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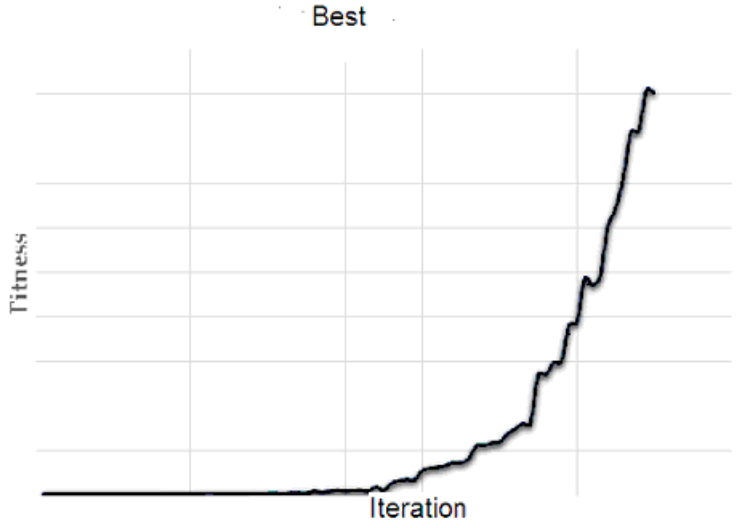
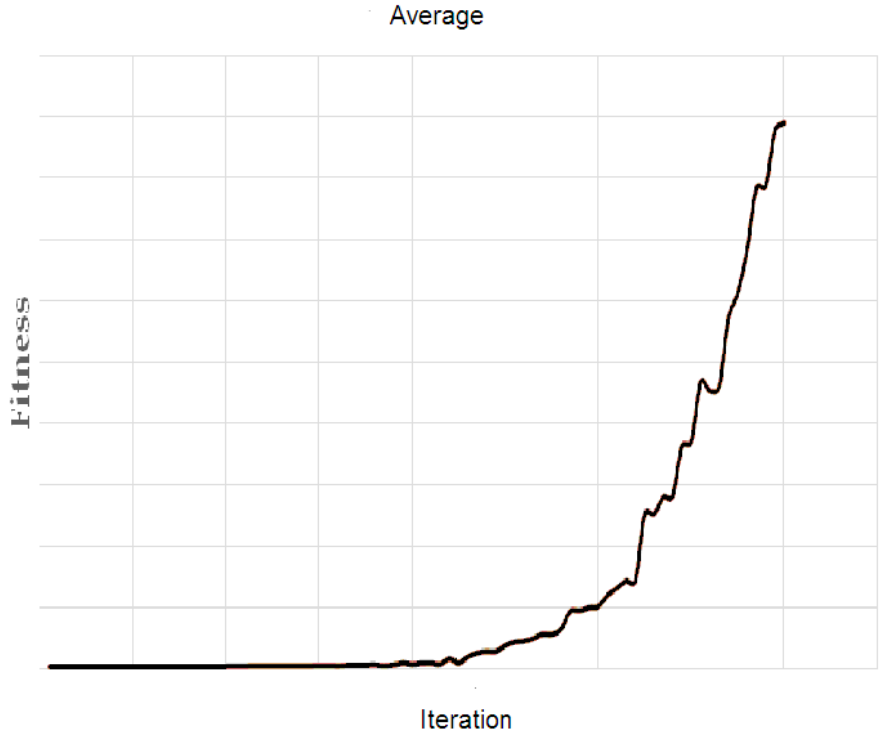
1. Maximize the following y in 3-D cases.

$y= x_1*sin(|x_1|)+ x_2*sin(|x_2|)$

2. Create a population of 20 chromosomes at random, with fitness being y.

3. Evole this population till fitness dosen't change






```
import random
from math import sin
        def get_average_value(generation):
```

```
        av_list = []
        for i in generation:
                sum = fitness_function(i)
        av_list.append(sum)
        average = reduce(lambda x, y: x + y, av_list) / len(av_list)
        min_value = min(av_list)
        return (average, min_value)
def fitness_function(i):
sum = 0
for j in i:
        sum += j * sin(abs(j))
        return sum
def main():
generation = []
for i in range(0, 20):
        hromosome = []
        for j in range(0, 20):
                hromosome.append(random.uniform(-5, 5))
                generation.append(hromosome)
                min_value = get_average_value(generation)[1]
        print(min_value)
        count = 0
        while count < 10:
                generation.sort(key=lambda x: fitness_function(x), reverse=False)
                fathers = generation[0:10]
                new_generation = []
        for i in range(0, 10):
                mother = random.randrange(0, 10)
                father = random.randrange(0, 10)
                rand_index = random.randrange(0, 20)
                first = fathers[mother][0:rand_index]
                first.extend(fathers[father][rand_index:20])
                second = fathers[father][0:rand_index]
                second.extend(fathers[mother][rand_index:20])
                new_generation.append(first)
                new_generation.append(second)
                new_generation.extend(fathers)
                new_max = get_average_value(new_generation)
        print(new_max)
        if new_max[1] < min_value:
                min_value = new_max[1]
                count = 0
        else:
                count += 1
generation = new_generation
if __name__ == '__main__':
main()
```