

5_March_mongo_version

March 6, 2021

```
[1]: import numpy as np
import math
import random
import json
import requests
from matplotlib import pyplot as plt
from pymongo import MongoClient
import copy
```

```
[2]: NUM_FEATURES=11
LB_LIMIT=-10
UB_LIMIT=10
MAX_ITR=20
MIN_COST=-999999 # ??/
POP_SIZE=26
MUT_RATE=0.2
RETENTION_RATE=0.25 # selection rate from prev generation
TODAY = "PROPER 5th March, STINT_2, Sorted on 0.95 x max + 0.05 x min | "
```

```
[3]: client = MongoClient("mongodb+srv://Raj:mongodb123@cluster0.lnsqb.mongodb.net/
    ↪ml-proj?retryWrites=true&w=majority")
db = client['ml-proj']
coll = db['main-coll']
details = db['details-2']
```

```
[4]: surviving_members_num=math.floor(POP_SIZE*RETENTION_RATE)
if surviving_members_num%2==1:
    surviving_members_num-=1
num_cells_mutate=math.ceil((POP_SIZE-1)*NUM_FEATURES*MUT_RATE) ## ??????
num_matings_per_itr=math.ceil((POP_SIZE-surviving_members_num)/2)
print("surviving members num is ", surviving_members_num)
```

surviving members num is 6

```
[5]: #print(locals())

global_storage=[]
```

```
[6]: API_ENDPOINT = 'http://10.4.21.156'
MAX_DEG = 11
SECRET_KEY = 'BKeUYuWnLNaT7N2zzbmzI9VktYLNGrwbMX2lBfiGksBb3m6mOR'
# SECRET_KEY = "none"

def urljoin(root, path=''):
    if path:
        root = '/' . join([root.rstrip('/'), path.rstrip('/')])
    return root

def send_request(id, vector, path):
    api = urljoin(API_ENDPOINT, path)
    vector = json.dumps(vector)
    response = requests.post(api, data={'id': id, 'vector': vector}).text
    if "reported" in response:
        print(response)
        exit()

    return response

def get_errors(id, vector):
    for i in vector:
        assert 0 <= abs(i) <= 10
    assert len(vector) == MAX_DEG

    return json.loads(send_request(id, vector, 'geterrors'))
```

```
[7]: anmol_arr=[]
```

```
[8]: def get_fitness_value(coeff_arr, curr_gen_num):
    #coeff_arr=coeff_arr.tolist()

    #return [1,2]

    #return random.random()

    assert(len(coeff_arr)==NUM_FEATURES)
    for i in range(0,NUM_FEATURES):
        if coeff_arr[i]>=10:
            coeff_arr[i] = 10
        elif i<=-10:
            coeff_arr[i] = -10

    val = get_errors(SECRET_KEY, coeff_arr)
    #print(f"coeff arr is {coeff_arr}")
```

```

        #print("val is ", val)
        annol_arr.append({"array_stuff":coeff_arr, "errors_returned":val, "gen":
↪curr_gen_num})

        ↵
↪#print("-----")

    return val

```

```

[9]: def get_fitness_value_alt(coeff_arr, curr_gen_num):
    assert(len(coeff_arr)==NUM_FEATURES)
    x=coeff_arr[0]
    y=coeff_arr[1]
    '''x_add=x*math.sin(4*x)
    y_add= 1.1 * y * math.sin(2*y)'''

    '''
    x_add=x*math.sin(4*x)
    y_add= 1.1 * y * math.sin(2*y)
    '''

    # x_add=x
    # y_add=y
    # print(f"x and x_add is {x} : {x_add}")
    # print(f"y and y_add is {y} : {y_add}")
    assert(x>=LB_LIMIT and x<=UB_LIMIT)
    assert(y>=LB_LIMIT and y<=UB_LIMIT)
    # val=x_add+y_add

    # val=0.01*( x*x*(y-2)*(y-3) - (x+y)**3 + y*y*y*(y-2*x))
    val_arr=[x+y]*2
    #print(val)
    #coeff_arr=coeff_arr.tolist()
    annol_arr.append({"array_stuff":coeff_arr, "errors_returned":val_arr, "gen":
↪curr_gen_num})
    #res_ret=[val,val]
    #print("val returned is ", res_ret)
    return val_arr

```

```

[10]: def create_starting_population(num_members, num_features, lb, ub):
    # Adam and Eve
    sample_pop = np.random.uniform(low=lb, high=ub, ↵
↪size=(num_members,num_features))
    return sample_pop

