

---

# Snake Game using Genetic Algorithm

---

HAGER ABO SHEREF



HAGER ABO SHEREF

560

$280 * 280$

$280 - 20$

$260 / 20 = 13$

12 step

without

hitting the

fence.



HAGER ABO SHEREF

---

# Genetic algorithm

---

01 **Initial population**

---

02 **Fitness function**

---

03 **Selection**

---

04 **Crossover**

---

05 **Mutation**

---

---

# Initial population

Population size = 8 x 4

Chromosome size = 1 x 4

Gene size = 1 x 2

The gene consists of two things :  
direction and steps

Steps → Random number from 0 to 12

Direction → Up, Down, Right, Left

---

# Initial population

Chromosome size = 1 x 4

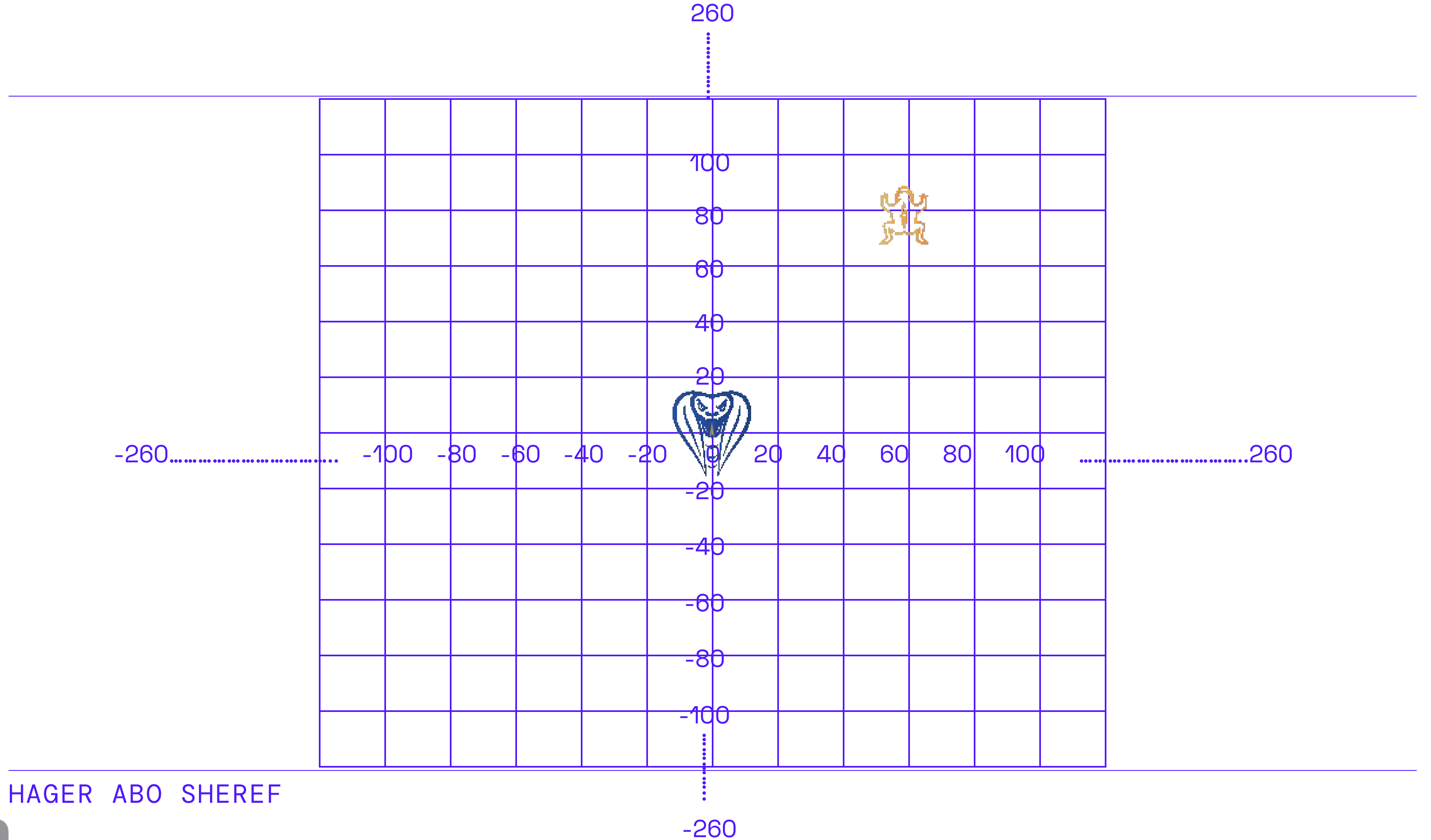
[[9, 'down'], [0, 'up'], [11, 'right'], [9, 'left']]

