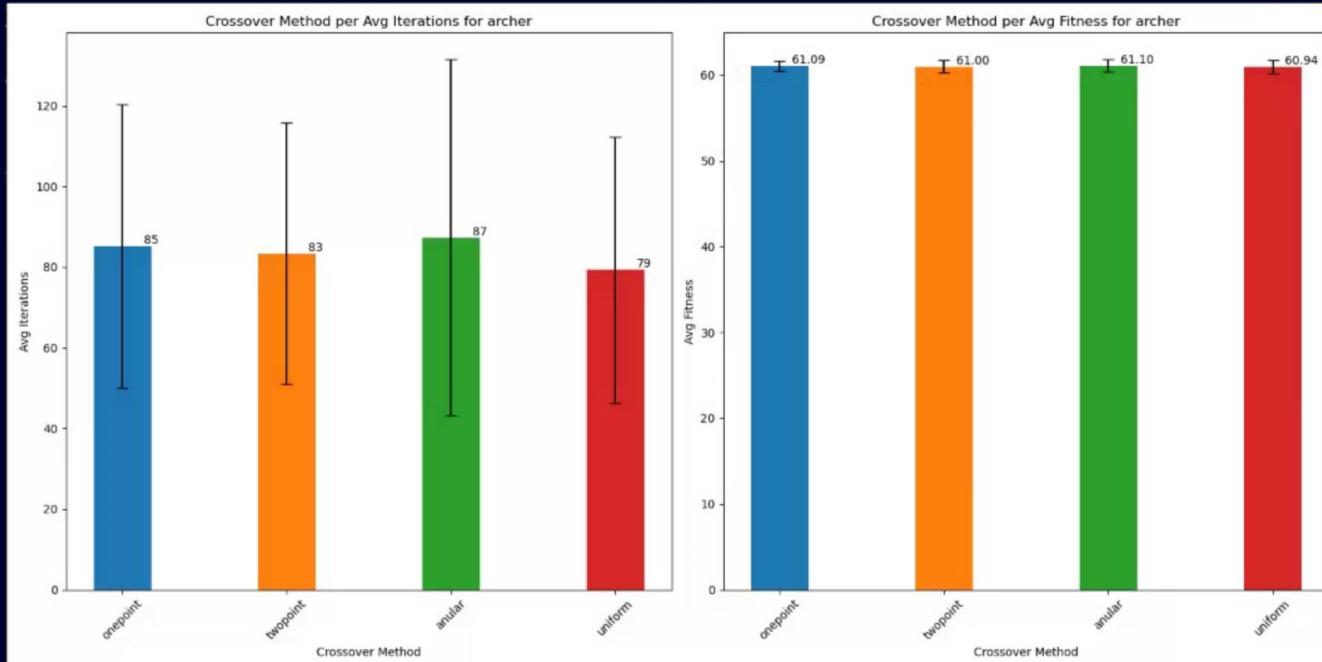
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10. 0.6)

Mutacion: multigen (uniform)

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Crossover Defender

Condiciones

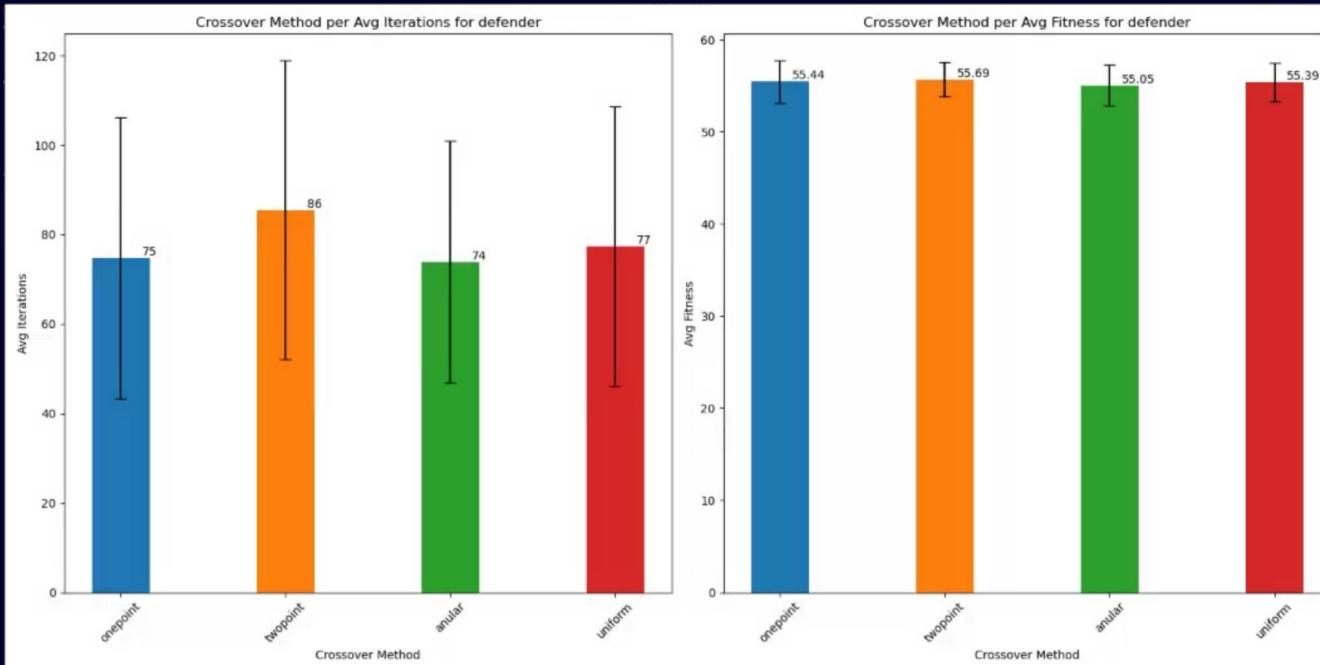
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10, 0.6)

Mutación: multigen (uniform)

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Crossover Infiltrate

Condiciones

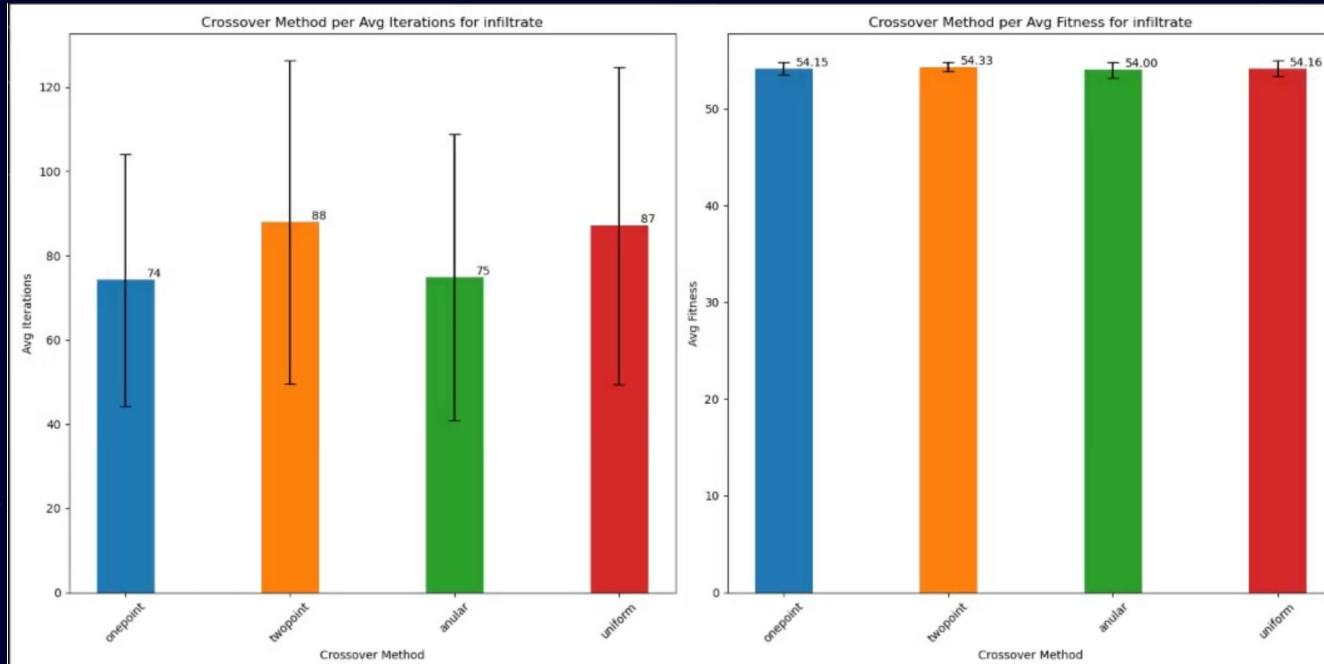
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10. 0.6)

Mutacion: multigen (uniform)

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Crossover

Promedio

Condiciones

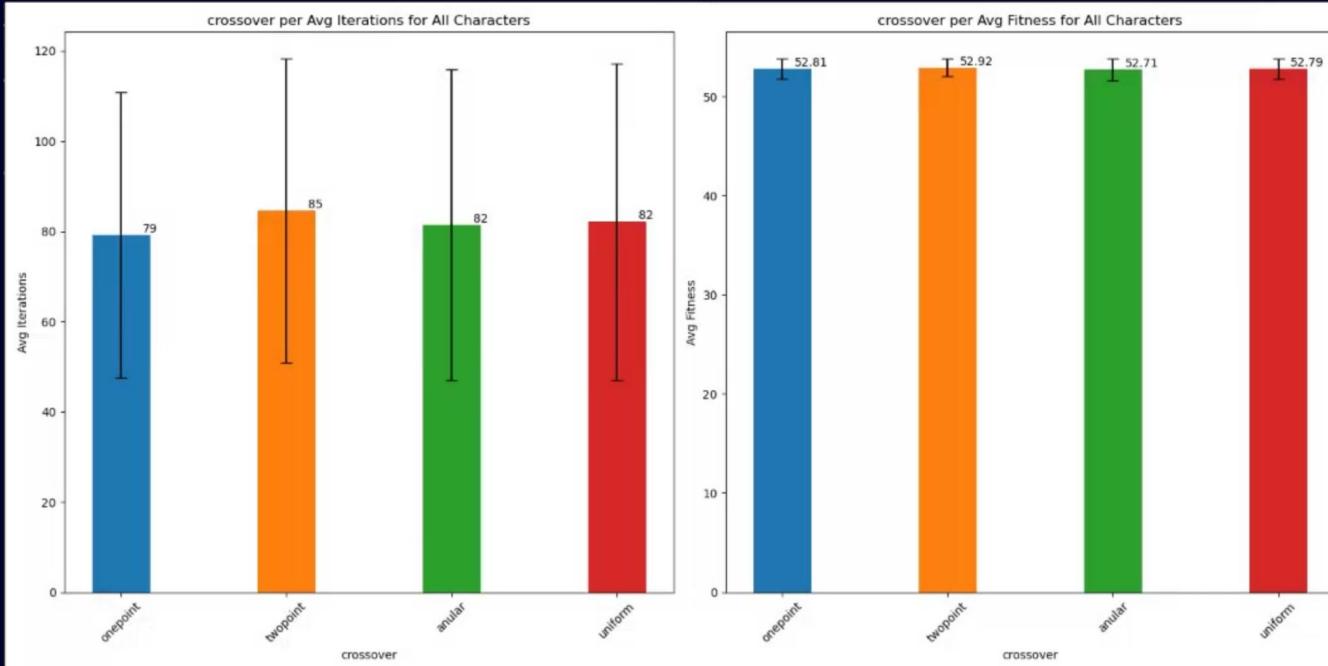
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10, 0.6)

Mutación: multigen (uniform)

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Crossover

Mejor método



ONE POINT

(aunque la verdad son todos más o menos iguales)



Mutación Warrior

Condiciones

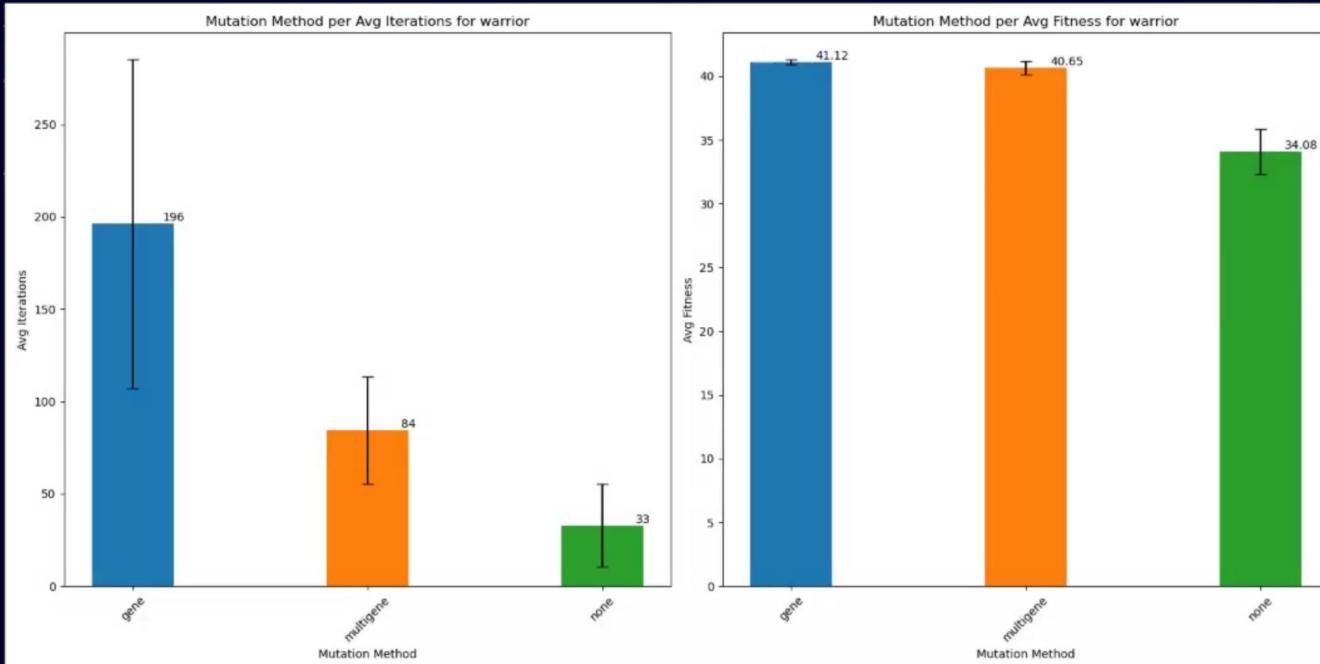
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Mutación Archer

Condiciones

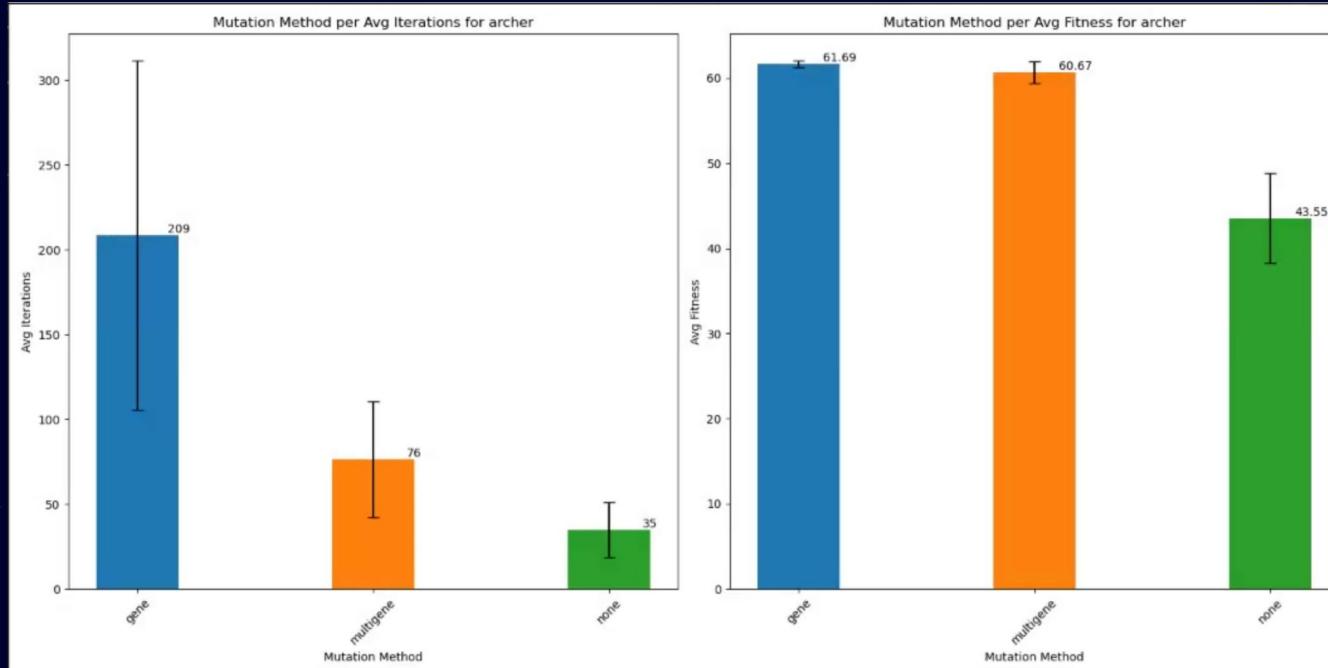
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Mutación Defender

Condiciones

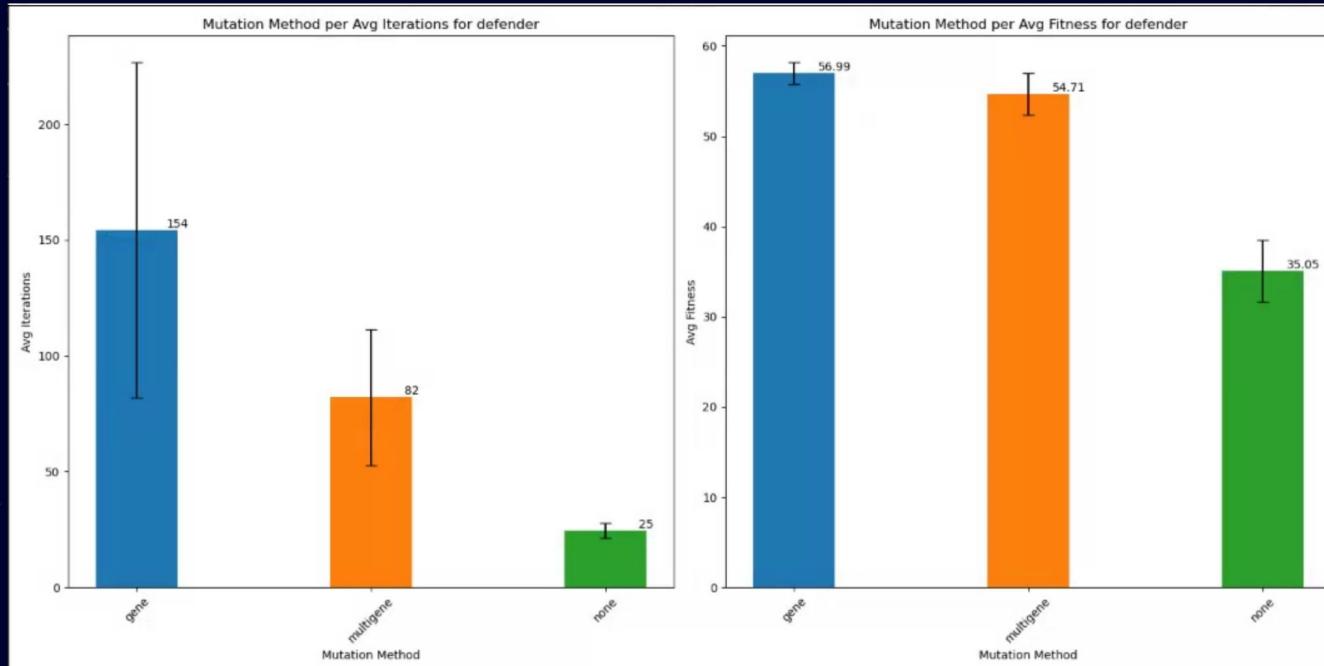
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Mutación Infiltrate

