

## PROGRAM-15

### MIN- MAX ALGORITHM PROBLEM

#### AIM:-

To write and execute the python program for the MIN-MAX algorithm program.

#### PROCEDURE:-

##### Imports and Setup:

- Import the required libraries: `math` and `random`.
- Define the simulated annealing function

##### Initialization:

- Initialize the starting state randomly within a specified range.
- Set the initial temperature.

##### Annealing Loop:

- Iterate until the temperature reaches a minimum threshold.

##### Define Cost Function:

- Define the cost function. In this case, it's the Rastrigin function simplified to 1D

##### Execution and Output:

- Execute the simulated annealing function with the defined parameters and print the optimum state.

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#### CODING:-

```
import math, random
```

```
def simulated_annealing(cost_func, start_temp, cooling_rate):
```

```
    state = current = random.uniform(-10, 10)
```

```
    temp = start_temp
```

```
    while temp > 0.001:
```

```
        new_state = current + random.uniform(-1, 1)
```

```
        cost_diff = cost_func(new_state) - cost_func(current)
```

```

    if cost_diff < 0 or math.exp(-cost_diff / temp) > random.random():

        state = new_state

    current = new_state

    temp *= cooling_rate

return state

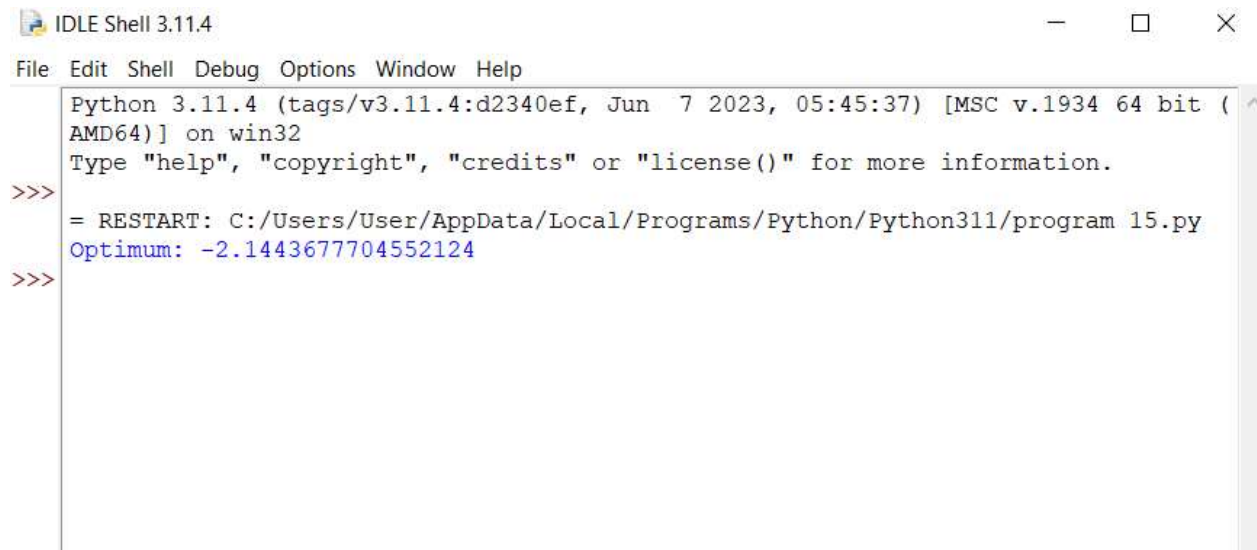
cost_func = lambda x: (x ** 2) - (10 * math.cos(2 * math.pi * x)) + 10 # Rastrigin
function simplified to 1D

start_temp, cooling_rate = 1000, 0.98

print("Optimum:", simulated_annealing(cost_func, start_temp, cooling_rate))

```

## OUTPUT:-



```

IDLE Shell 3.11.4
File Edit Shell Debug Options Window Help
Python 3.11.4 (tags/v3.11.4:d2340ef, Jun 7 2023, 05:45:37) [MSC v.1934 64 bit (AMD64)] on win32
Type "help", "copyright", "credits" or "license()" for more information.
>>>
= RESTART: C:/Users/User/AppData/Local/Programs/Python/Python311/program 15.py
Optimum: -2.1443677704552124
>>>

```

## RESULT:-

Hence the program has been successfully executed and verified.