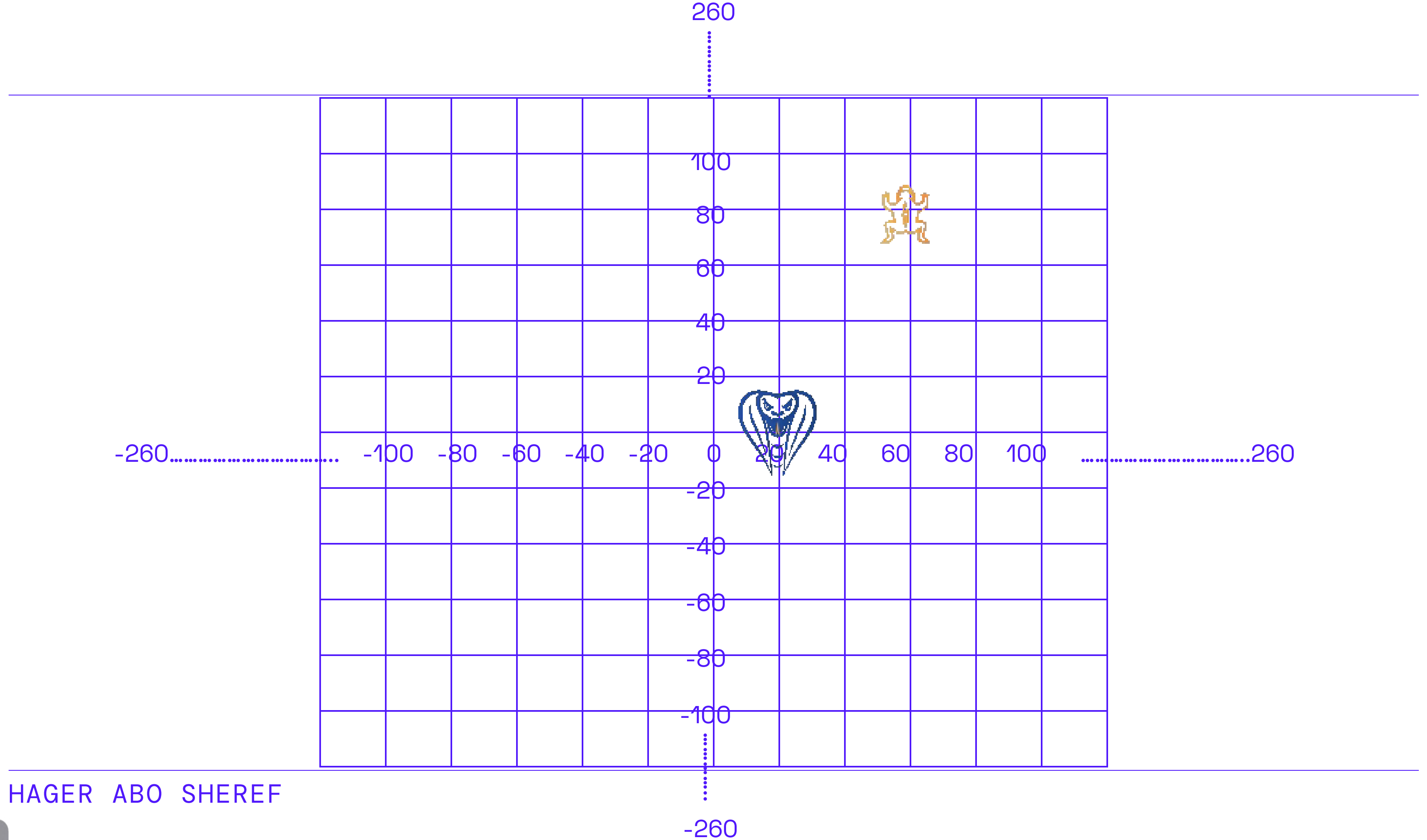
Gene size = 1 x 2

[9, 'down']