Condiciones

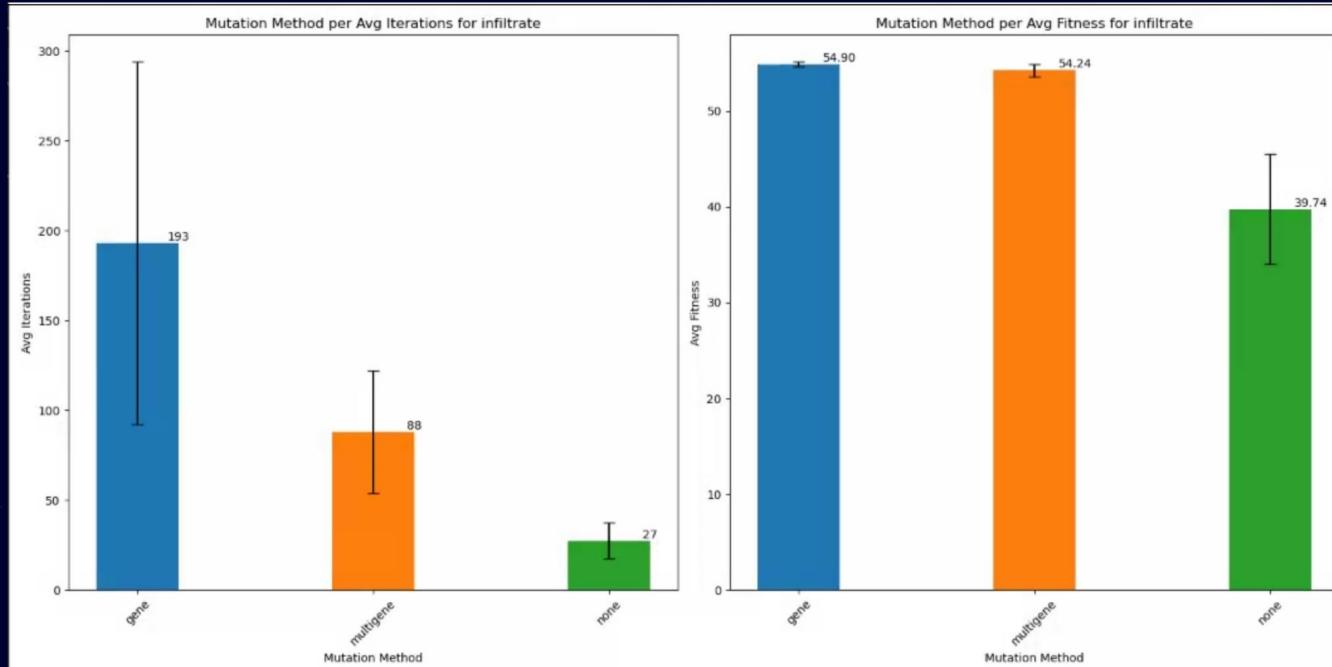
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Mutación

Promedio

Condiciones

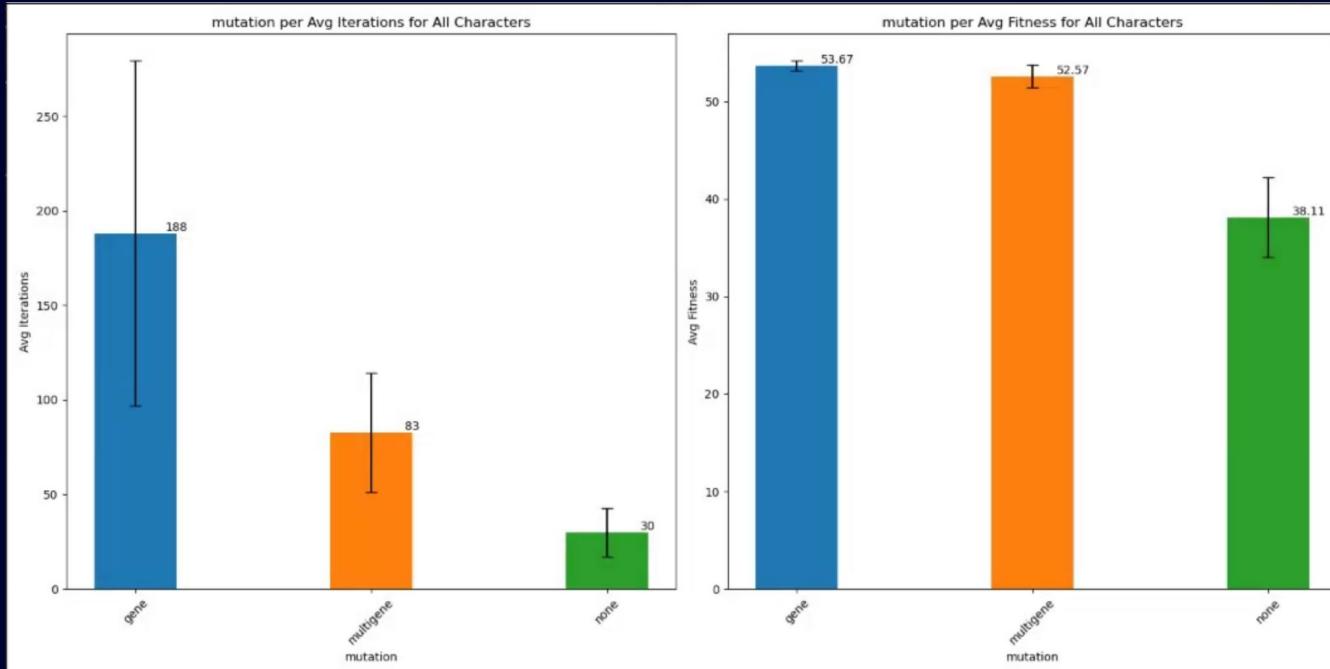
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Mutación

Mejor método



MULTIGENE
¿Uniform?



Mutación

Funciones de mutación

$F: N \rightarrow [0;1]$

$\text{Uniform}(i) = p$, con p constante

$\text{Random}(i) = \text{random}(0;1)$

$\text{Decrease}(i) = 1 / (i+1)$

$\text{Increase}(i) = \min\{ 1 ; (i+1)/100 \}$

$\text{OscilatingIncrease}(i) = ((i+1) \% 100) / 100$

Función de mutación

Warrior

Condiciones

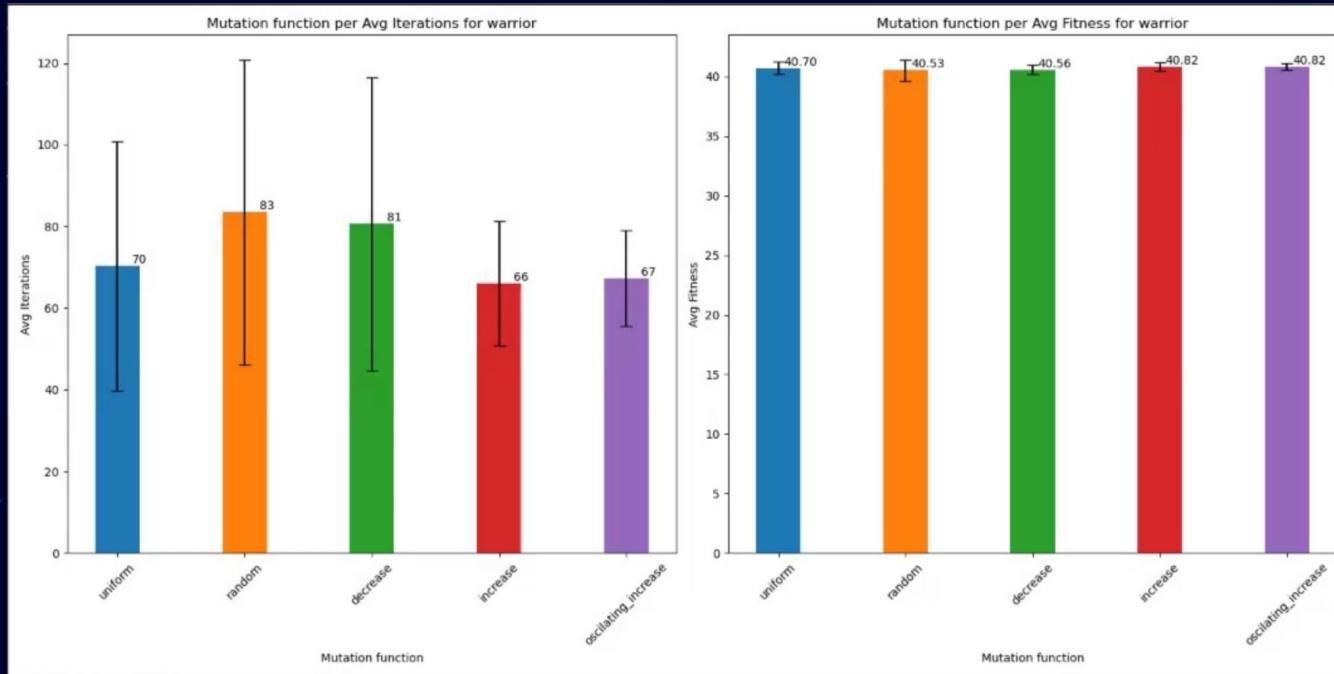
Población: 25 (20 padres elegidos en cada generación)

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{roulette}$

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Función de mutación

Archer

Condiciones

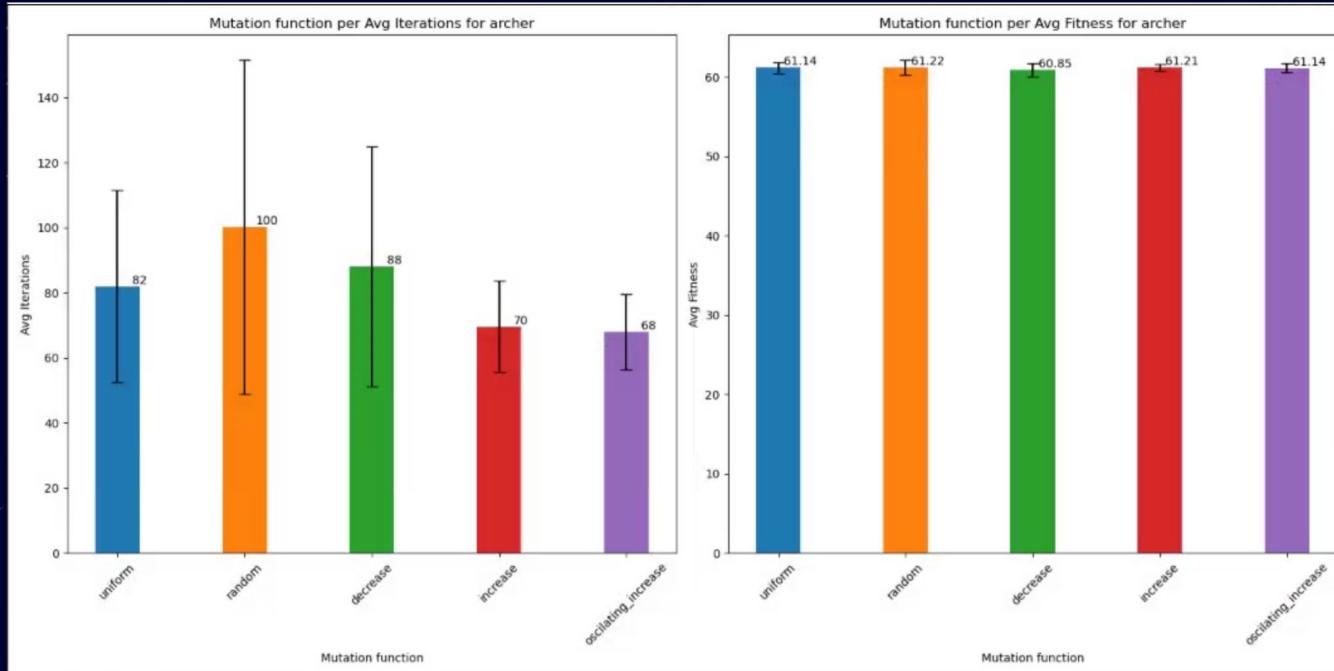
Población: 25 (20 padres elegidos en cada generación)

Selección: 0.5 * deterministic (0.4) + 0.5 * roulette

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - 0.5 * deterministic (0.4) + 0.5 * universal



Función de mutación

Defender

Condiciones

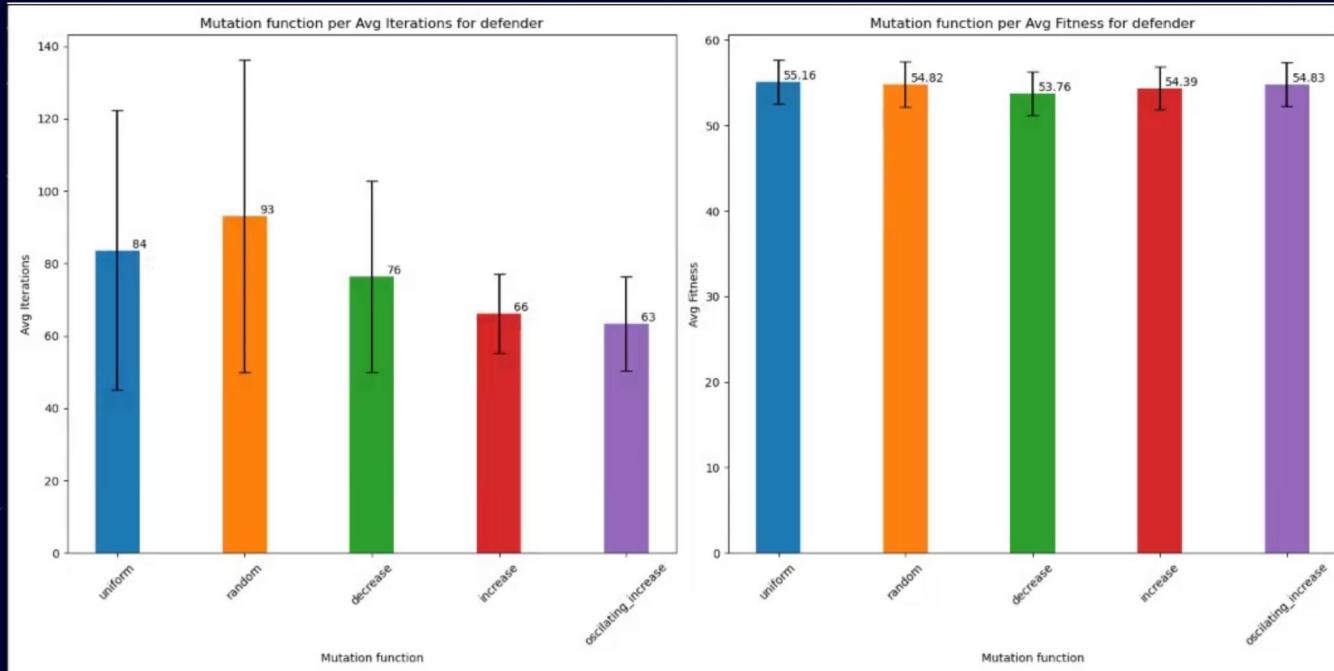
Población: 25 (20 padres elegidos en cada generación)

Selección: 0.5 * deterministic (0.4) + 0.5 * roulette

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - 0.5 * deterministic (0.4) + 0.5 * universal



Función de mutación

Infiltrate

Condiciones

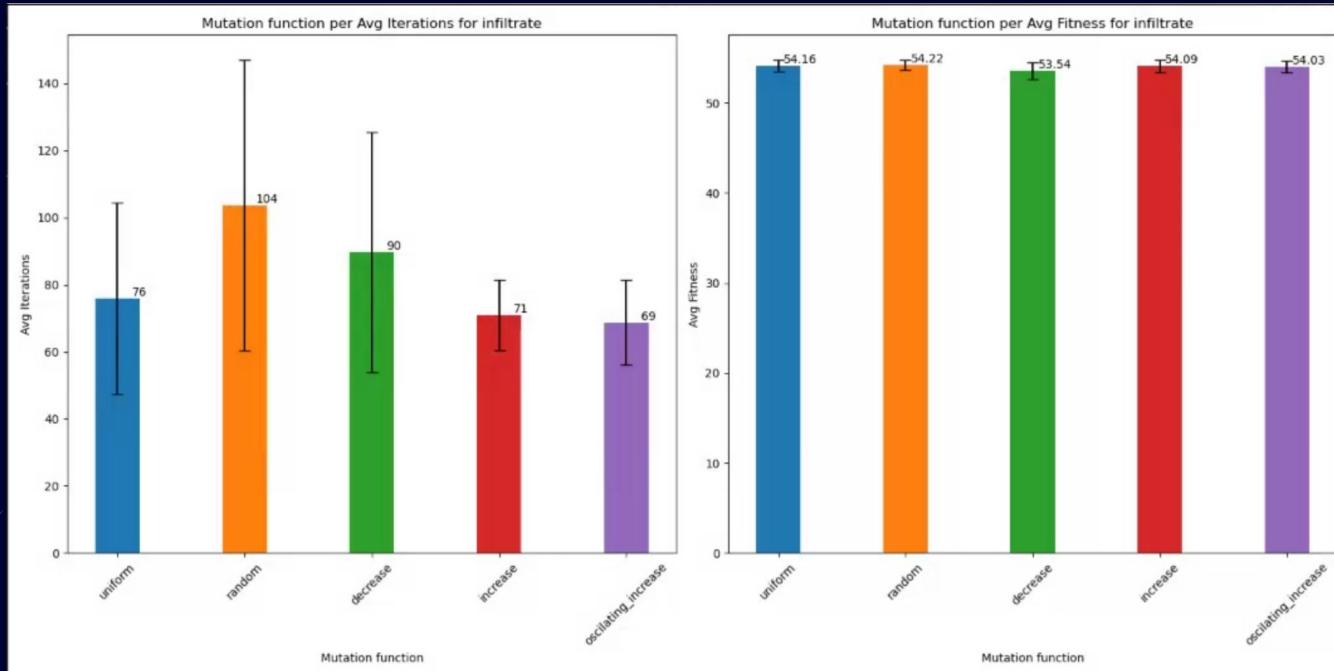
Población: 25 (20 padres elegidos en cada generación)

Selección: 0.5 * deterministic (0.4) + 0.5 * roulette

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - 0.5 * deterministic (0.4) + 0.5 * universal



Función de mutación

Promedio

Condiciones

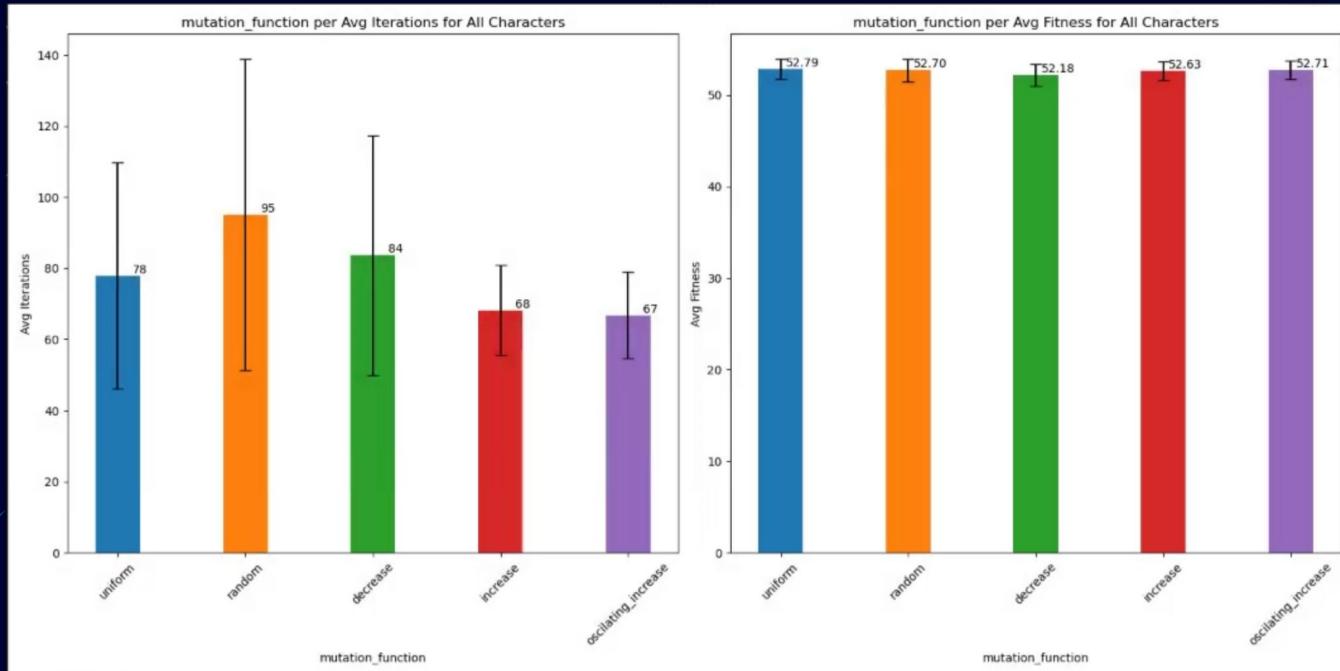
Población: 25 (20 padres elegidos en cada generación)

Selección: 0.5 * deterministic (0.4) + 0.5 * roulette

Corte: structure (10. 0.6)