```

```
[11]: def insert_single_member_into_db(gen_id, features, errors):
    coll.insert_one({
        'generation': gen_id,
        'try_vector': features,
        'errors': errors,
        'desc' : TODAY
    })
    details.update_one({"try_vector": features},
                       {"$set": {"errors": errors}})
```

```
[12]: global_json=[]
```

```
[13]: print(global_json)
```

```
[]
```

```
[14]: def calculate_fitness_for_curr_pop(members_list, curr_gen_num):
    '''receives a 2D array'''

    tot_len=len(members_list)
    fitness_arr=[]

    errors_traced=[]

    for i in range(0,tot_len):
        its_fitness_val = [0, 0]
        exist_vec = coll.find({'try_vector': members_list[i]}).count()
        exist_vec=0
        print('exist? ', exist_vec)
        if exist_vec > 0:
            doc_found = coll.find_one({'try_vector': members_list[i]})
            its_fitness_val = doc_found['errors']
            details.update_one({"try_vector": members_list[i]},
                              {"$set": {"errors": doc_found['errors']}})
            print('DOC', doc_found)
            print('VAL', its_fitness_val)
        else:
            its_fitness_val = get_fitness_value(members_list[i], curr_gen_num)
            insert_single_member_into_db(curr_gen_num,
            ↪members_list[i],its_fitness_val)

        fitness_arr.append(0.05 * min(its_fitness_val[1],its_fitness_val[0])+0.
            ↪95 * max(its_fitness_val[1],its_fitness_val[0]))

        if type(its_fitness_val)!=list:
            raise TypeError("WEIRD TYPE GOLIATH ERROR")
        errors_traced.append(its_fitness_val)
```

```
#print("fitness arr being sent is ")
#print(*fitness_arr, sep="\t")
return fitness_arr, errors_traced
```

```
def sort_generation_members(members_list, curr_gen_num):
#     print(f"type is {type(members_list)} and arg is ")
    #print(*members_list, sep='\n')
    tot_len=len(members_list)
    cost_arr , unsorted_errors_traced_here = np.
↪array(calculate_fitness_for_curr_pop(members_list, curr_gen_num))

    sort_indices = np.argsort(cost_arr)

    # Descending
    #sort_indices=sort_indices[::-1]

    if type(members_list[0])!=list:
        raise TypeError("Friday error")

    sorted_members_list=[]
    sorted_costs=[]
    # print("member is ", members_list)
    for num in range(0,tot_len):
        i=sort_indices[num]
        #print(f"here member for {i} is ", members_list[i])

        sorted_members_list.append(members_list[i])
        sorted_costs.append(cost_arr[i])


    # $$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$$

    # print("Sorted indices are \n", sort_indices)
    #sin(x) : 0, 45, 90
    #90, 45,0   (1, 1/root 2, 0)
    #45->1/root 2
    #0->0
    '''print("\nSorted members are \n")
    print(*sorted_members_list, sep='\n')
    print("-----")

    print("\nSorted costs are \n")
    print(*sorted_costs, sep='\n')
    print("#####")'''
```

```

'''
    return sorted_members_list, sorted_costs, unsorted_errors_traced_here,
    ↪sort_indices

```

```

[16]: def get_probabilities(n):
    numerator=np.arange(1,n+1)
    #print("init is ", numerator)
    numerator*=-1
    denom=(n*(n+1))/2
    numerator+=n+1
    #print("init is ", numerator)

    numerator=np.divide(numerator, denom)
    return numerator

```

```

[17]: def crossover(parent1, parent2):

    '''
        Deb and Agrawal [196] developed the simulated binary crossover (SBX) to
        ↪simulate the
        behavior of the one-point crossover operator for binary representations.
    '''

    child1 = np.empty(NUM_FEATURES)
    child2 = np.empty(NUM_FEATURES)
    print(f"parent 1 is {parent1}")
    print(f"parent 2 is {parent2}")

    u = random.random()
    n_c = 3
    '''where  $r_j \sim U(0, 1)$ , and  $\eta > 0$  is the distribution index. Deb and Agrawal
    ↪suggested
    that  $\eta = 1$ .'''

    '''The SBX operator generates offspring symmetrically about the parents,
    ↪which prevents
    bias towards any of the parents. For large values of  $\eta$  there is a higher
    ↪probability that
    offspring will be created near the parents. For small  $\eta$  values, offspring
    ↪will be more
    distant from the parents.'''

    if (u < 0.5):
        beta = (2 * u)**((n_c + 1)**-1)
    else:

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        beta = ((2*(1-u))**(-1))**((n_c + 1)**(-1))

    parent1 = np.array(parent1)
    parent2 = np.array(parent2)
    child1 = 0.5*((1 + beta) * parent1 + (1 - beta) * parent2)
    child2 = 0.5*((1 - beta) * parent1 + (1 + beta) * parent2)

    for i in range(len(child1)):
        child1[i]=max(child1[i],LB_LIMIT)
        child1[i]=min(child1[i],UB_LIMIT)

    for i in range(len(child2)):
        child2[i]=max(child2[i],LB_LIMIT)
        child2[i]=min(child2[i],UB_LIMIT)

    print(f"CHILD 1 is {child1}")
    print(f"CHILD 2 is {child2}")

    print("#-----")

    return child1.tolist(), child2.tolist()

```

```

[18]: def get_mutated_version(arr, really=False):
    mut_prob_now=0.7
    arr=arr.tolist().copy()
    if really:
        #arr=arr.tolist()
        #print(arr)
        len_arr=len(arr)
        for i in range(0,len_arr):
            prob=random.uniform(0, 1)
            if prob<=mut_prob_now:
                curr_val=arr[i]
                if curr_val==0:
                    curr_val=1
                d_val=random.uniform(-abs(0.5*curr_val), abs(0.5*curr_val))
                arr[i]+=d_val
                arr[i]=min(arr[i],UB_LIMIT)
                arr[i]=max(arr[i],LB_LIMIT)
                #print(f"{i} mutated {curr_val}->{arr[i]}")
        return arr
    else:
        return arr