9 → Steps

down → Direction







260

100

80

60

40

20

-260

-100

-80

-60

-40

-20

0

20

40

60

80

100

260

-20

-40

-60

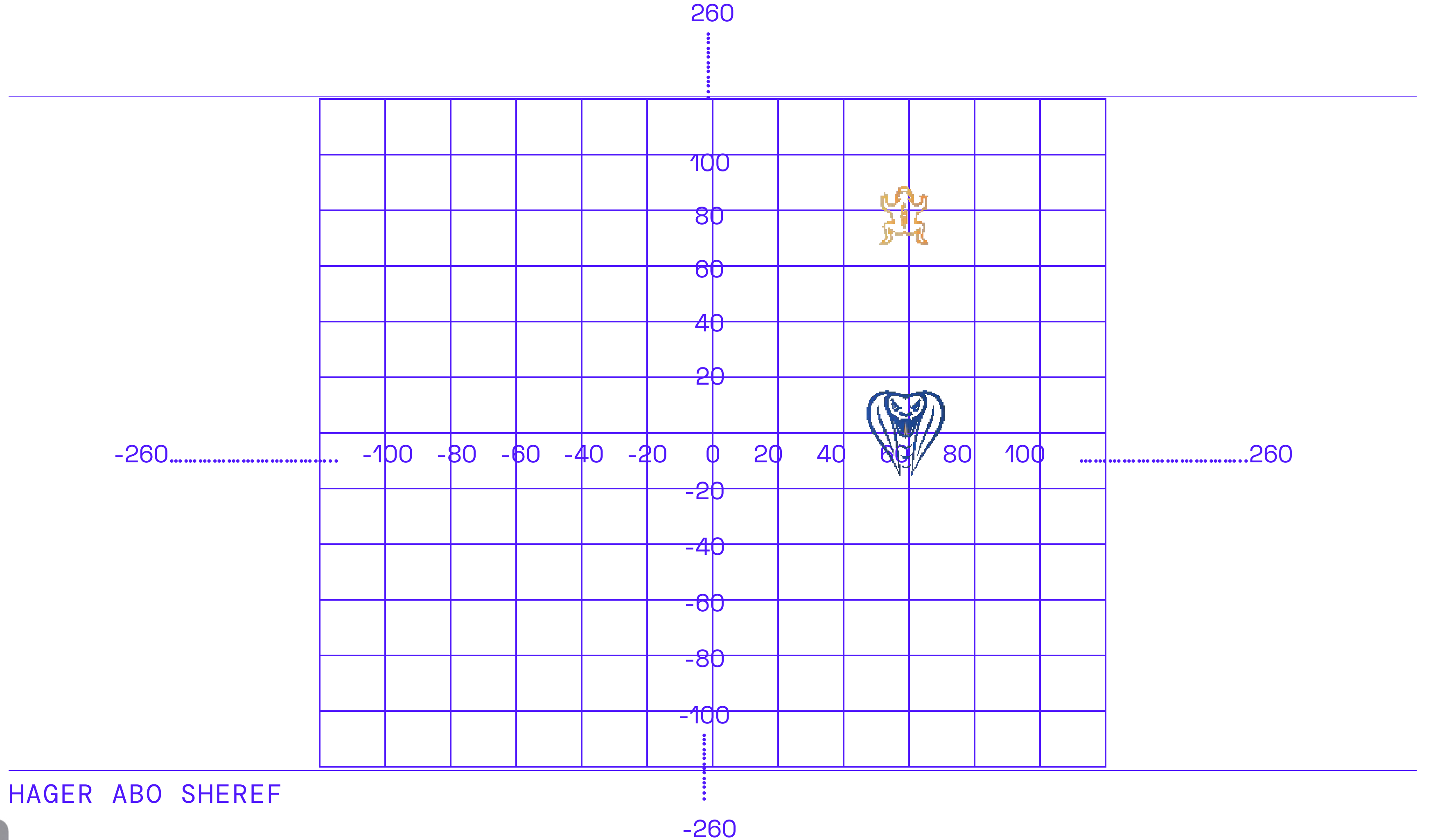
-80

-100

.....

-260

HAGER ABO SHEREF



260

100

80

60

40

20

-260

-100

-80

-60

-40

-20

0

20

40

60

80

100

260

-20

-40

-60

-80

-100

.....

-260

HAGER ABO SHEREF

260

100

80

60

40

20

-260

-100

-80

-60

-40

-20

0

20

40

60

80

100

260

-20

-40

-60

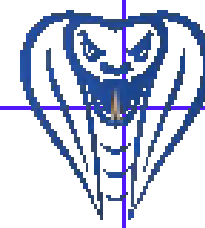
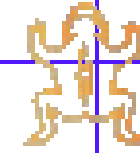
-80