Crossover: onepoint

Reemplazo: traditional - 0.5 * deterministic (0.4) + 0.5 * universal



Mutación

Mejor método

MULTIGENE
Oscillating Increase

Selección Warrior

Condiciones

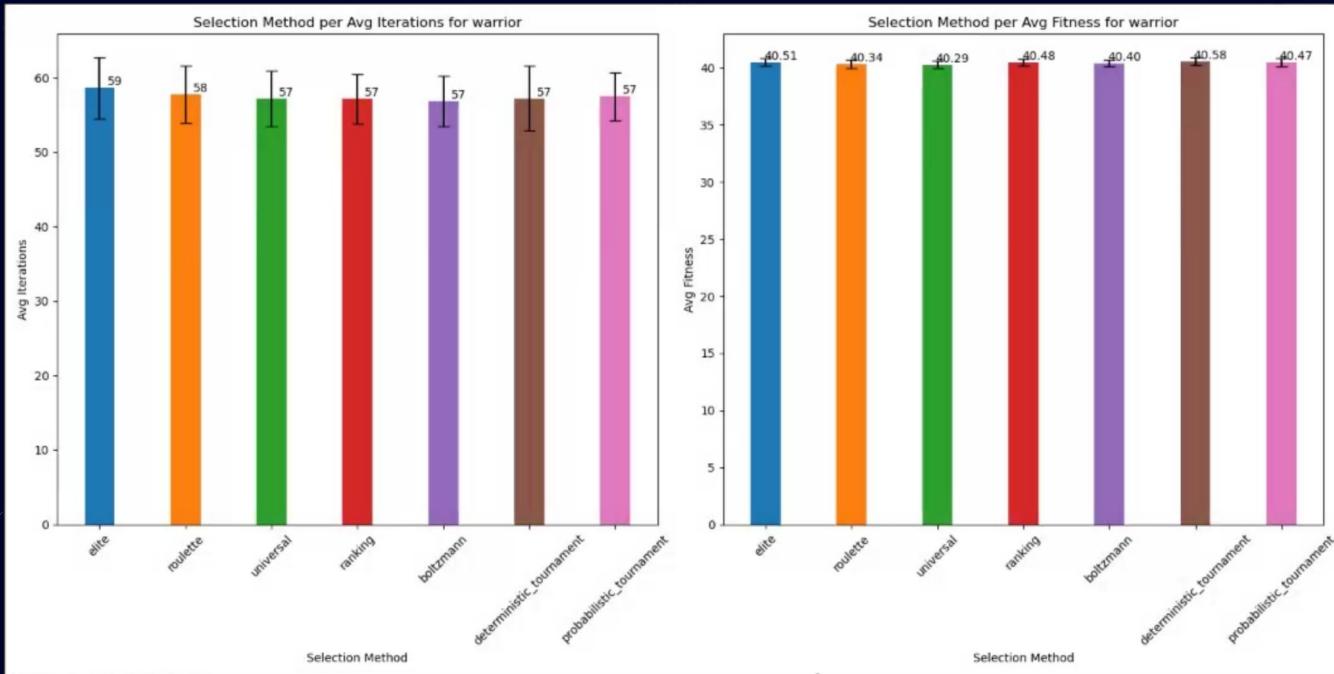
Población: 25 (20 padres elegidos en cada generación)

Corte: structure (10. 0.6)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Selección Warrior

Condiciones

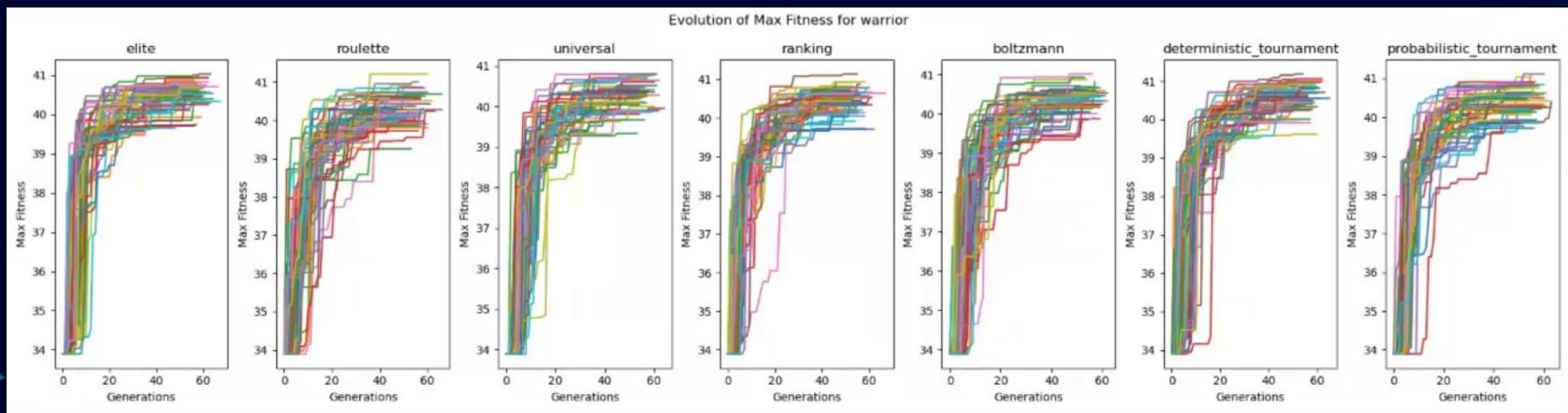
Población: 25 (20 padres elegidos en cada generación)

Corte: structure (10. 0. 6)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Selección Archer

Condiciones

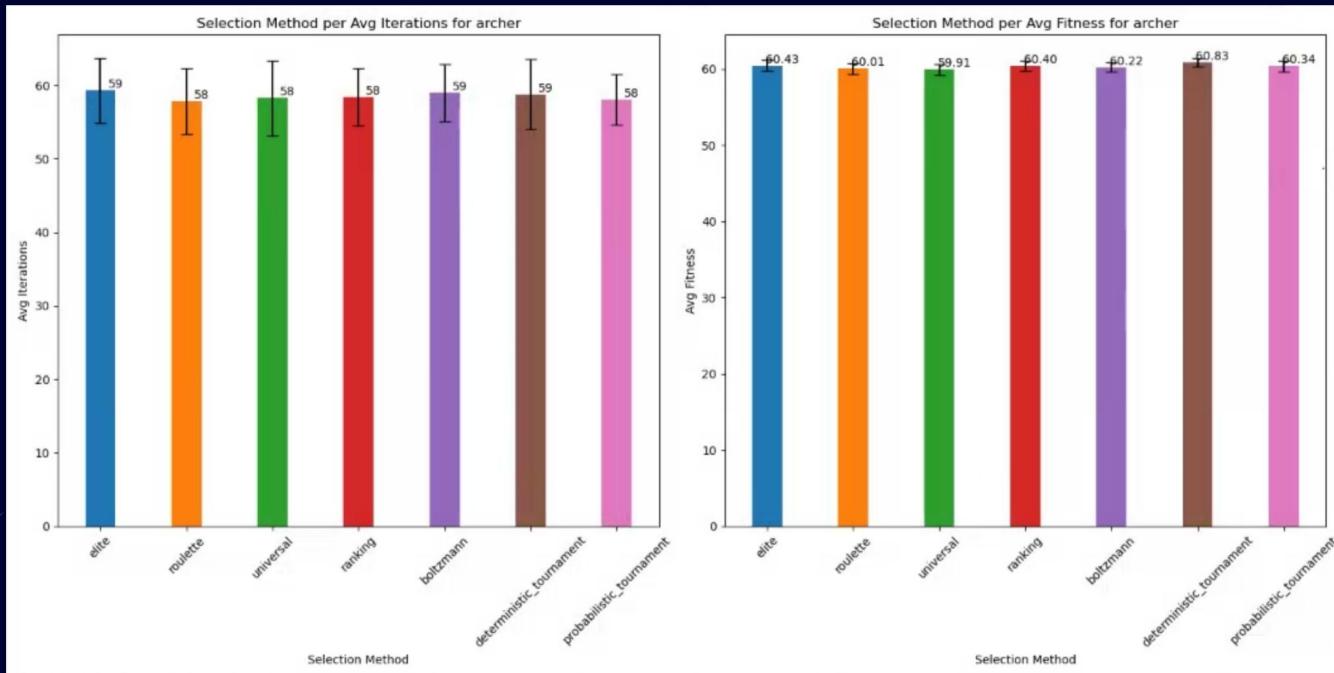
Población: 25 (20 padres elegidos en cada generación)

Corte: structure (10. 0.6)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: traditional - 0.5 * deterministic (0.4) + 0.5 * universal



Selección Defender

Condiciones

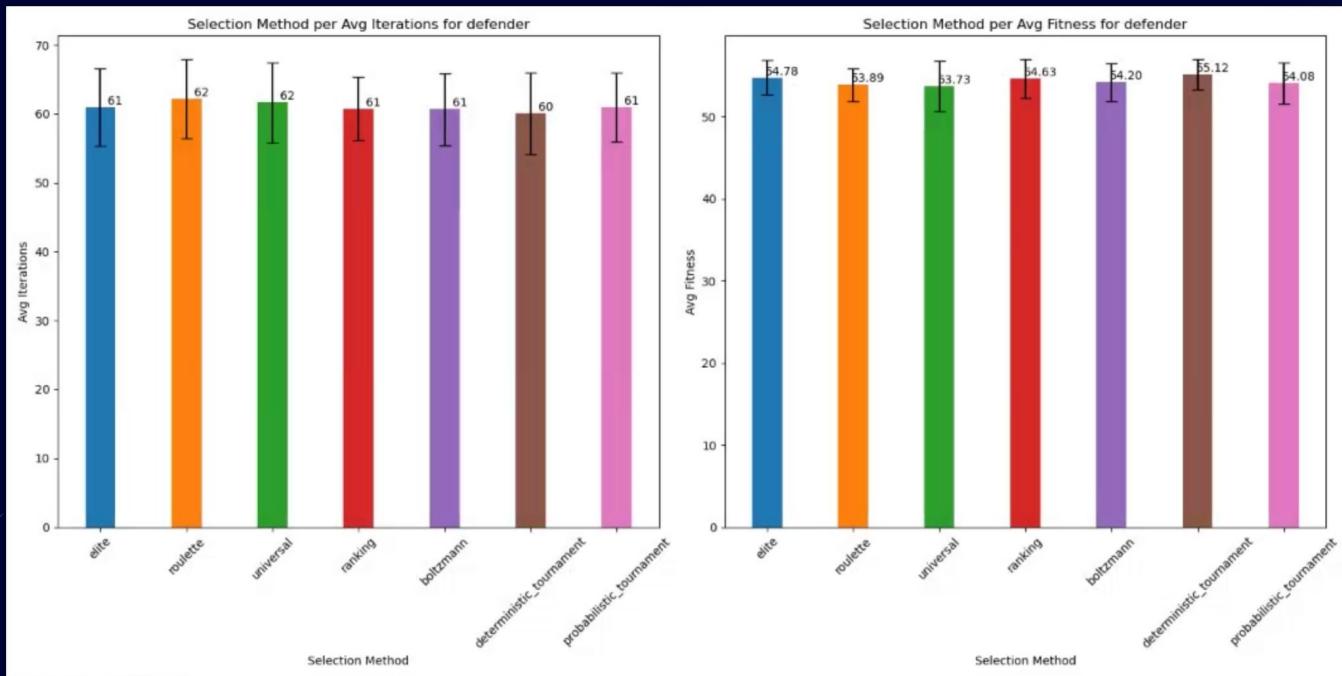
Población: 25 (20 padres elegidos en cada generación)

Corte: structure (10. 0.6)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: traditional - 0.5 * deterministic (0.4) + 0.5 * universal



Selección Infiltrate

Condiciones

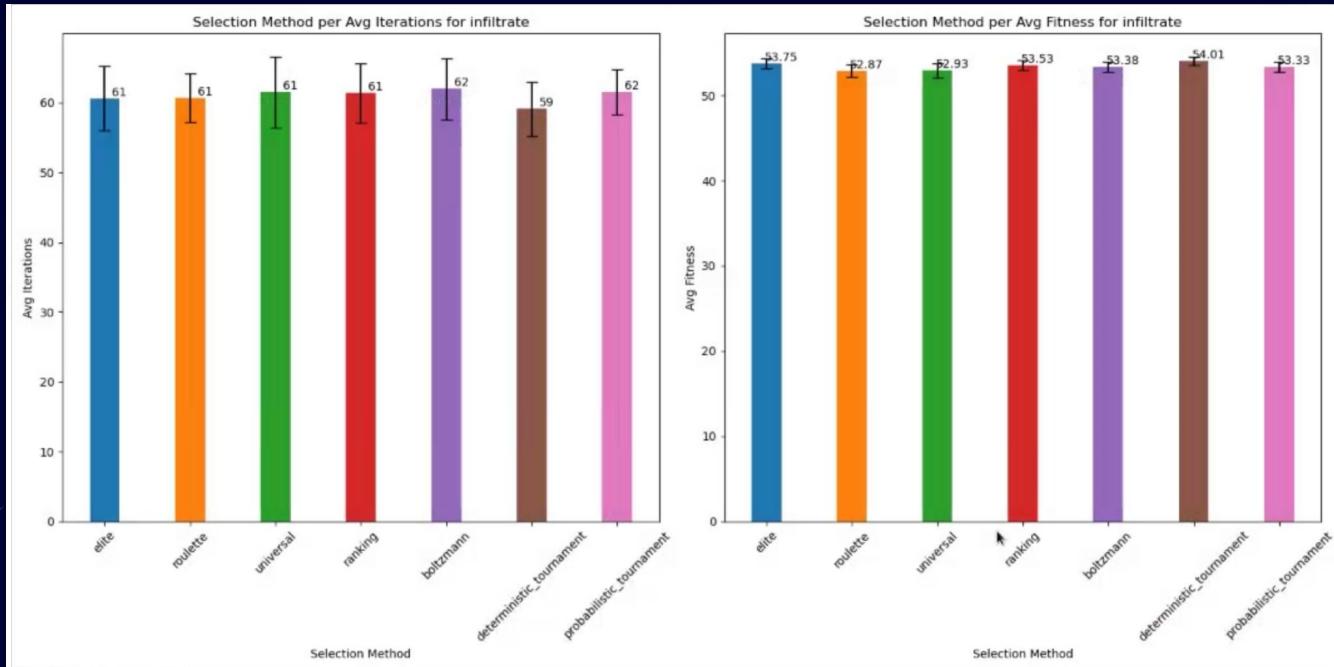
Población: 25 (20 padres elegidos en cada generación)

Corte: structure (10. 0.6)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Selección Promedio

Condiciones

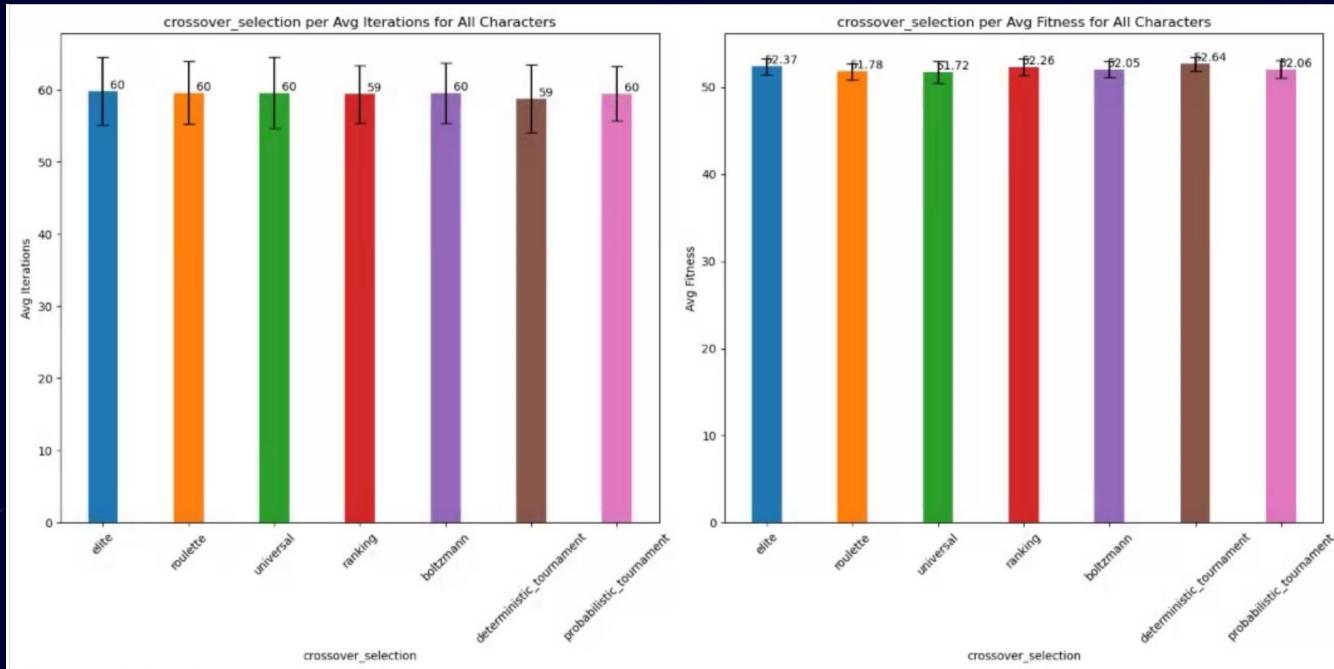
Población: 25 (20 padres elegidos en cada generación)

Corte: structure (10. 0.6)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: traditional - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{universal}$



Selección

Mejor método

DETERMINISTIC TOURNAMENT

(aunque la verdad son todos más o menos iguales)

Reemplazo: Sesgo Joven

Condición de corte: Estructura

Similarity : Complemento de brecha generacional

$$S = 1 - G$$

$$S \leq (\text{#population} - \text{#children}) / \text{#population}$$

Reemplazo: Sesgo Joven

Cantidad de padres

Warrior

Condiciones

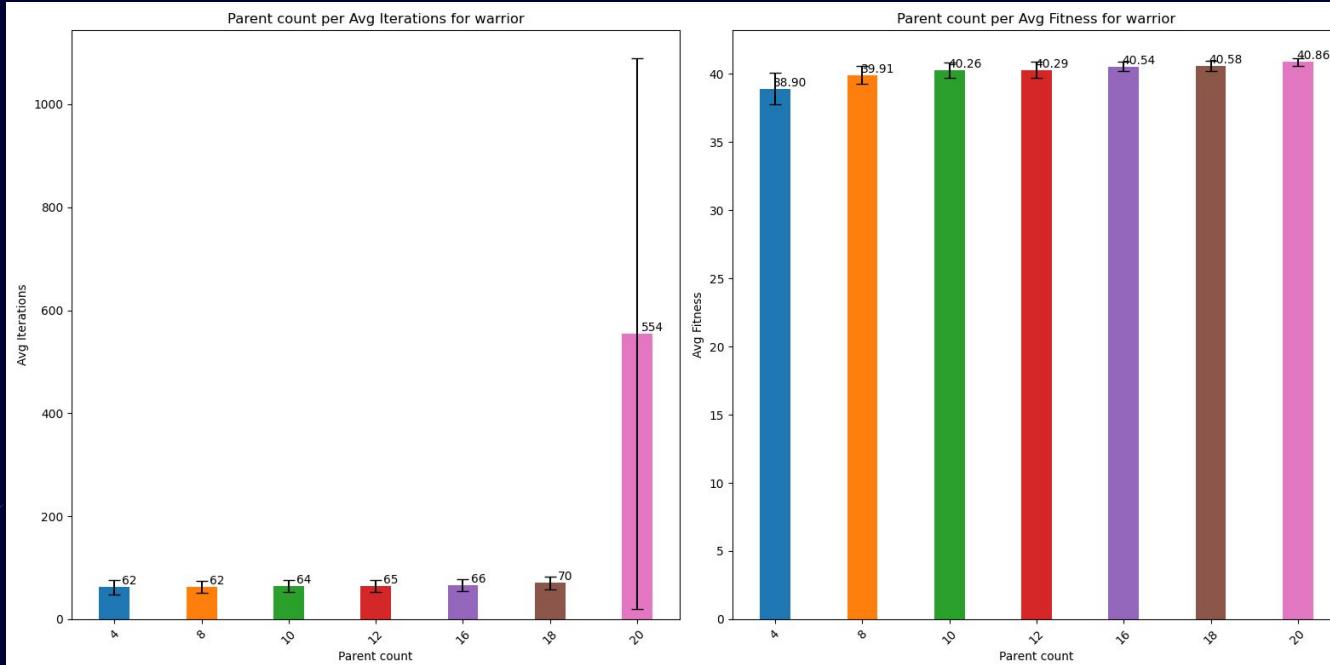
Población: 25

Corte: content (20)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: youngbias - 0.5 * deterministic (0.4) + 0.5 * universal



Reemplazo: Sesgo Joven

Cantidad de padres

Warrior

Condiciones

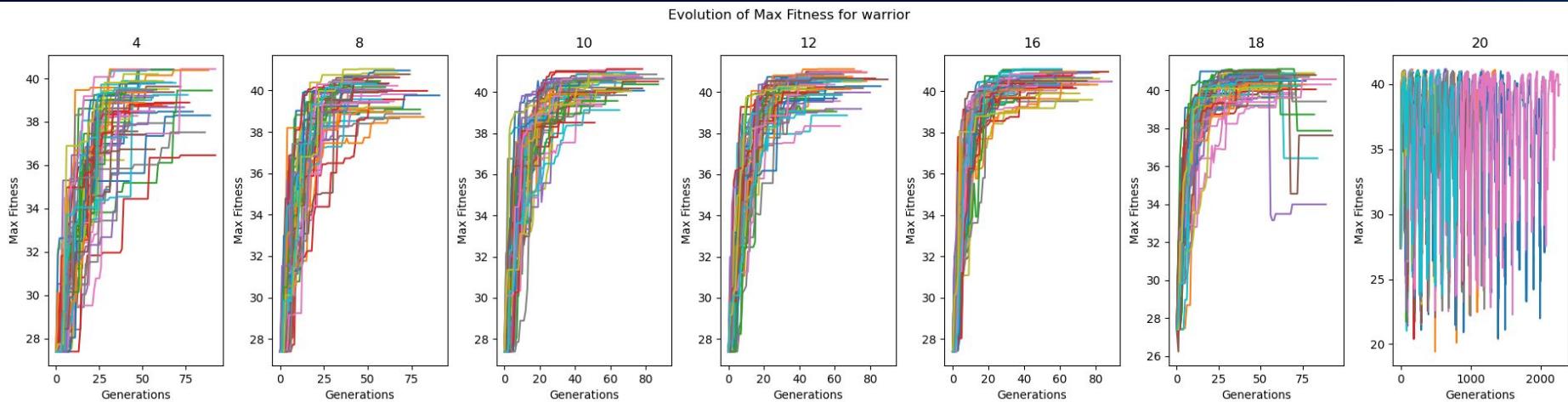
Población: 25

Corte: content (20)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: $\text{youngbias} - 0.5 * \text{deterministic}(0.4) + 0.5 * \text{universal}$



Reemplazo: Sesgo Joven

Cantidad de padres

Promedio

Condiciones

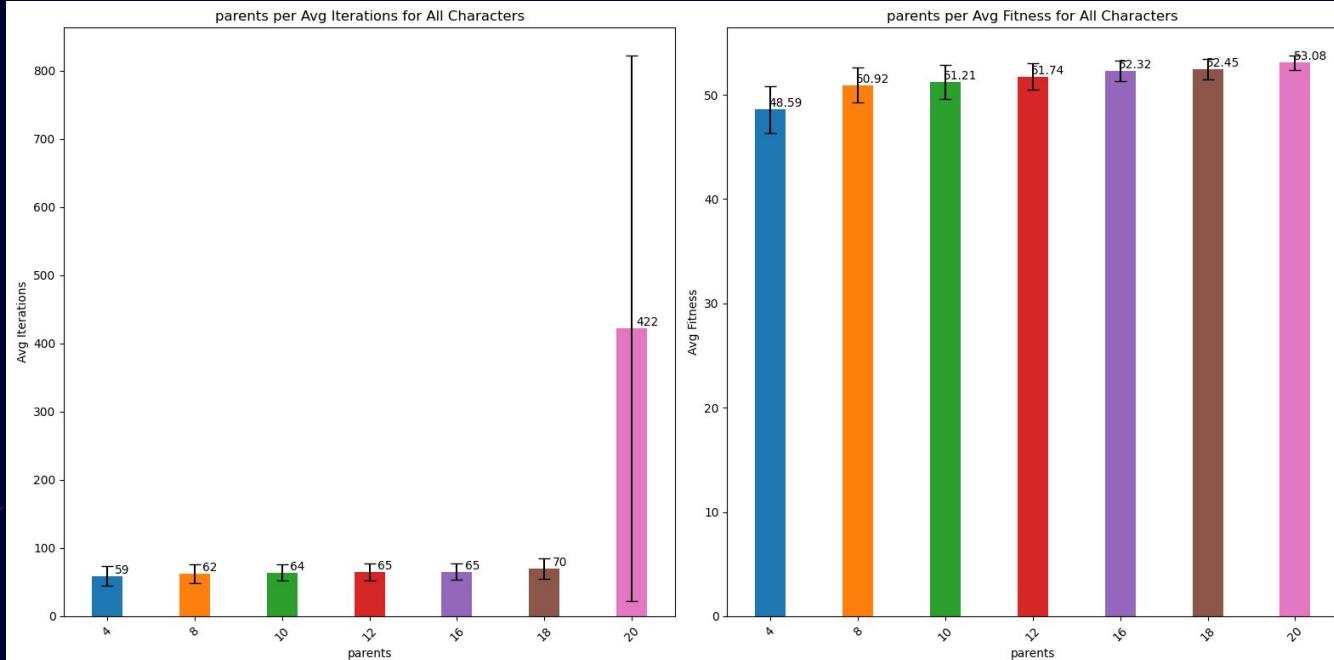
Población: 25

Corte: content (20)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: youngbias - 0.5 * deterministic (0.4) + 0.5 * universal



Reemplazo: Sesgo Joven

Cantidad de padres + elite

Warrior

Condiciones

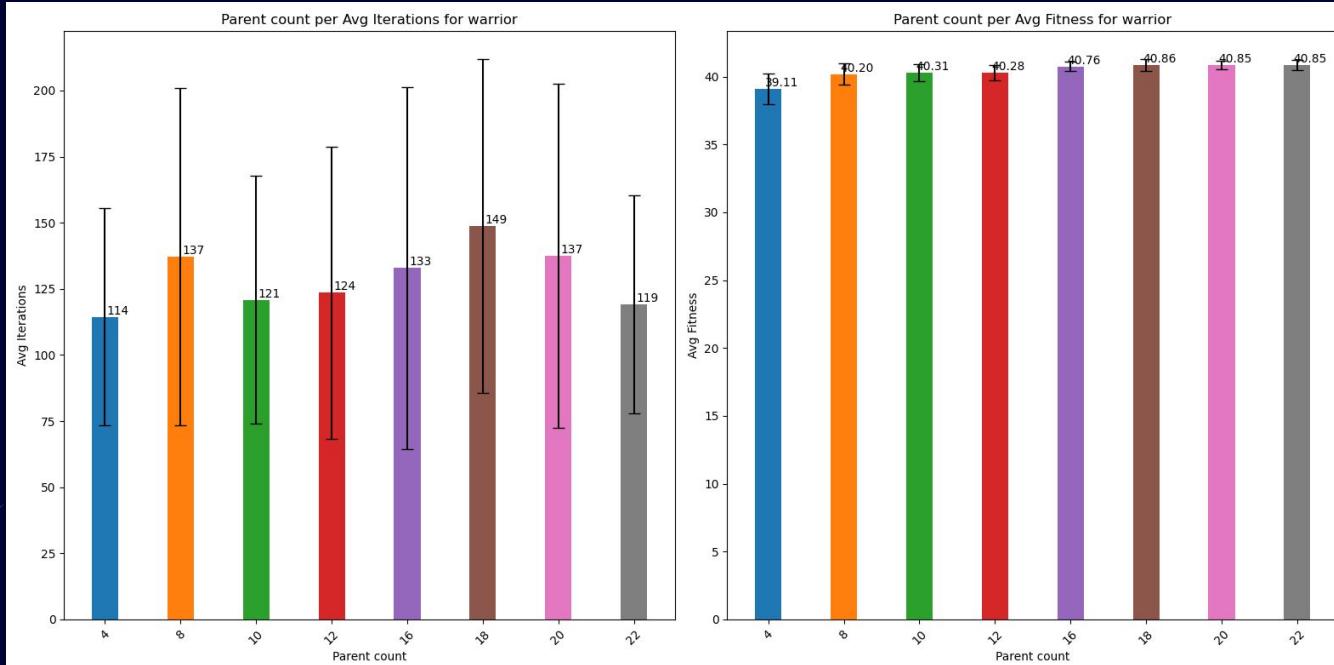
Población: 25

Corte: content (50)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: youngbias - 0.5 * deterministic (0.4) + 0.5 * elite



Reemplazo: Sesgo Joven

Cantidad de padres + elite

Warrior

Condiciones

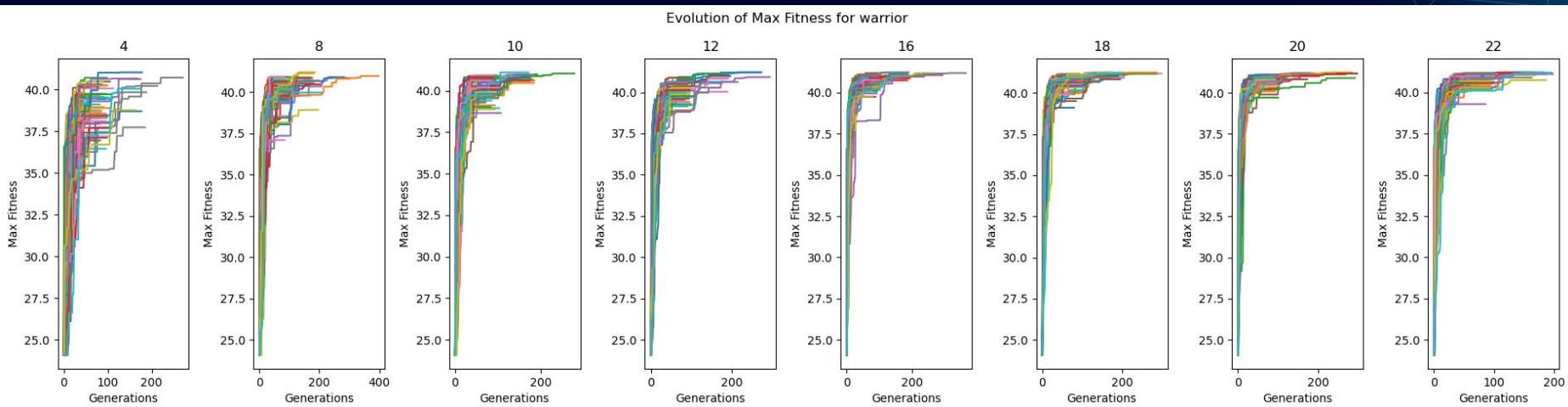
Población: 25

Corte: content (50)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: youngbias - $0.5 * \text{deterministic} (0.4) + 0.5 * \text{elite}$



Reemplazo: Sesgo Joven

Cantidad de padres + elite

Promedio

Condiciones

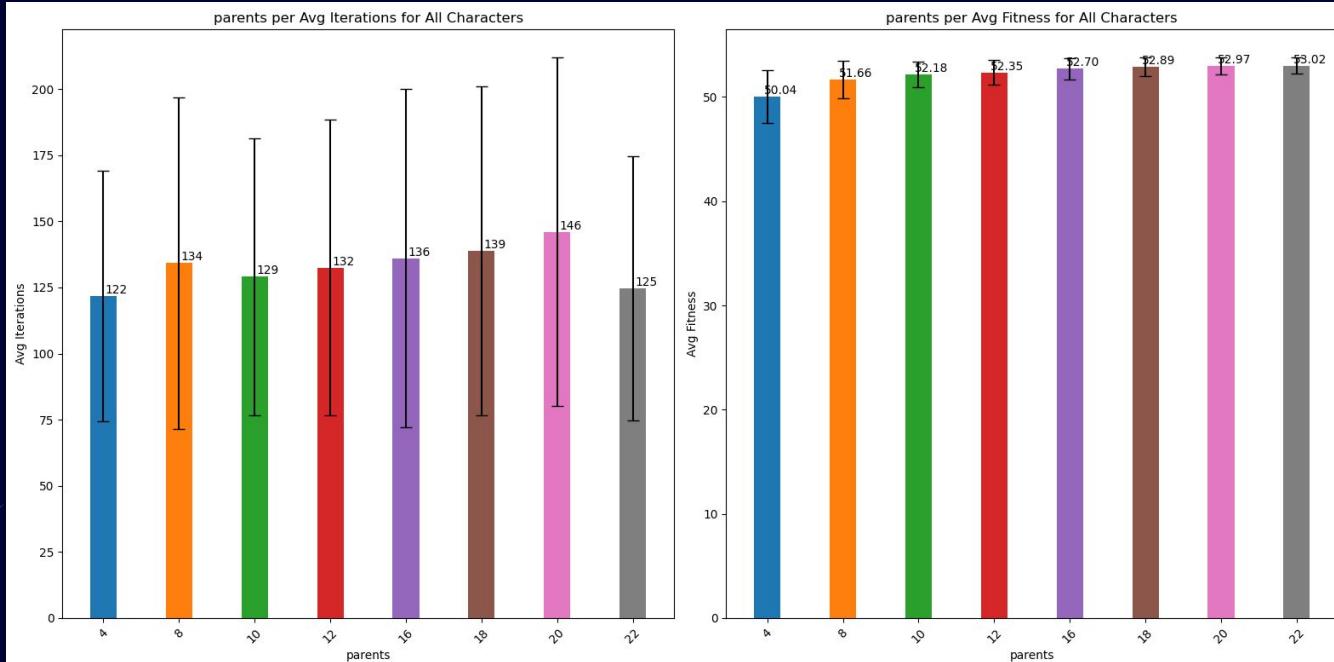
Población: 25

Corte: content (50)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: youngbias - 0.5 * deterministic (0.4) + 0.5 * elite



Reemplazo: Tradicional

Cantidad de padres

Warrior

Condiciones

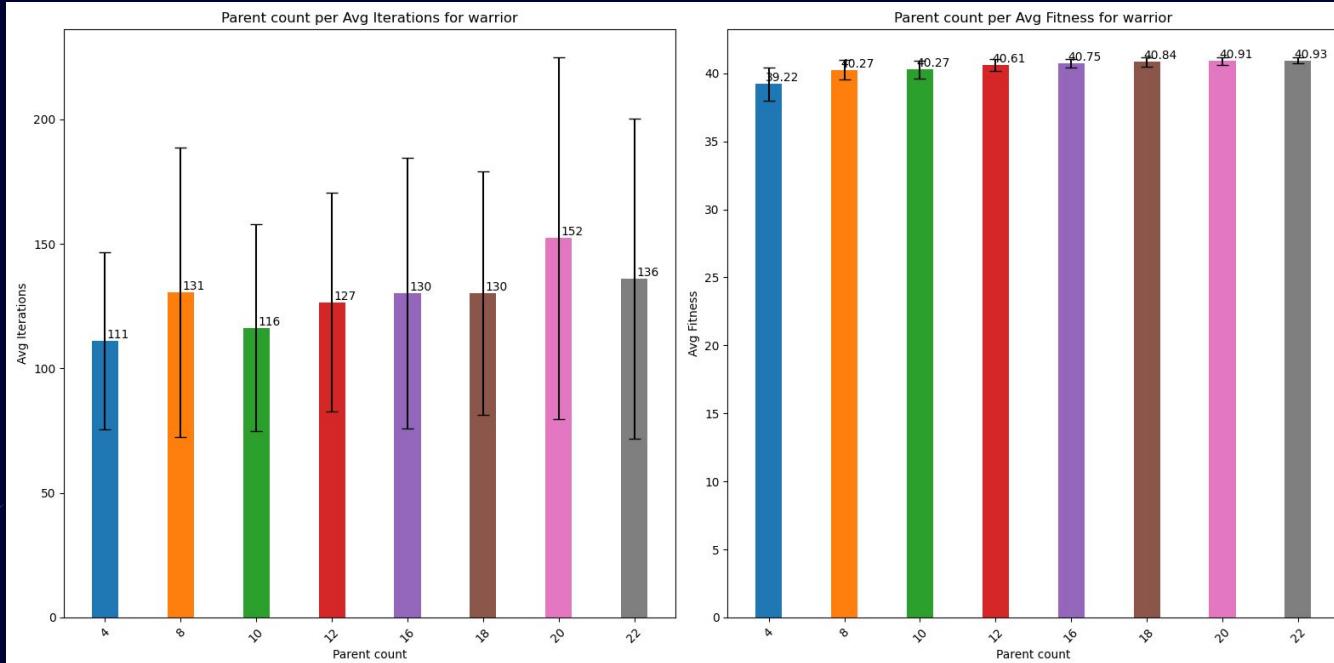
Población: 25

Corte: content (50)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: traditional - $0.5 * \text{deterministic (0.4)} + 0.5 * \text{universal}$



Reemplazo: Tradicional

Cantidad de padres

Condiciones

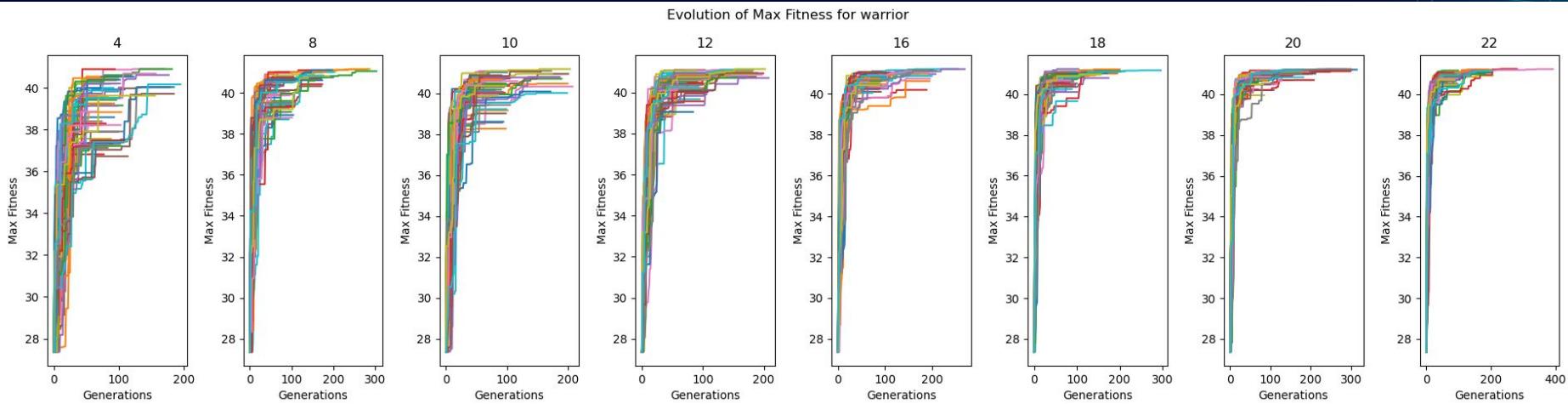
Población: 25

Corte: content (50)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: traditional - 0.5 * deterministic (0.4) + 0.5 * universal



Reemplazo: Tradicional

Cantidad de padres

Promedio

Condiciones

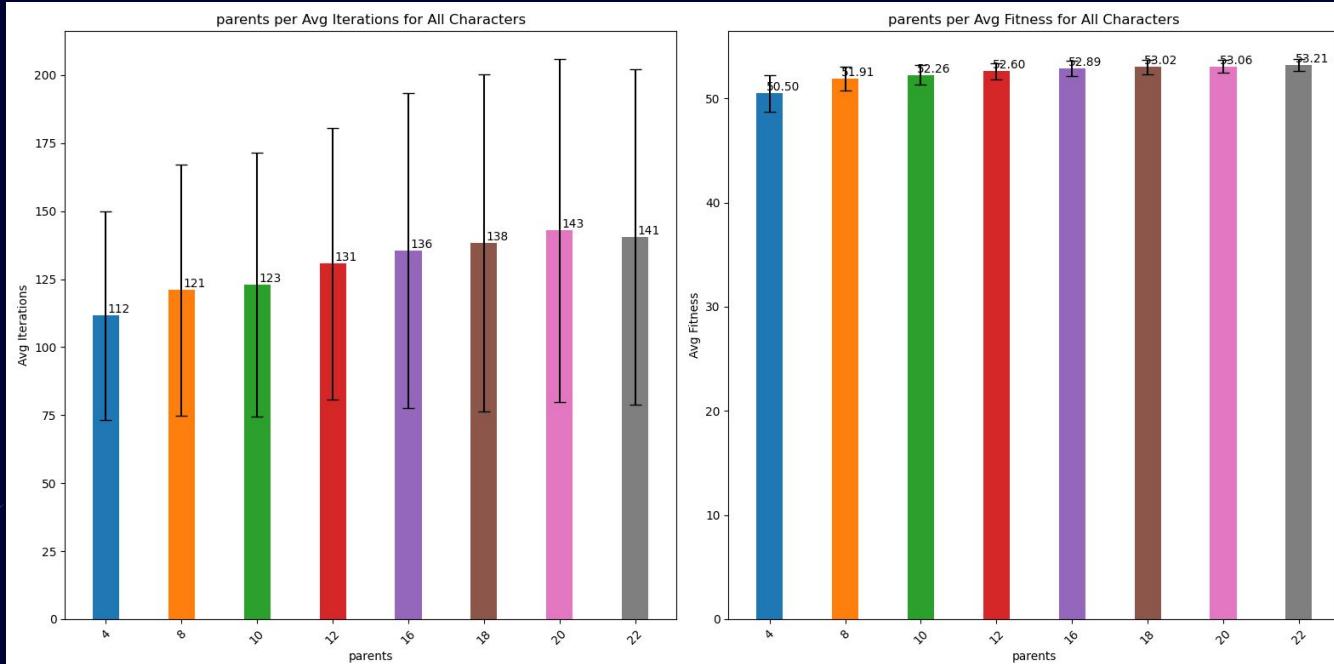
Población: 25

Corte: content (50)