-100

-260

HAGER ABO SHEREF

Pitch



260

100

80

60

40

20

-260

-100

-80

-60

-40

-20

0

20

40

60

80

100

260

-20

-40

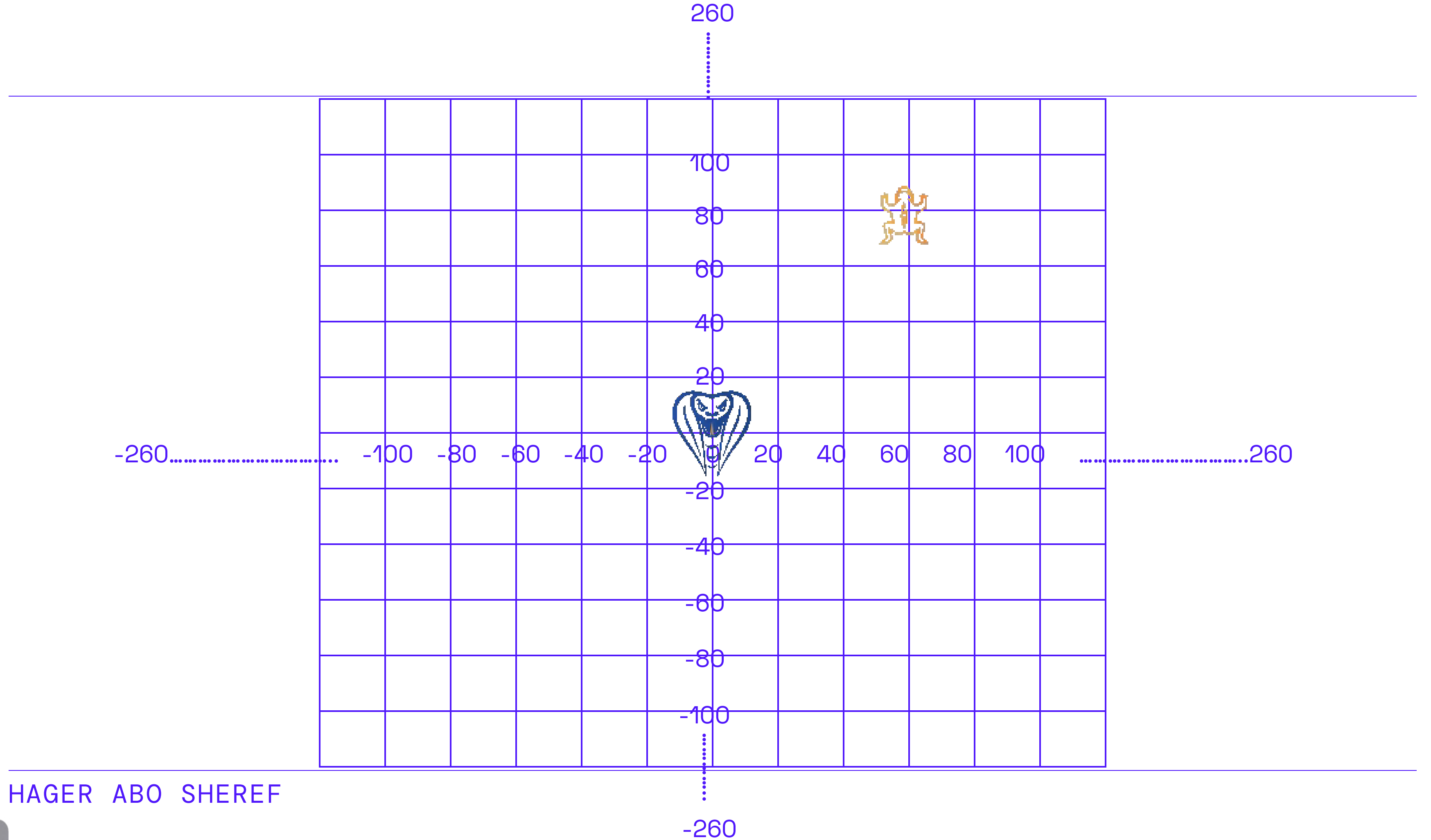