Crossover: onepoint

Mutación: multigene oscillating increase

Reemplazo: traditional - 0.5 * deterministic (0.4) + 0.5 * universal



Reemplazo

Mejor método

TRADITIONAL (siempre)

YOUNG BIAS (con elite)

YOUNG BIAS (cantidad acotada de padres)

Reemplazo: Selección Warrior

Condiciones

Población: 25

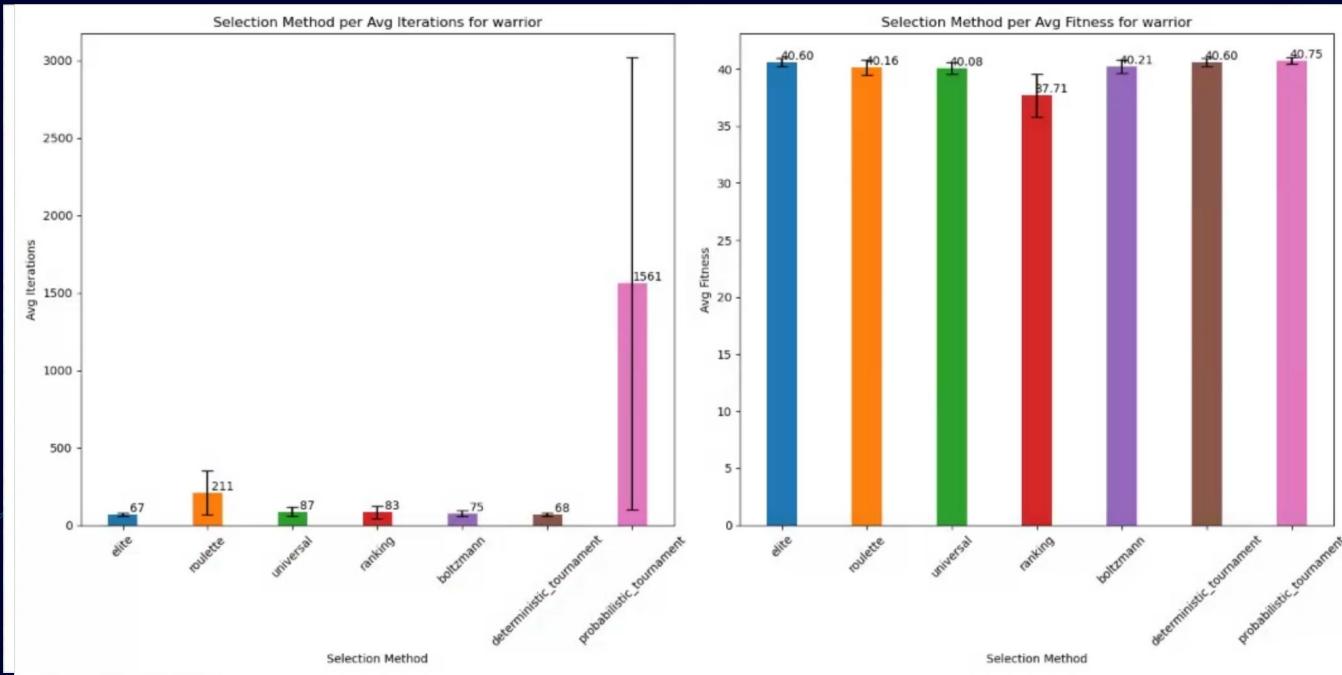
Parents: 20

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{elite}$

Corte: content (20)

Mutacion: multigen oscillating increase

Crossover: one point



Reemplazo: Selección

Warrior

Condiciones

Población: 25

Parents: 20

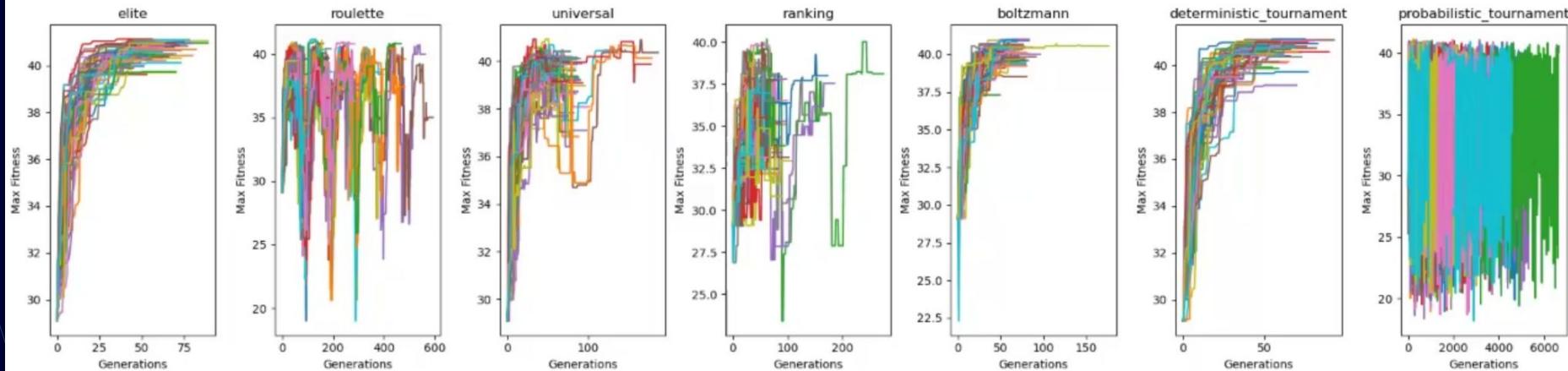
Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{elite}$

Corte: content (20)

Mutacion: multigen oscillating increase

Crossover: one point

Evolution of Max Fitness for warrior



Reemplazo: Selección Archer

Condiciones

Población: 25

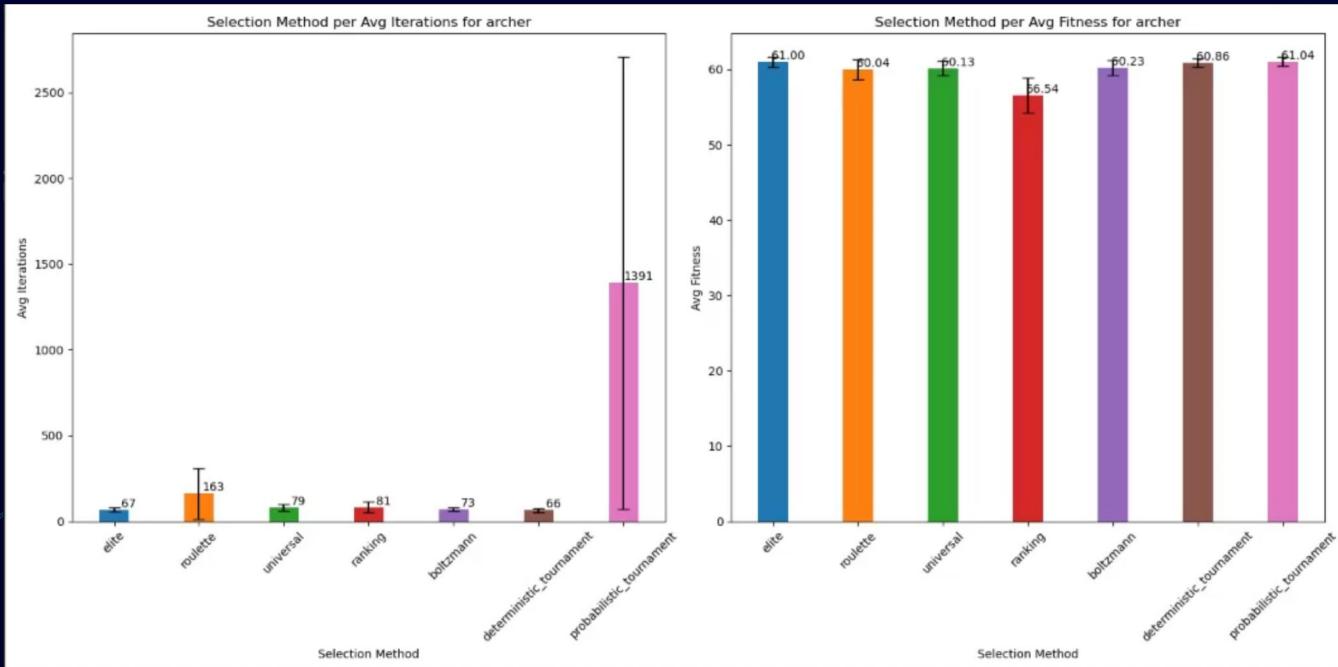
Parents: 20

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{elite}$

Corte: content (20)

Mutacion: multigen oscillating increase

Crossover: one point



Reemplazo: Selección Defender

Condiciones

Población: 25

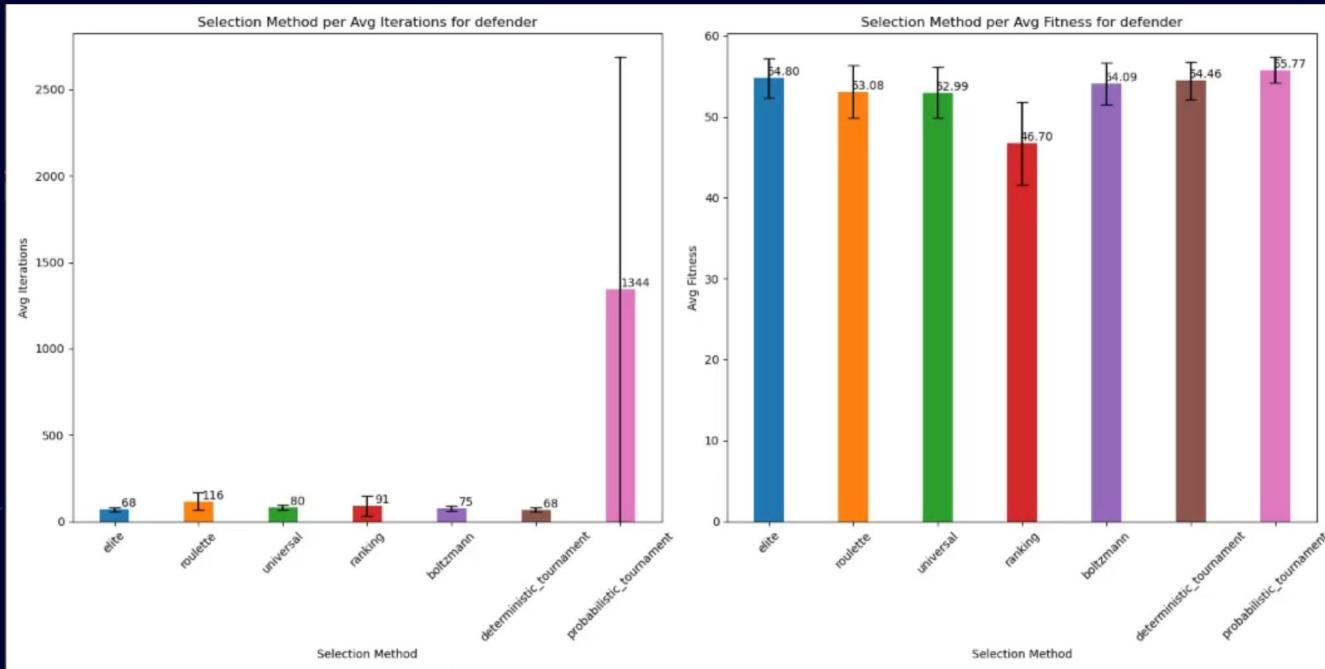
Parents: 20

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{elite}$

Corte: content (20)

Mutacion: multigen oscillating increase

Crossover: one point



Reemplazo: Selección Infiltrate

Condiciones

Población: 25

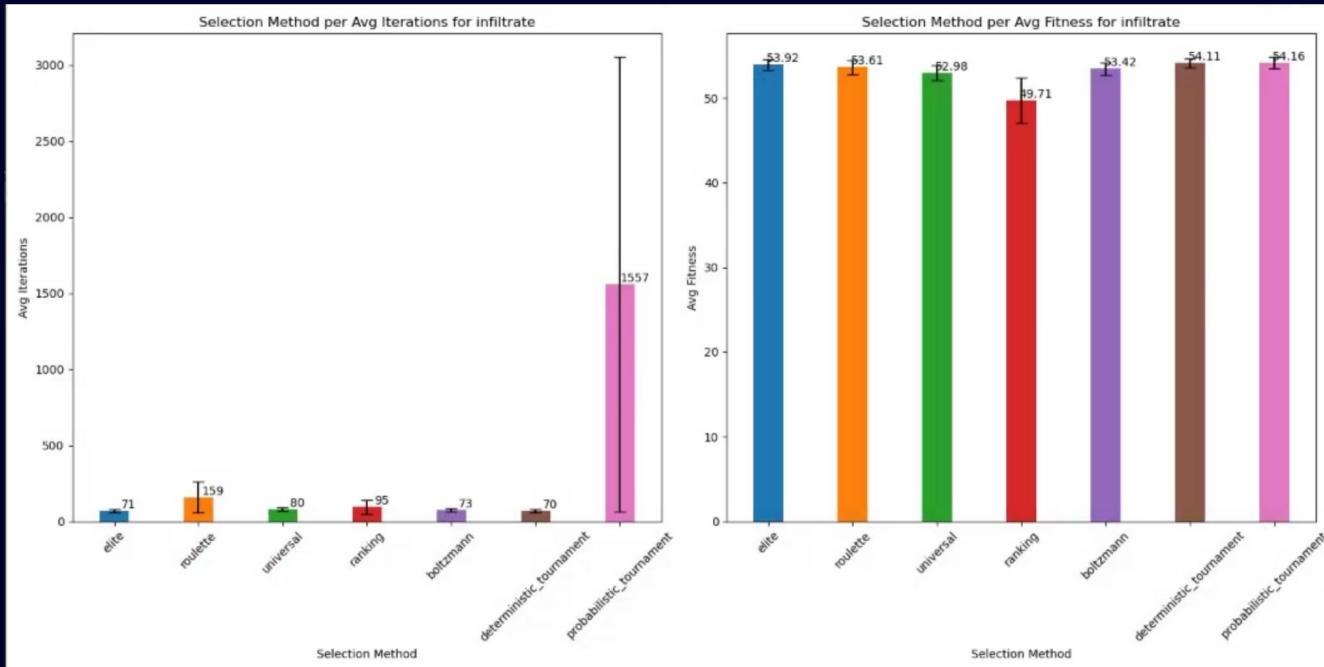
Padres: 20

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{elite}$

Corte: contenido (20)

Mutación: multigen oscillating increase

Crossover: one point



Reemplazo: Selección

Promedio

Condiciones

Población: 25

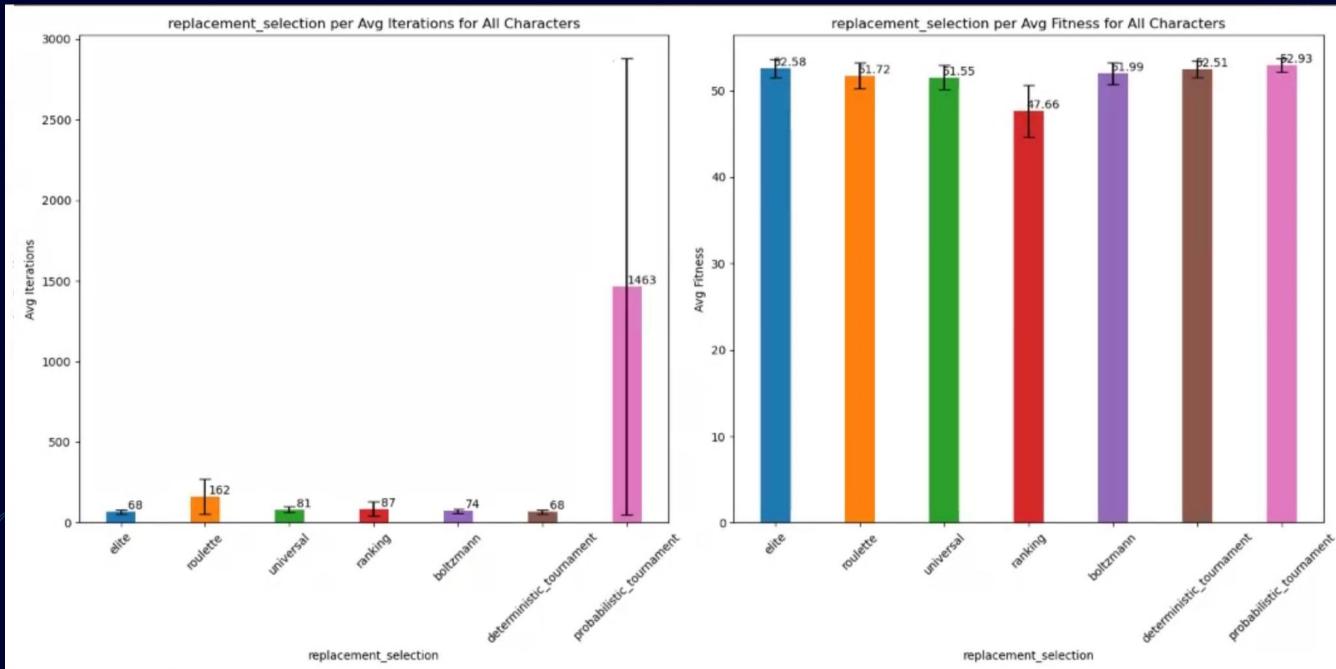
Parents: 20

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{elite}$

Corte: content (20)

Mutacion: multigen oscillating increase

Crossover: one point



Reemplazo: Selección

Mejor método

**ELITE
DETERMINISTIC TOURNAMENT**

Condición de Corte

Condiciones

Población: 25

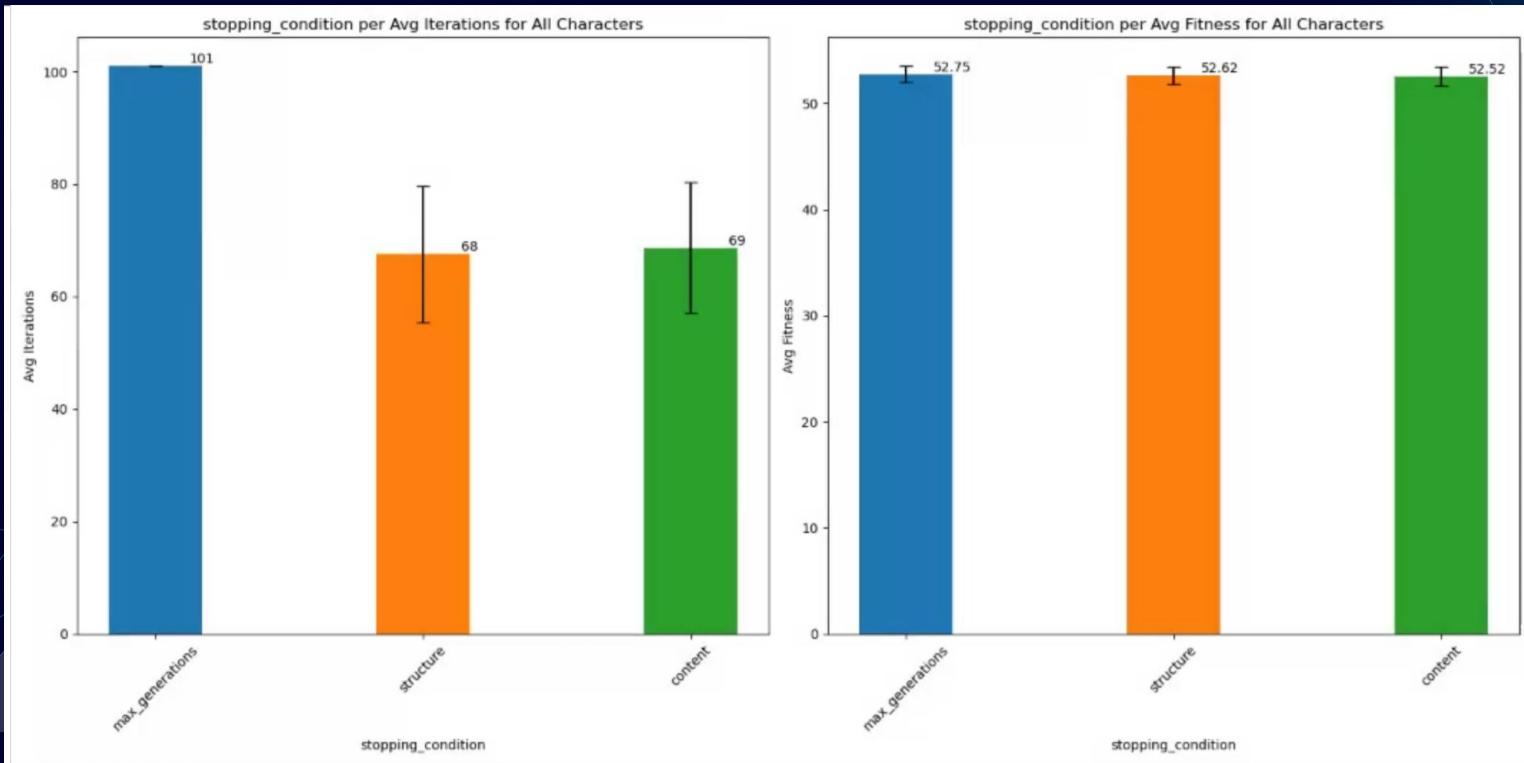
Parents: 20

Selección: $0.5 * \text{deterministic} (0.4) + 0.5 * \text{elite}$

Corte: content (20) - structure (20, 0.6) - iterations (100)

Mutación: multigen oscillating increase

Crossover: one point



Condición de corte

Mejor método



STRUCTURE
(a menos que sea youngbias)



Mejores Combinaciones

Técnicas:

- Tanteo utilizando los parámetros elegidos
- Recursión tomando última población como inicial
- Una vez tanteado un fitness, se utiliza **around optimal**

And the winners are...

Clase (atk; def)	Height	Strength	Agility	Expertise	Resistance	Health	Fitness
Warrior (0.6; 0.4)	1.915	74.821	74.554	0.625	≈ 0	≈ 0	41.257
Archer (0.9; 0.1)	1.915	74.823	74.564	0.612	≈ 0	≈ 0	61.886
Defender (0.1; 0.9)	1.3	≈ 0	≈ 0	0.625	74.553	74.820	58.240
Infiltrate (0.8; 0.3)	1.915	74.819	74.558	0.622	≈ 0	≈ 0	55.009



Conclusiones

- Conviene apostar por el aspecto dominante e ignorar los otros
- Hay una altura ideal para cada estilo (ataque / defensa)
- El expertise debería no ser una prioridad, pero tampoco O
- Buscar un máximo se puede hacer con precisión arbitraria (y el costo aumenta mucho dependiendo de ella)

Resultados

Mejores condiciones:

Población: 25

Parents: 20

Selección: $0.5 * \text{deterministic} + 0.5 * \text{elite}$

Corte: structure

Mutacion: multigen oscillating increase

Crossover: one point

Reemplazo: traditional - $0.5 * \text{deterministic} + 0.5 * \text{elite}$

Gracias!

Preguntas?

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01

8 - Puzzle



Objetivo

5	7	3
8	2	
1	6	4



1	2	3
8		4
7	6	5

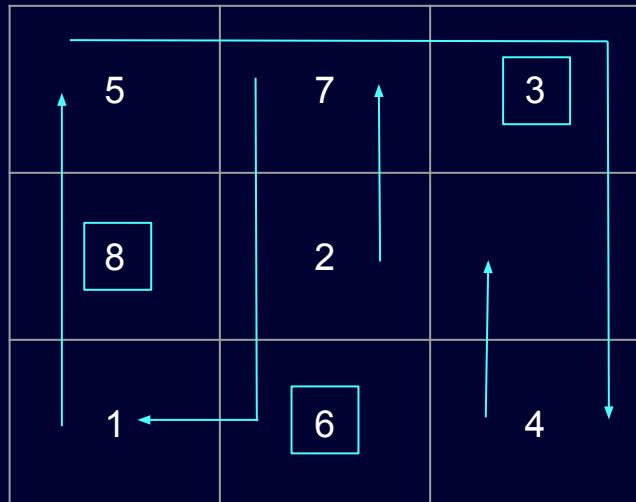
Estructura de estado:

Matriz 3x3 de enteros

5	7	3
8	2	0
1	6	4

Heurística 1

Suma de la distancia Manhattan de cada número a la posición de solución



$$4 + 3 + 0 + 0 + 1 + 2 + 0 + 1 = 11$$

Heuristica 2

Cantidad de números fuera de su casillero solución (sin contar el espacio vacío)

5		7		3
8		2		
1		6		4

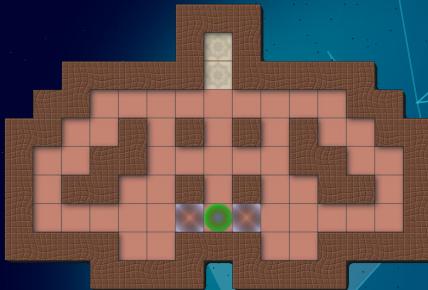
= 5

Metodos de busqueda

A* IDA*

02

Sokoban

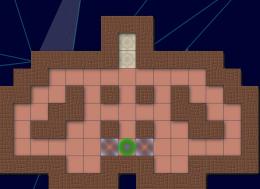


Estructura de estados:

Matriz de entidades

Se parsea el código que sigue el formato de game-sokoban.com

```
'#': Entity.WALL,  
' ': Entity.SPACE,  
'.': Entity.GOAL,  
'$': Entity.BOX,  
'@': Entity.PLAYER,  
'*': Entity.BOX_ON_GOAL,  
'+': Entity.PLAYER_ON_GOAL
```



```
###  
#. #  
#####.#####  
## ## ##  
## # # # # #  
# # # # # # #  
# # # # # # #  
# # # # # # #  
##### # # # #  
##### # # # #
```

lvl2.txt

```
class Entity(object):  
    SPACE = ''  
    WALL = '#'  
    BOX = '▣'  
    PLAYER = '@'  
    GOAL = '!'  
    BOX_ON_GOAL = '*'  
    PLAYER_ON_GOAL = 'x'
```

```
###  
#!#  
#####!#####  
## ## ##  
## # # # # #  
# # # # # # #  
# # # # # # #  
# # # # # # #  
##### # # # #  
##### # # # #
```

Matriz de entidades de NxM

Heurísticas

Métricas de distancia:

Distancia Euclíadiana, Distancia Manhattan

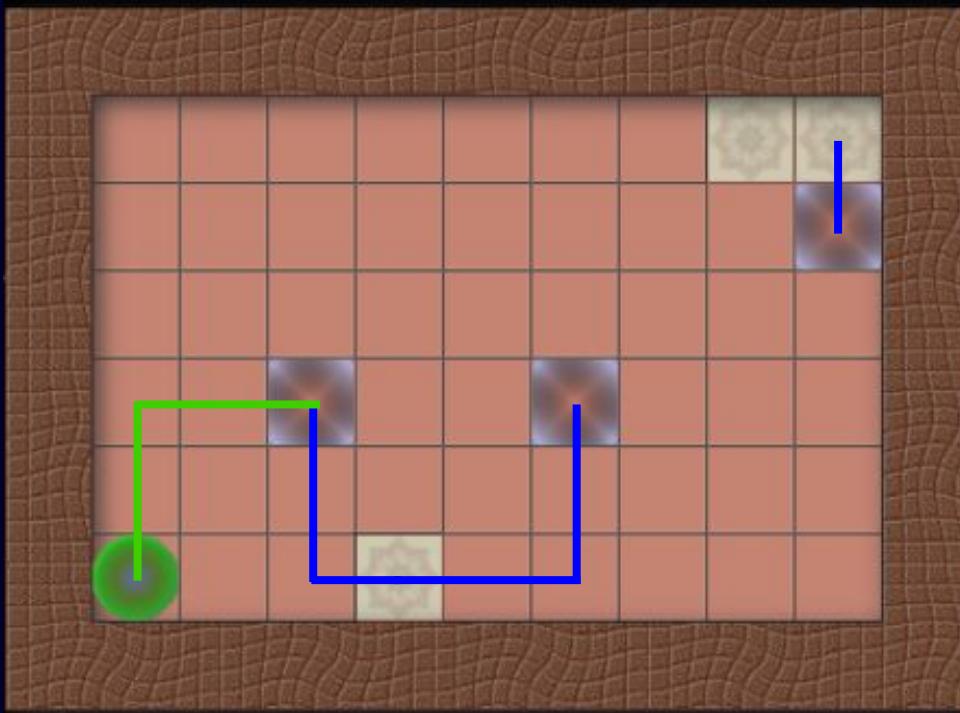
Heurística de Distancia (DH):

Por cada caja se suma su distancia al goal más cercano.

Heurística de Distancia con jugador (DH+P):

A la heurística de distancia se le suma la distancia del jugador a la caja más cercana.

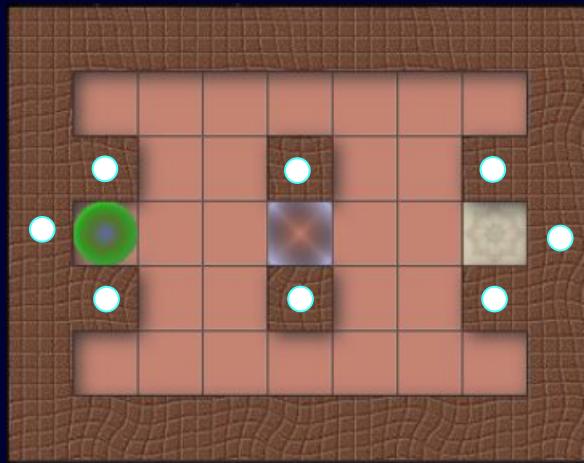
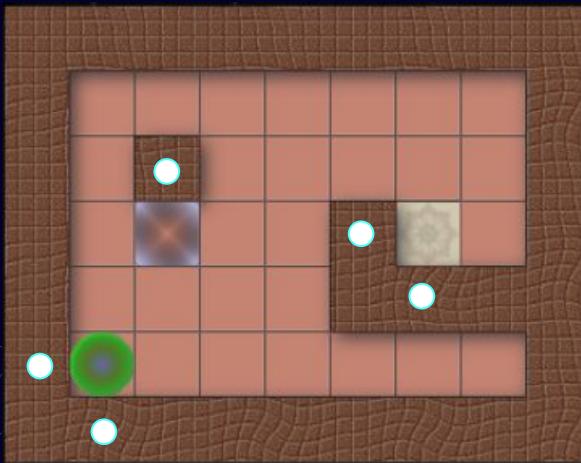
Heuristicas



Heurísticas

Heurística de Distancia modificada (MDH+P):

Igual que la heurística de distancia, pero se le suma la cantidad de paredes que rodean las entidades afectadas (cajas, goals, jugador)



Optimizaciones

Esquinas

Las cajas no pueden estar en las esquinas (a no ser que sea un goal). No hay manera de sacarlas de allí.

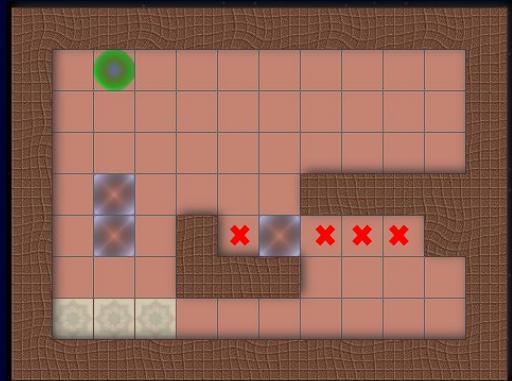
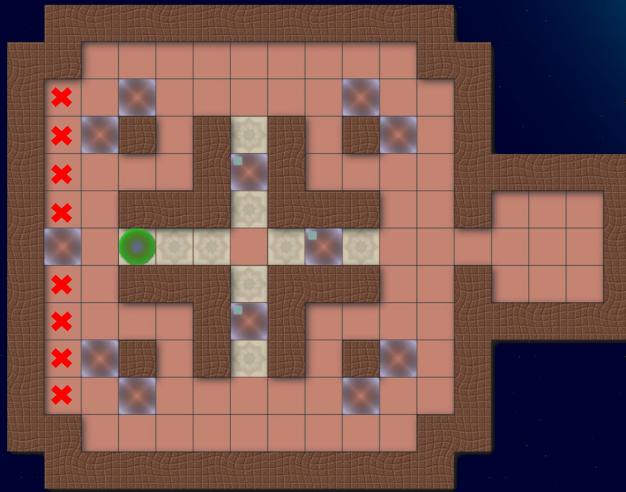


Optimizaciones

Columnas o Filas

En caso de que una caja esté reposando sobre una pared (vertical o horizontal) y que en los extremos haya esquinas, no puede salir de ahí.

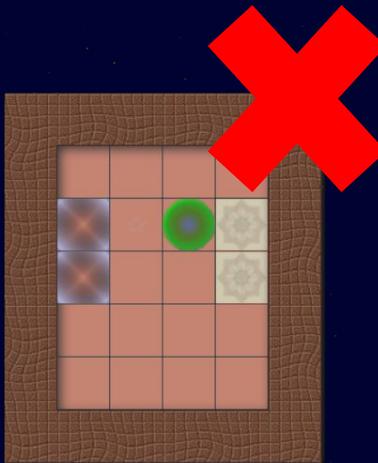
Notar que las paredes pueden ser intercaladas.



Optimizaciones

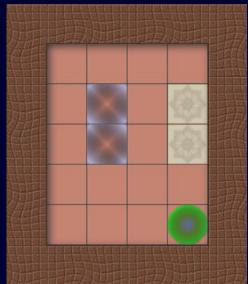
Dos cajas

En caso que haya dos cajas juntas con paredes a su lado, esas cajas no tienen forma de salir.



Análisis 1 - Algoritmos

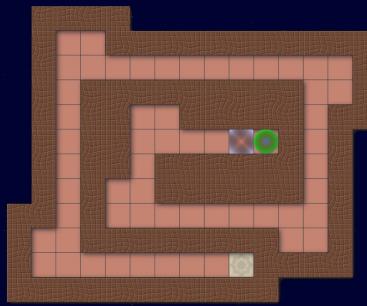
Constante: Heuristica Manhattan



LVL 1

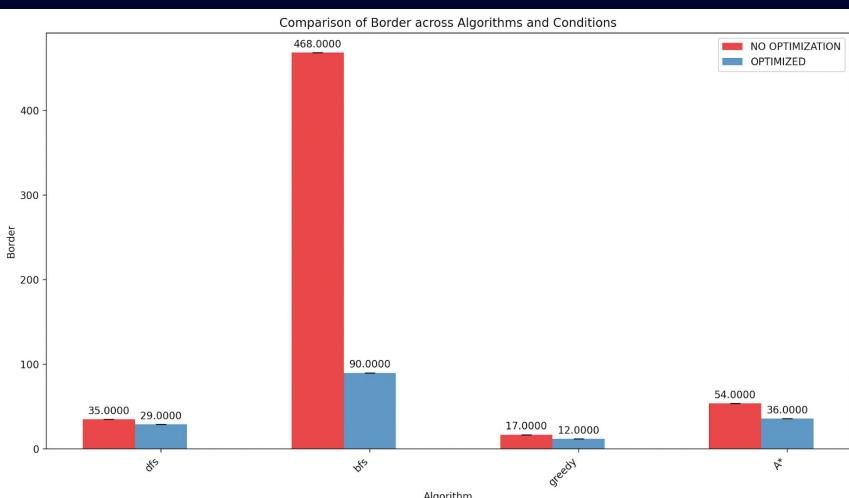
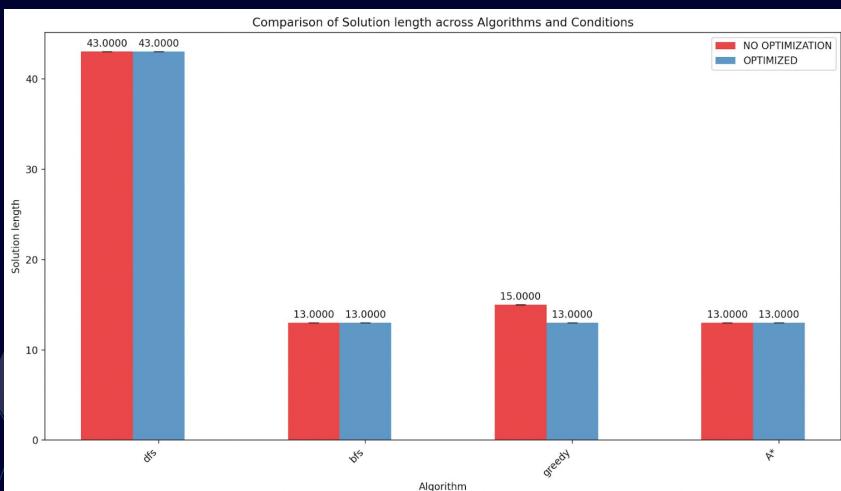
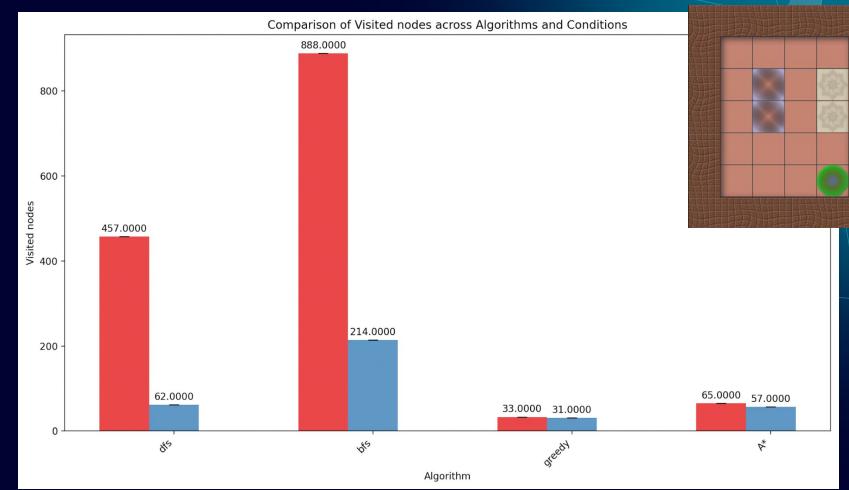
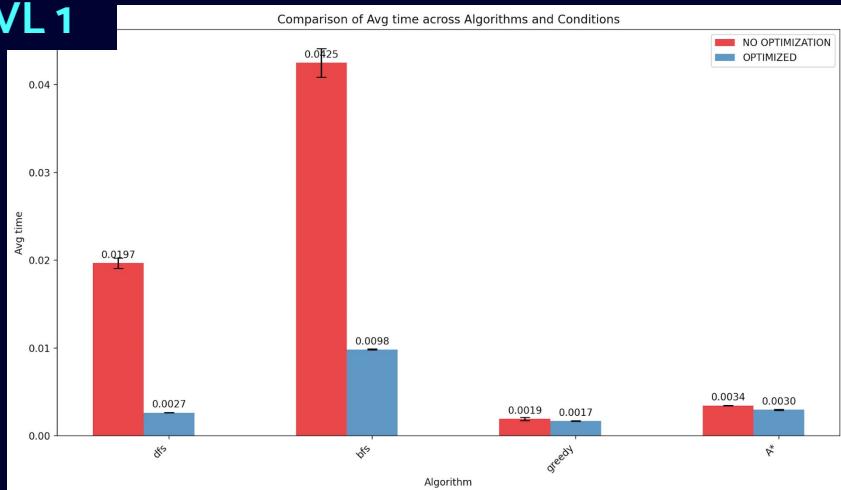