-60

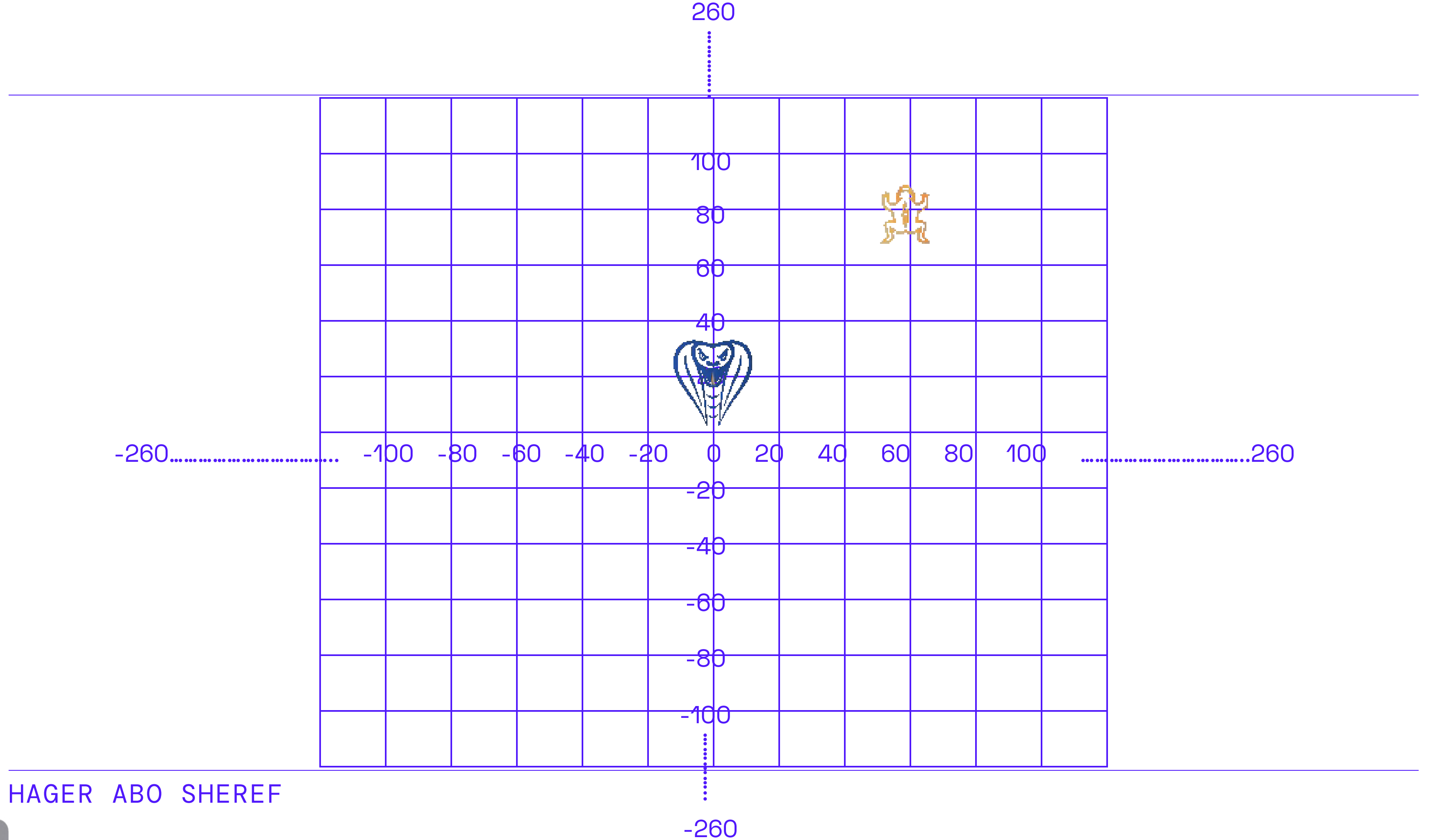
-80

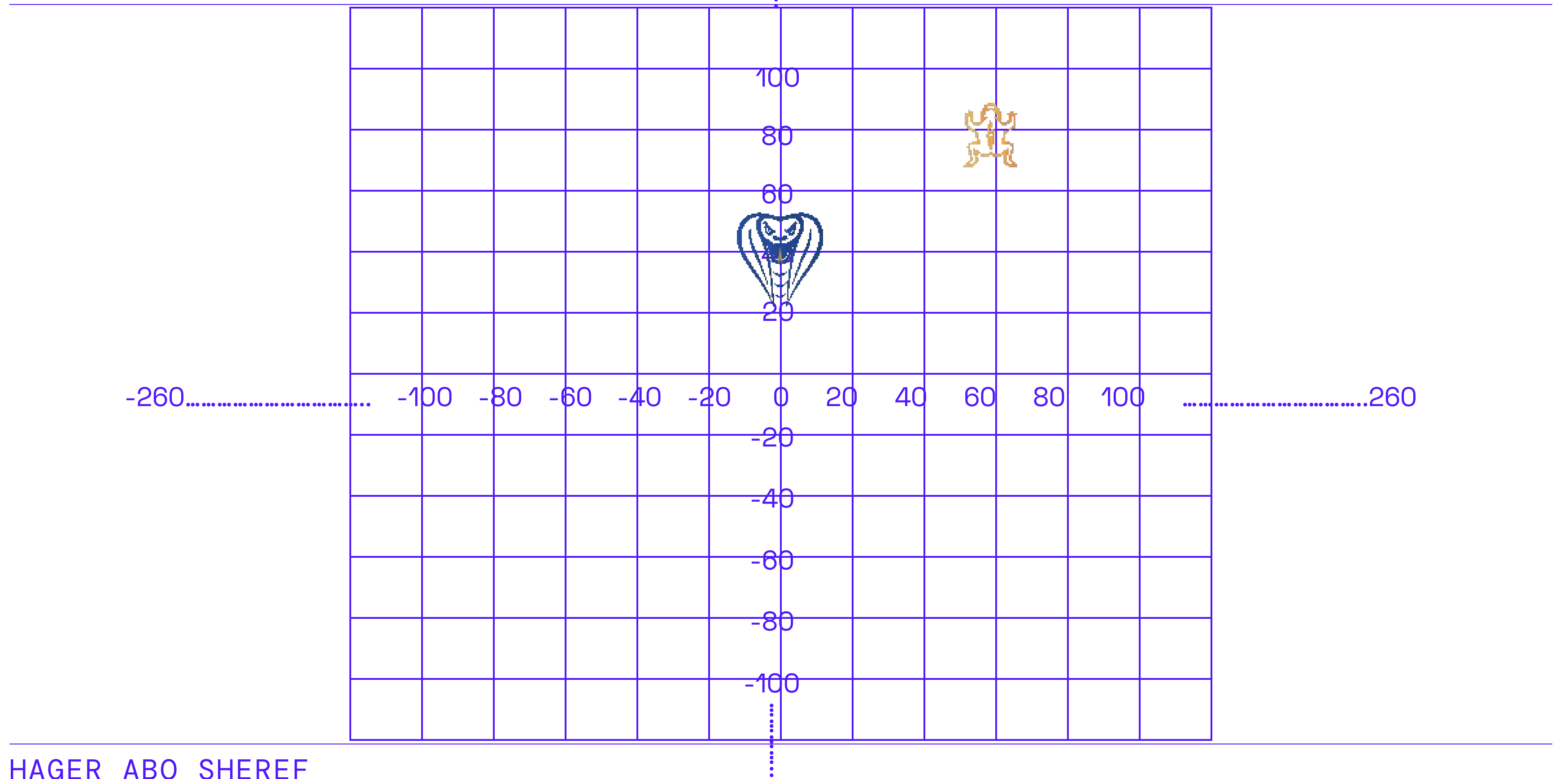
-100

-260

HAGER ABO SHEREF

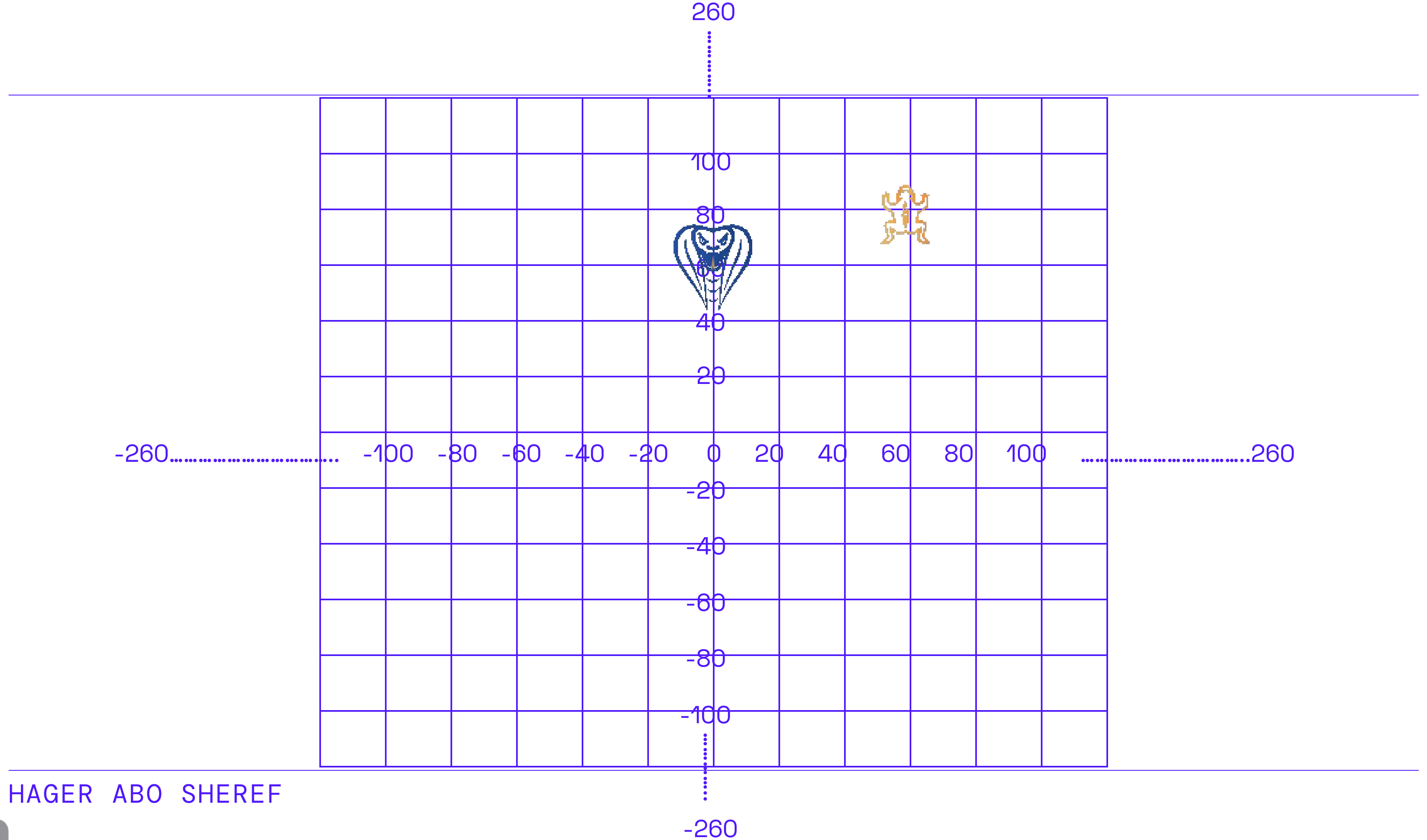