LVL 2

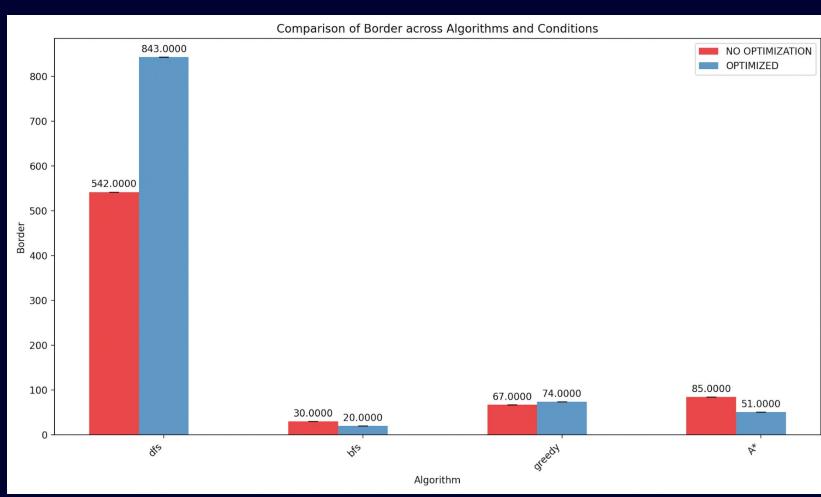
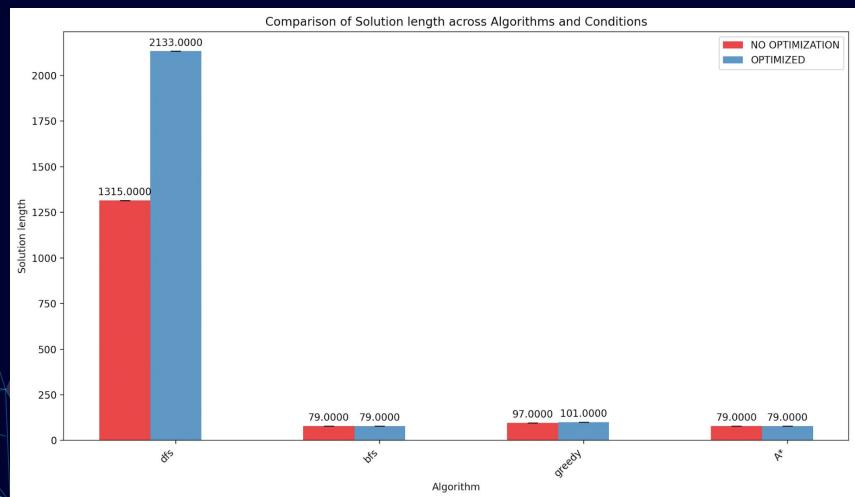
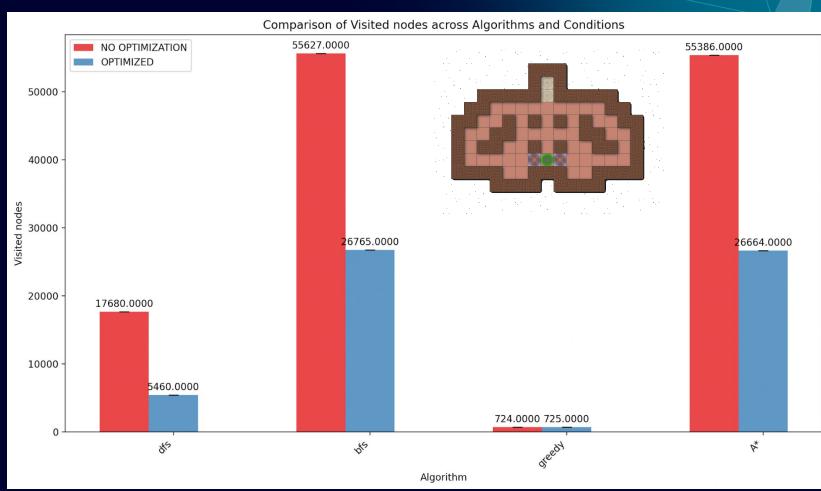
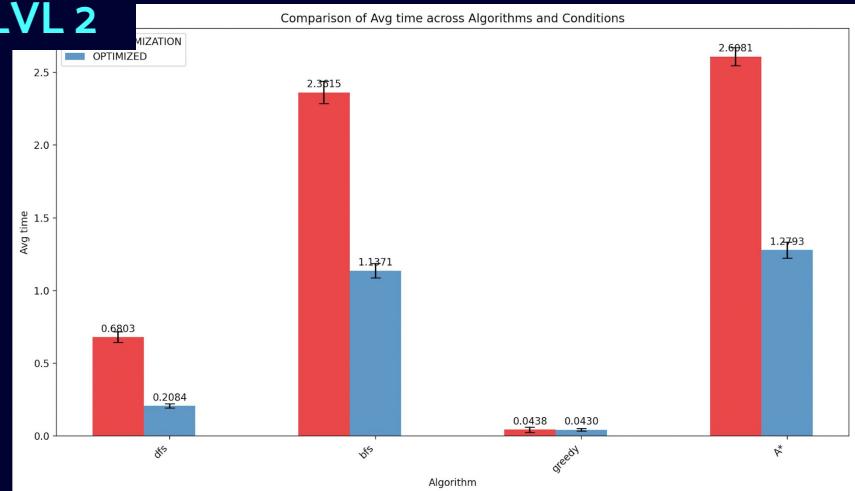


LVL 3

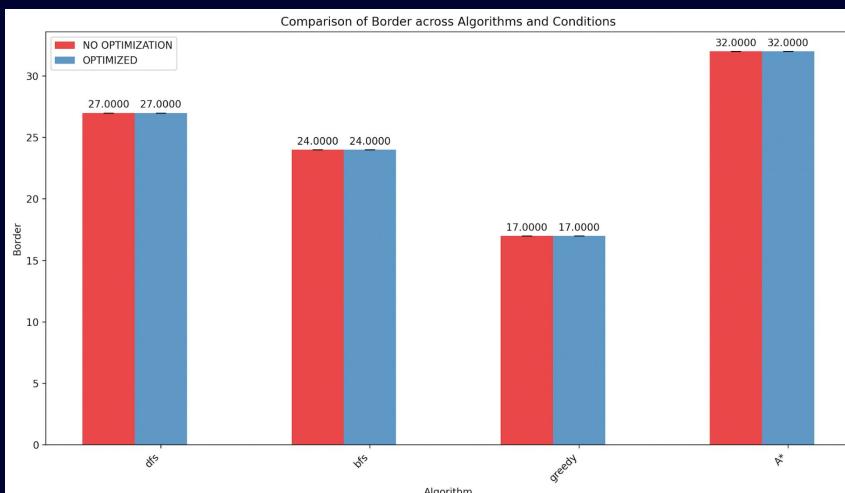
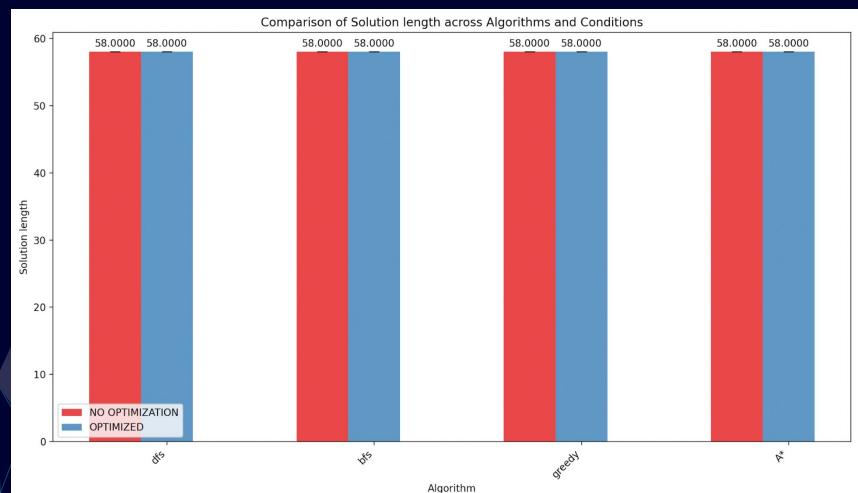
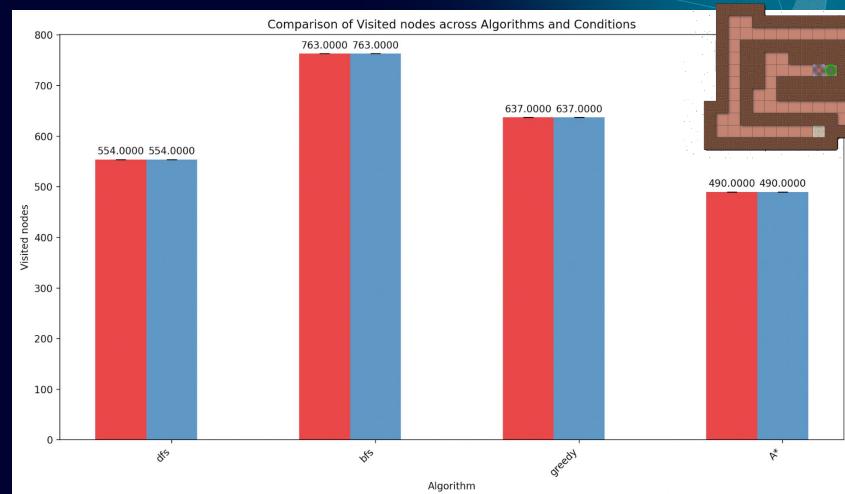
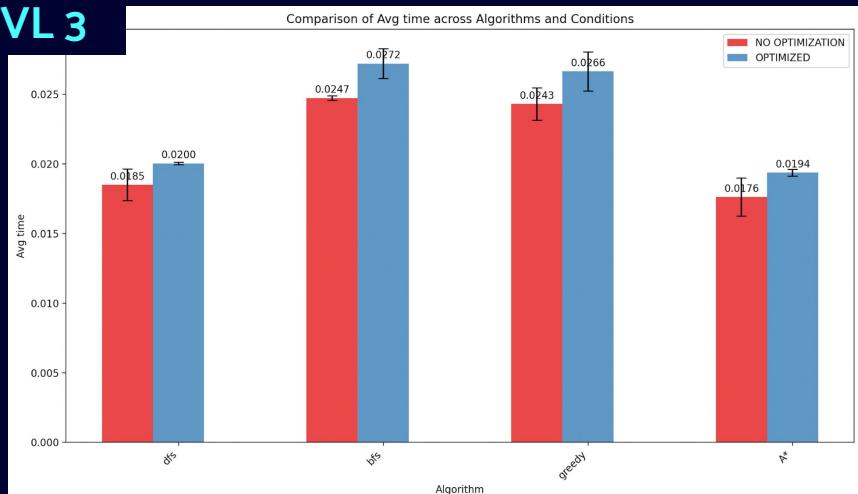
LVL 1



LVL 2

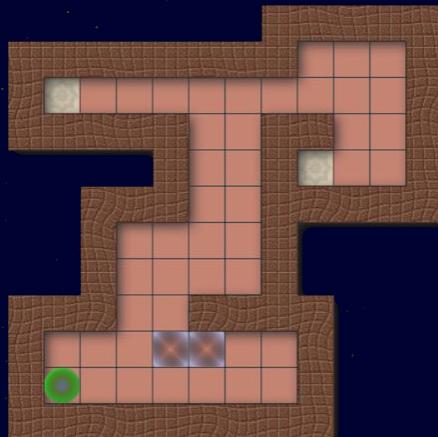


LVL 3

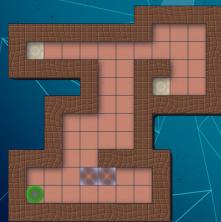


Análisis 1 - Heurísticas

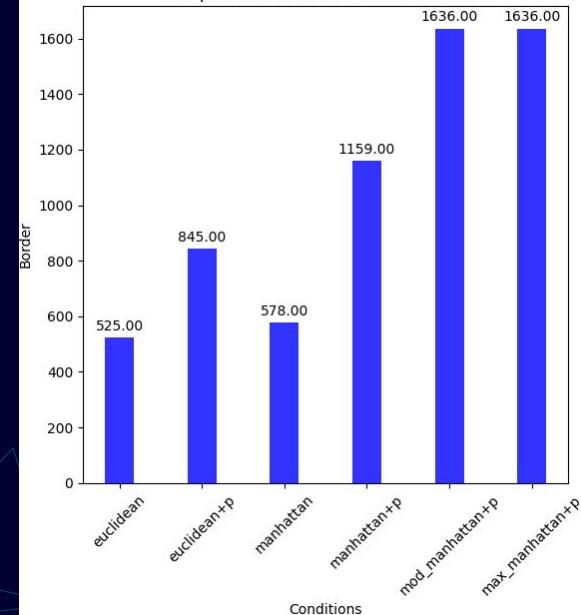
Se compara el performance de las heurísticas en el siguiente nivel:



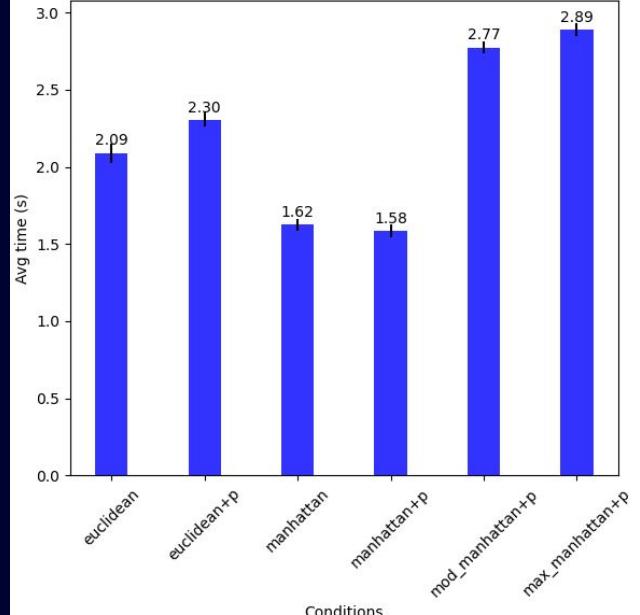
Análisis 1 - Heurísticas



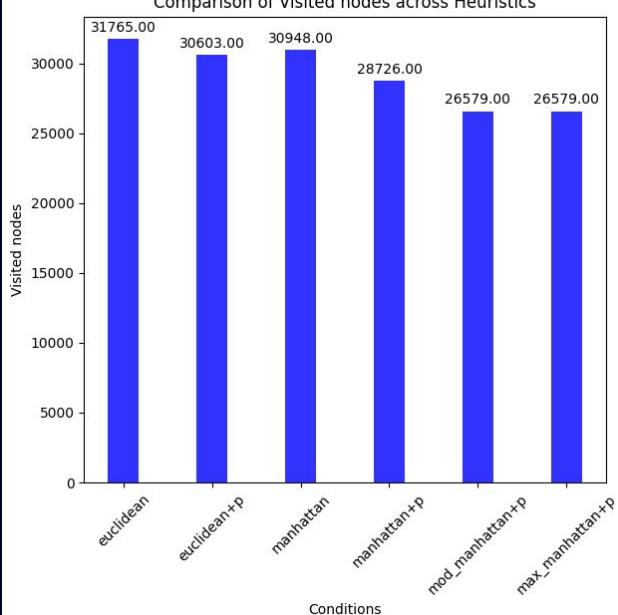
Comparison of Border across Heuristics



Comparison of Avg time (s) across Heuristics

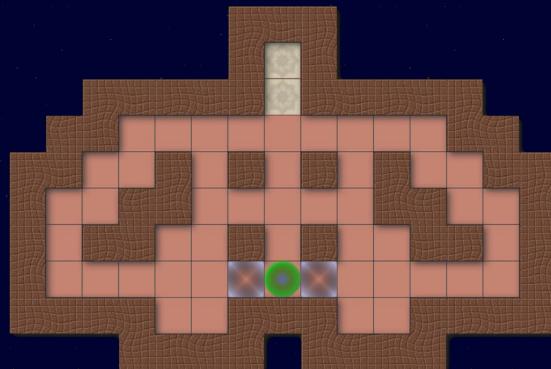


Comparison of Visited nodes across Heuristics

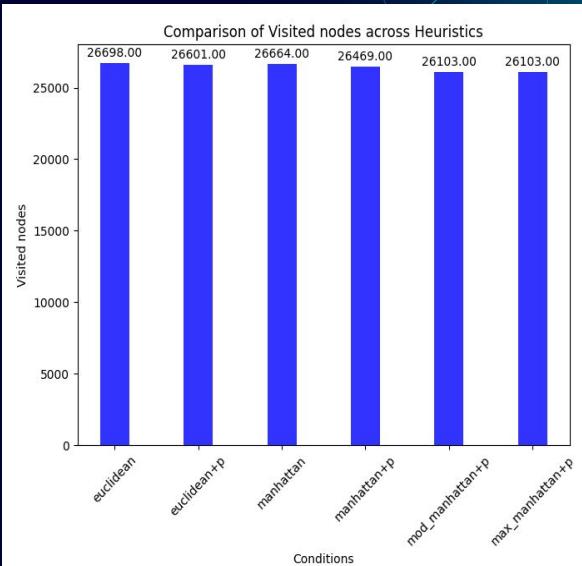
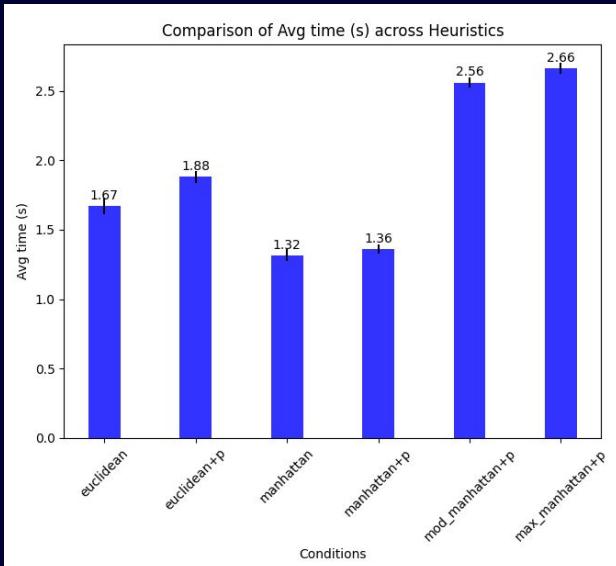
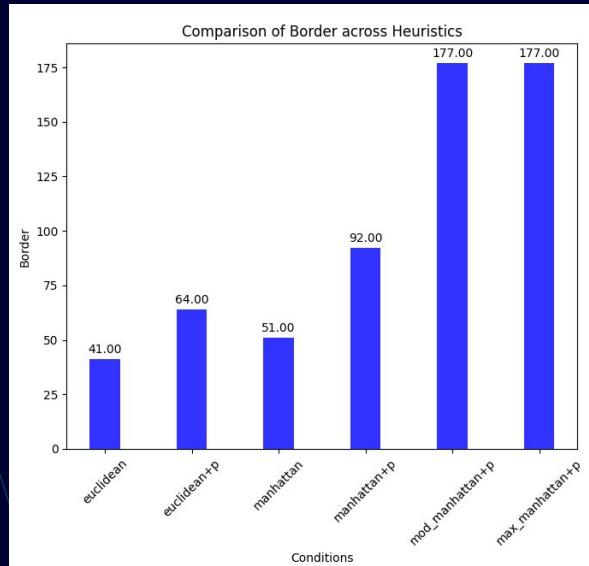
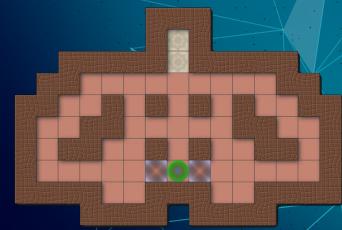


Análisis 2 - Heurísticas

Se compara el performance de las heurísticas en el siguiente nivel:



Análisis 2 - Heurísticas



Gracias!

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How to create a project proposal

Creating a project proposal can be done in five steps:

1. Define the project objectives and timeline
2. Identify resources needed to complete the project
3. Develop a budget for the project and estimate any potential risks associated with it
4. Write down your proposed solution and provide supporting documents or evidence that prove its feasibility if necessary
5. Develop a communication plan to ensure key stakeholders are kept informed of progress throughout the entire process



Budget

Sources of funding

Funding for a company can come from personal savings or investments, bank loans and other loan options, venture capital and angel investors, grants, competitions or programs, crowdfunding...