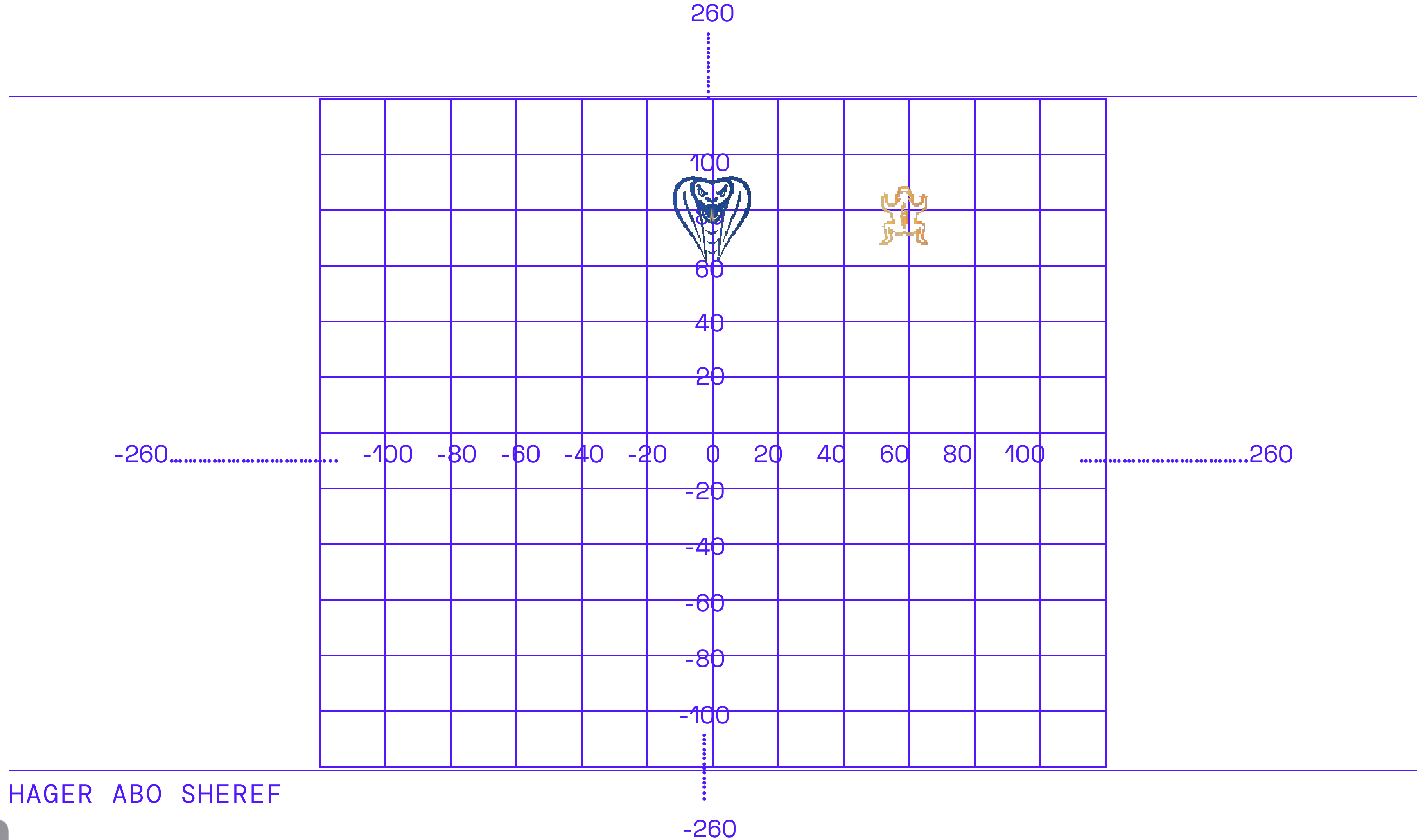




HAGER ABO SHEREF







260

100

80

60

40

20

-260

-100

-80

-60

-40

-20

0

20

40

60

80

100

260

-20

-40

-60

-80

-100

.....

-260

HAGER ABO SHEREF

260

100

80

60

40

20

-260

-100

-80

-60

-40

-20

0

20

40

60

80

100

260

-20

-40

-60

-80

-100

.....

-260

HAGER ABO SHEREF

---

# Fitness function

Random position for frog for the first time

The position of the snake is always fixed [0 , 0]

Calculate the distance between the current position of the snake after using one solution (one chromosome) and the position of the frog using the euclidean distance

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Best fitness → distance ≤ 60 → range(0,60)

# Selection (Random)

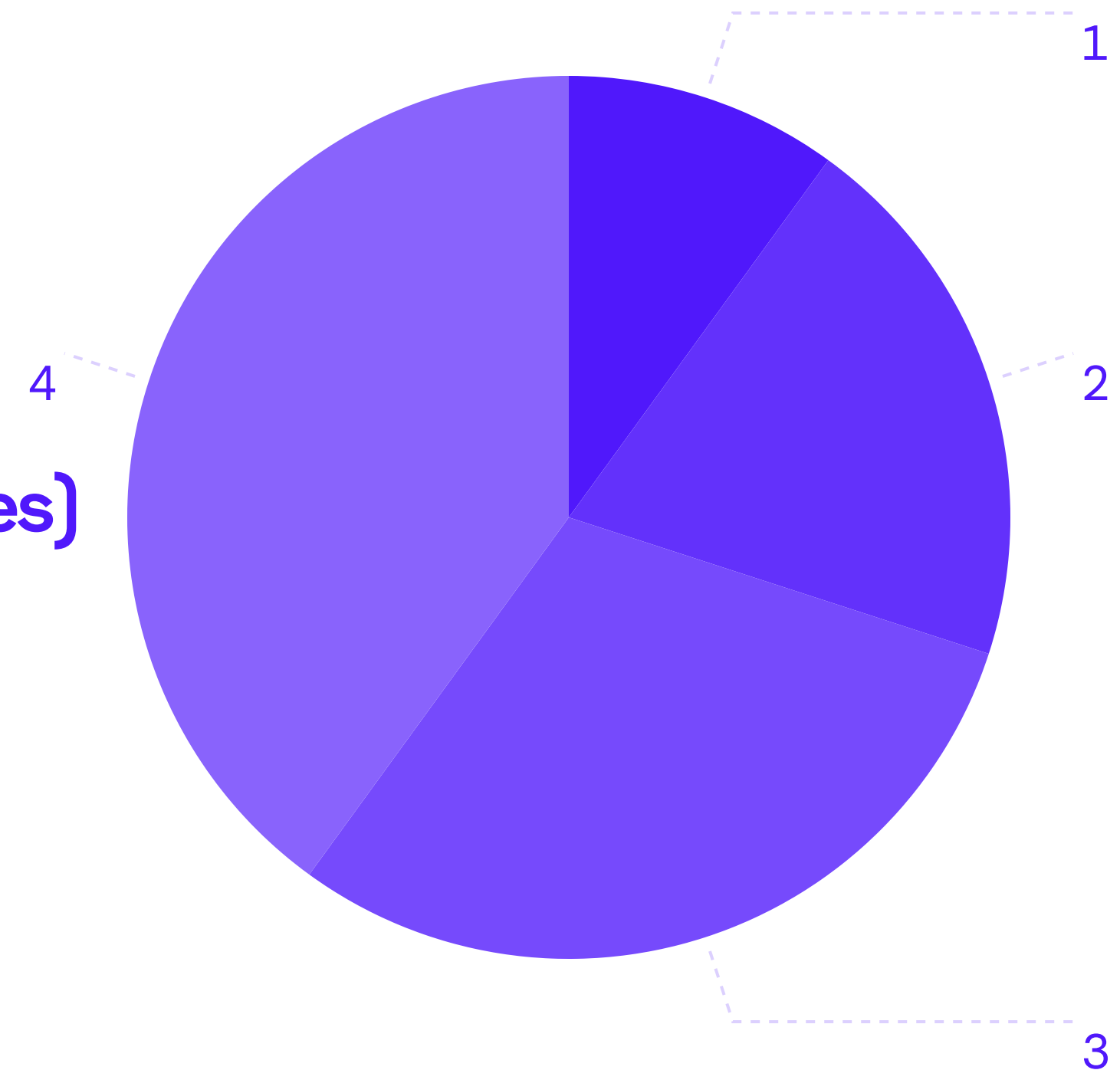
Choose random individuals

Calculate probability of each individual

The least distance → The greatest probability

The probability =  $(1/\text{distance}) / \text{sum}(1/\text{distances})$

Individual recurrence may occur



---

## Crossover (Single point)

Take each 2 parents and apply single point crossover

Single point → random number → range [1,4]

[[8, 'down'], [6, 'left'], [9, 'up'], [5, 'right']] → parent 1

[[2, 'up'], [10, 'left'], [4, 'right'], [1, 'down']] → parent 2

Single point = 1

[[8, 'down'], [10, 'left'], [4, 'right'], [1, 'down']] → child 1

[[2, 'up'], [6, 'left'], [9, 'up'], [5, 'right']] → child 2

---

## Mutation (swap)

In each individual, choose 2 genes and exchange them

[[8, 'down'], [6, 'left'], [9, 'up'], [5, 'right']]

[[5, 'right'], [6, 'left'], [9, 'up'], [8, 'down']]



---

# The End

---

HAGER ABO SHEREF