Equipment and materials

Equipment and materials costs refer to all the expenses related to the purchasing, maintenance and upkeep of any physical items used in production or other business processes inside the company

Personnel costs

Personnel costs refer to the expenses incurred in hiring, training and retaining staff for a company. This can include salaries, bonuses, benefits and other payroll-related costs

Travel and miscellaneous

Travel and miscellaneous costs refer to expenses related to any travel-related activities, such as conferences, trainings or business trips. It may also include office supplies, communications services, licenses and other miscellaneous expenses

Solutions

Solution 1

Implementing a new CRM (Customer Relationship Management) system to improve customer data management and sales tracking

Solution 4

Developing a new product or service to diversify the business and increase revenue streams

Solution 2

Outsourcing specific business functions (such as accounting or IT) to a third-party provider to reduce costs and increase time efficiency

Solution 5

Implementing a cost-saving initiative, such as energy-efficient practices or process automation, to reduce expenses

Solution 3

Launching an e-commerce platform to expand the reach of the business and increase online sales

Solution 6

Establishing strategic partnerships with other businesses to gain access to new markets or innovative technologies





\$500,000

Net profit of the project

200 units

Break-even point

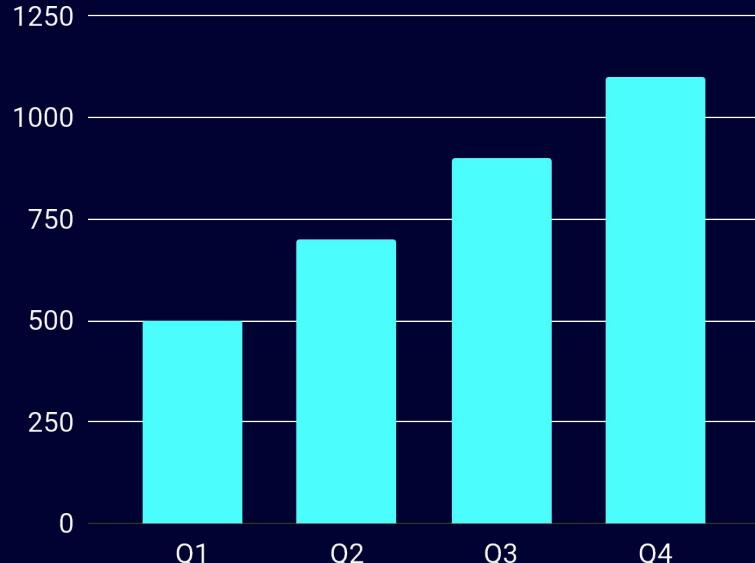
25%

Market share in the industry

10 million

First-year revenue of the project

Project data



Benefits of using graphs

Graphs in project proposals offer visual organization, enabling clear presentation of information in a structured format. They enhance the visual appeal, facilitate data comparison and improve overall clarity and professionalism of your project proposal

Follow the link in the graph to modify its data and then paste the new one here. [For more info. click here](#)

Project activities

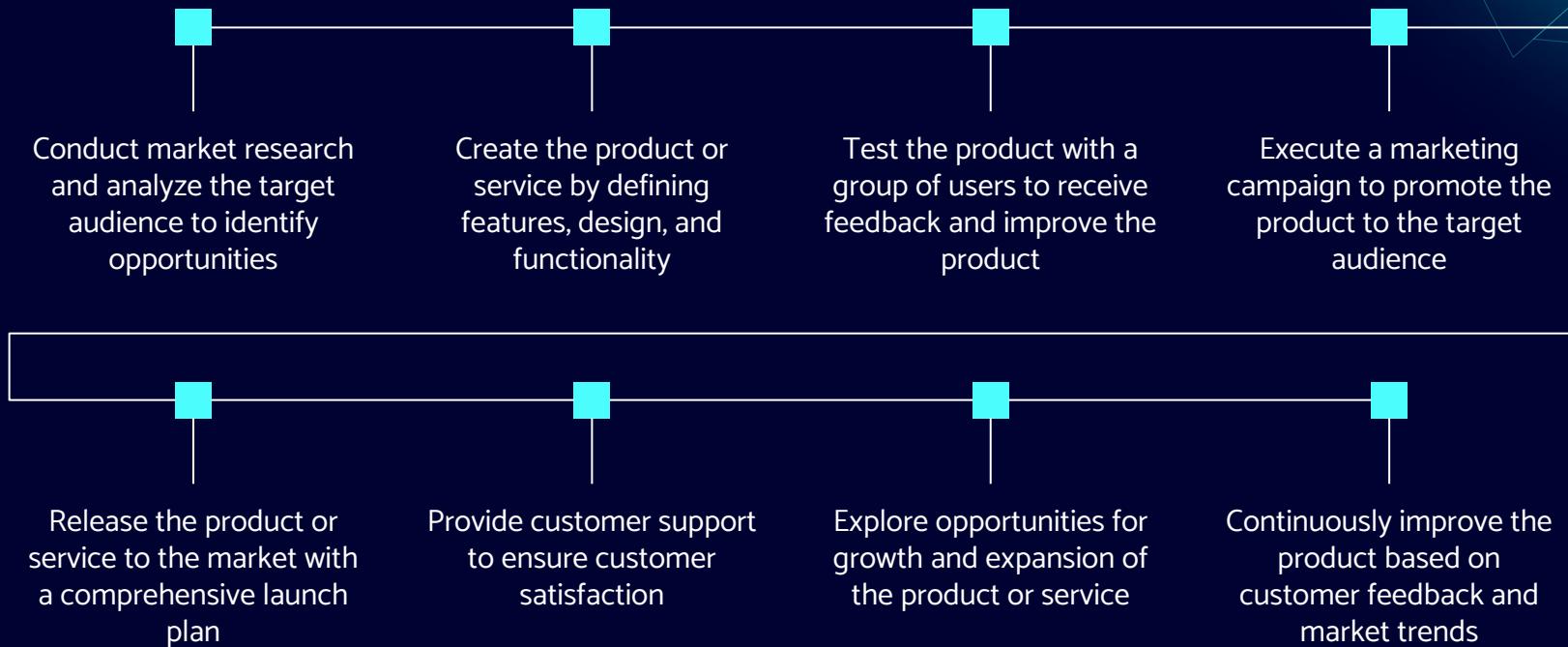
Activity	Start date	End date	Resource	Cost	Revenue
Market research	1/1/20XX	1/15/20XX	Market research firm	\$20,000	
Product development	1/16/20XX	6/30/20XX	R&D team	\$200,000	
Beta testing	7/1/20XX	8/15/20XX	Beta testers	\$10,000	
Marketing campaign	1/1/20XX	1/15/20XX	Advertising agency	\$100,000	
Product launch	1/16/20XX	6/30/20XX	Sales team	\$50,000	\$500,000
Post-launch support	7/1/20XX	8/15/20XX	Support team	\$50,000	\$800,000

What to show in a mockup

1. Product/website description: A brief overview of the product/website, including its key features, dimensions, and materials used
2. Features and benefits: A detailed explanation of the product's/website's features and how they will benefit the user
3. Technical specifications: A list of the product's/website's technical specifications, such as dimensions, weight, power requirements, connectivity options and hosting platform



Project timeline



Project roadmap

Photo showcase

A photo showcase can be a useful addition to a business project proposal as it can help to visually communicate the concept or idea being proposed



Project expenses

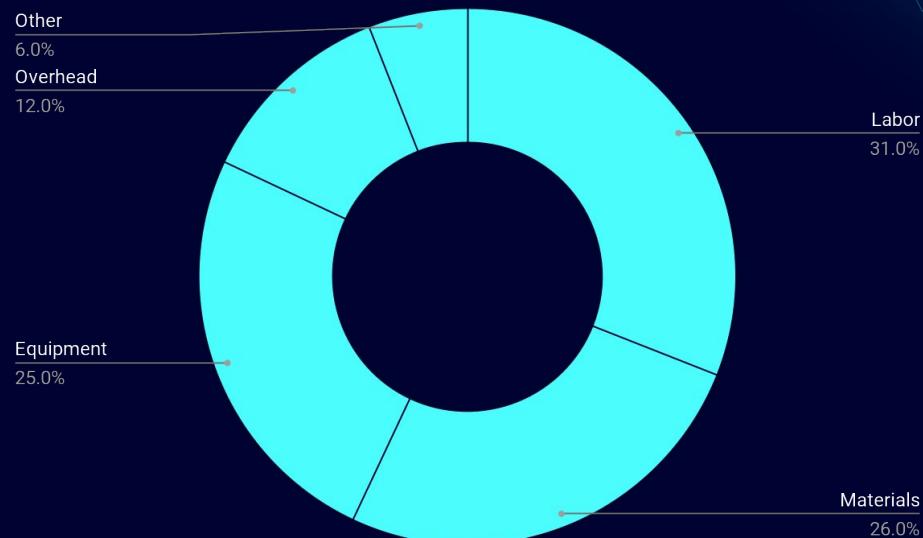
Labor

Materials

Equipment

Overhead

Other



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KPI dashboard

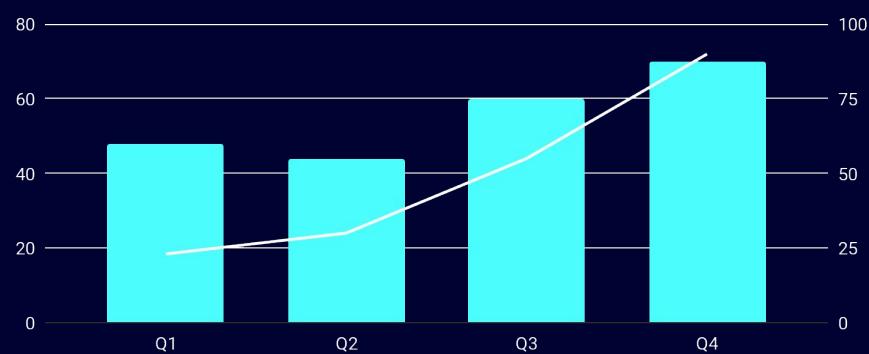
Resource	Utilization rate	Cost per unit
Labor	85%	\$50
Equipment	70%	\$100
Materials	95%	\$20
Rent	90%	\$1,000
Energy	80%	\$80
Software licenses	80%	\$200
Advertising	60%	\$500

120 u/day

Output per worker

2h

Time to complete a task

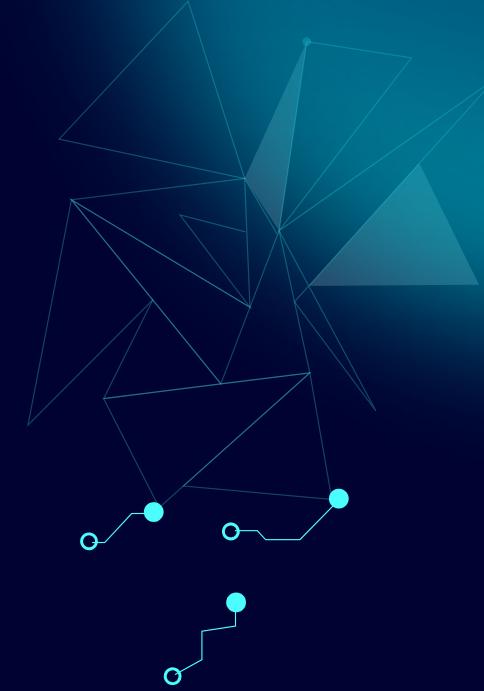


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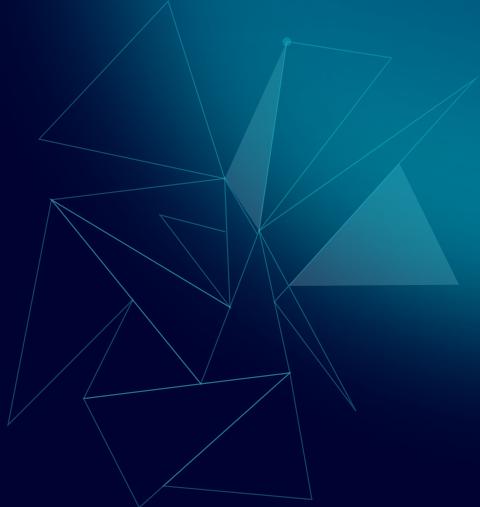
Here's an assortment of alternative resources whose style fits the one of this template:

- [Artificial intelligence landing page template](#)



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- [Person using ai tool at job I](#)
- [Person using ai tool at job II](#)
- [Person using ai tool at job III](#)
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Illustrations

- [Artificial intelligence landing page](#)



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#4cfdfd

#ffffffff

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Pana



Amico



Bro



Rafiki



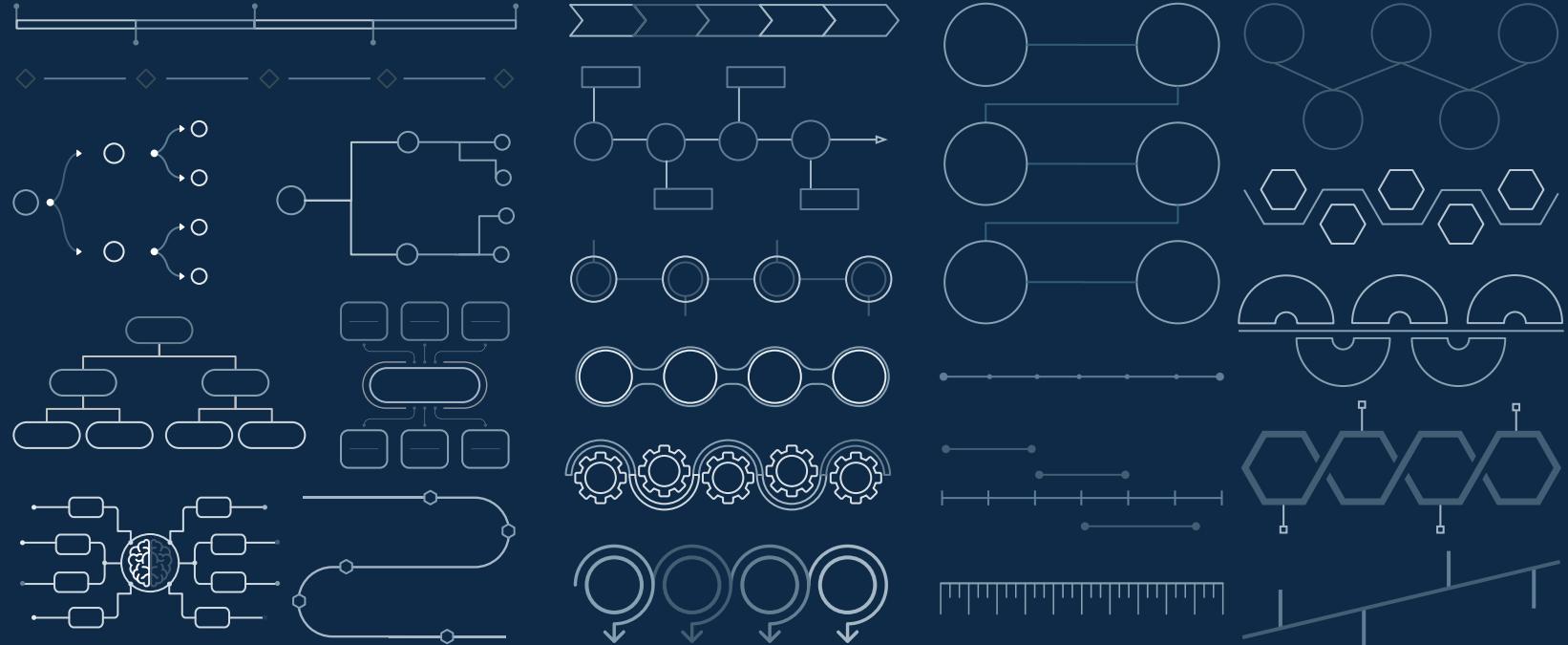
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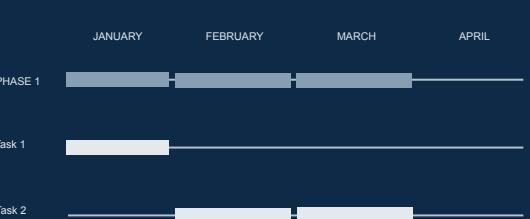
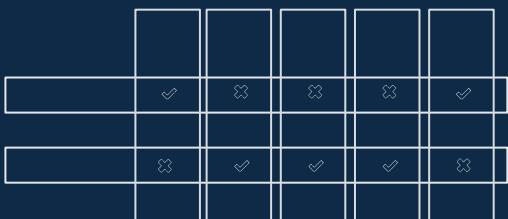
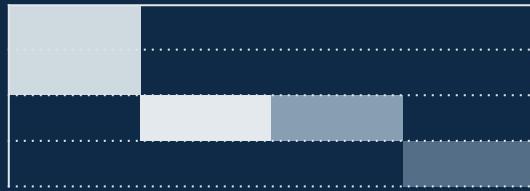
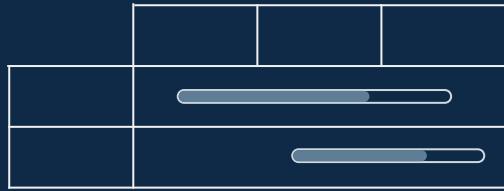
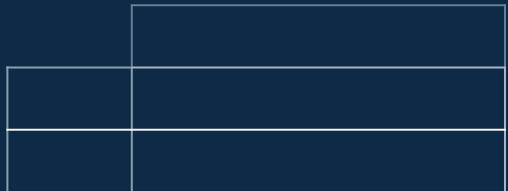
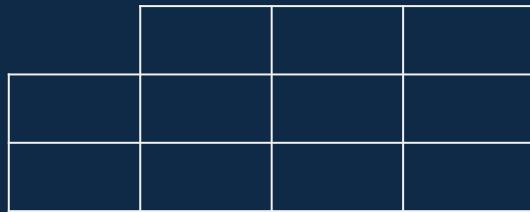
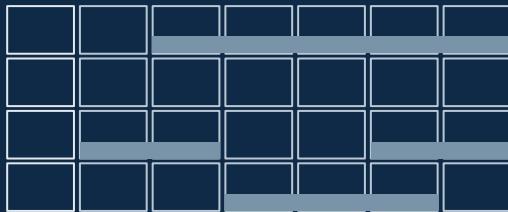
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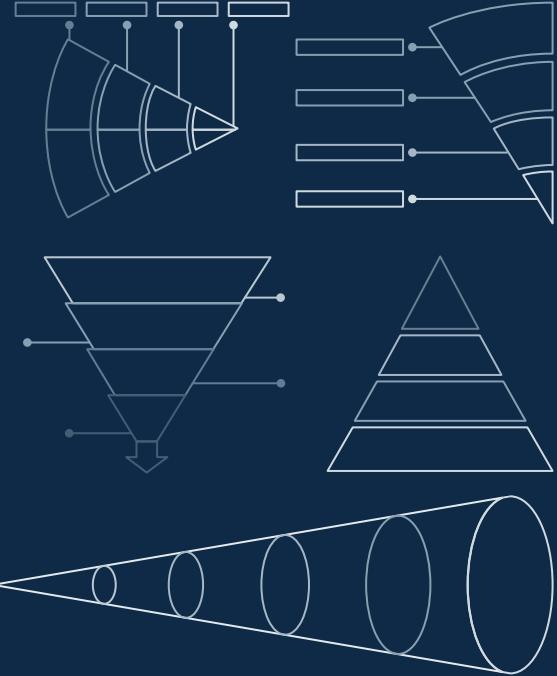
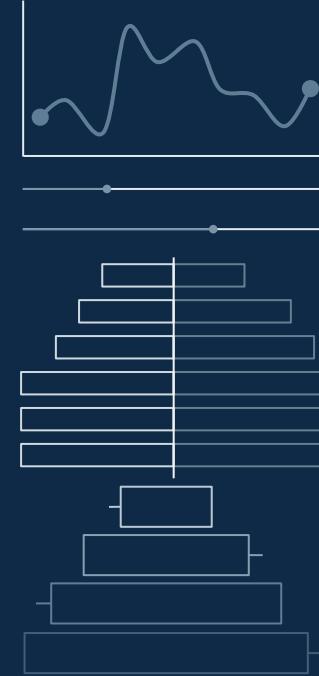
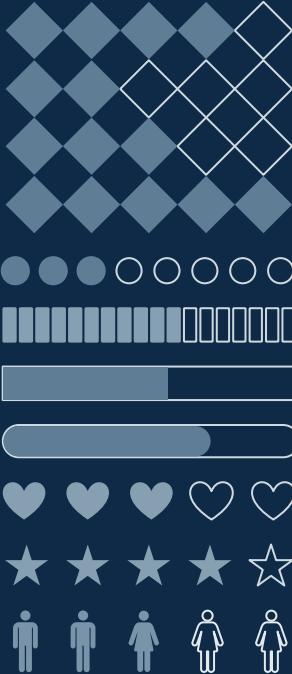
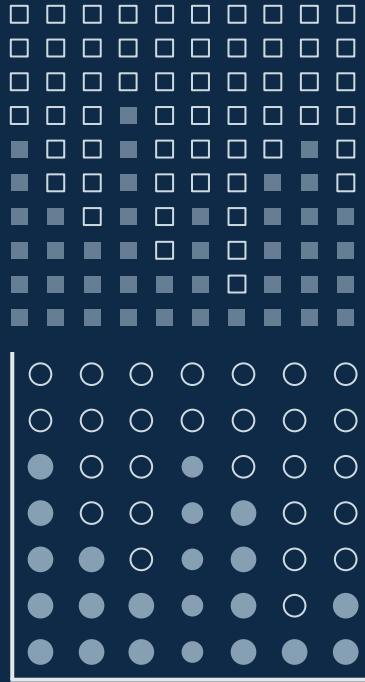












...and our sets of editable icons

You can **resize** these icons without losing quality.

You can **change the stroke and fill color**; just select the icon and click on the **paint bucket/pen**.

In Google Slides, you can also use **Flaticon's extension**, allowing you to customize and add even more icons.



Educational Icons



Medical Icons



Business Icons



Teamwork Icons



Help & Support Icons



Avatar Icons



Creative Process Icons



Performing Arts Icons



Nature Icons



SEO & Marketing Icons