```

```

[19]: # Iterations
#parents_now=sorted_initial_pop.copy()

CURR_GEN_NUM=1
init_arr=np.array(
[
[0.0, -1.3783500660791644e-12, -6.424818573634483e-14, 6.580019545565703e-11,
↪-2.0984549655895666e-10, -1.6152790712010518e-15, 7.763006729384186e-16, 2.
↪2757658578306265e-05, -1.9193275505106666e-06, -8.894106807593951e-09, 7.
↪758133607867065e-10],

[0.0, -1.457990220064754e-12, -9.648767410168089e-14, 7.485339950833092e-11, -1.
↪9881004961860312e-10, -1.5962350118384506e-15, 7.521932081253182e-16, 2.
↪3668681206269528e-05, -1.989031728863744e-06, -7.991914261771e-09, 7.
↪860139677568573e-10],

[-0.030191655016508116, -1.370451290585018e-12, 1.944684541618345e-14, 8.
↪210907153265034e-11, -2.2255497577166302e-10, -1.7133147300890716e-15, 7.
↪847853460987011e-16, 2.174237713450648e-05, -2.0639270090069506e-06, -5.
↪206637844452329e-09, 7.75711723530254e-10],

[-0.016347746048917644, -1.3387827712968235e-12, -6.541567279446175e-14, 8.
↪651454674726037e-11, -2.1494946650019876e-10, -1.8360756358315474e-15, 1.
↪1093211039965001e-15, 2.515778146953262e-05, -2.015649193094959e-06, -8.
↪786550389563894e-09, 8.047779335648933e-10],
]

)
#init_arr = np.array([10,10])

#init_arr=np.array([LB_LIMIT+0.1,UB_LIMIT-0.1])
# # Create the initial population
starting_population_mat=create_starting_population(POP_SIZE, NUM_FEATURES,
↪LB_LIMIT, UB_LIMIT)

for i in range(0,POP_SIZE):
    if i<4:
        starting_population_mat[i]=get_mutated_version(np.array(init_arr[i%4]),
↪False)
    else:
        starting_population_mat[i]=get_mutated_version(np.
↪array(init_arr[i%4]),True)

'''starting_population_mat = np.array([
]

```



```

'''
starting_population_mat=starting_population_mat
print("\nStarting pop is \n")
print(*starting_population_mat, sep="\n\n")

generation_info=[]
generation_info.append({"members":starting_population_mat.tolist(),
↳ "avg_fitness":0, "min_fitness":0})
#print(generation_info)

```

Starting pop is

```

[ 0.00000000e+00 -1.37835007e-12 -6.42481857e-14  6.58001955e-11
 -2.09845497e-10 -1.61527907e-15  7.76300673e-16  2.27576586e-05
 -1.91932755e-06 -8.89410681e-09  7.75813361e-10]

[ 0.00000000e+00 -1.45799022e-12 -9.64876741e-14  7.48533995e-11
 -1.98810050e-10 -1.59623501e-15  7.52193208e-16  2.36686812e-05
 -1.98903173e-06 -7.99191426e-09  7.86013968e-10]

[-3.01916550e-02 -1.37045129e-12  1.94468454e-14  8.21090715e-11
 -2.22554976e-10 -1.71331473e-15  7.84785346e-16  2.17423771e-05
 -2.06392701e-06 -5.20663784e-09  7.75711724e-10]

[-1.63477460e-02 -1.33878277e-12 -6.54156728e-14  8.65145467e-11
 -2.14949467e-10 -1.83607564e-15  1.10932110e-15  2.51577815e-05
 -2.01564919e-06 -8.78655039e-09  8.04777934e-10]

[ 3.03449210e-01 -1.72706167e-12 -6.51874419e-14  6.58001955e-11
 -1.91888466e-10 -8.11880713e-16  7.76300673e-16  2.27576586e-05
 -1.97683041e-06 -8.54960144e-09  8.96279538e-10]

[-2.37213263e-01 -9.04629277e-13 -8.44686365e-14  7.48533995e-11
 -2.88027417e-10 -1.59623501e-15  8.96150822e-16  2.36686812e-05
 -2.43730963e-06 -1.15806122e-08  7.86013968e-10]

[-4.15487630e-02 -7.80339065e-13  1.05824730e-14  9.67853649e-11
 -1.82776248e-10 -8.85952267e-16  7.84785346e-16  1.77378370e-05
 -2.75228341e-06 -7.39561525e-09  7.75711724e-10]

[-1.66200922e-02 -1.34531221e-12 -3.97582423e-14  8.80262339e-11
 -1.49545121e-10 -2.74716531e-15  1.10932110e-15  2.51577815e-05
 -2.01564919e-06 -7.42742677e-09  8.96718603e-10]

[ 1.72211655e-01 -1.37170378e-12 -4.93449430e-14  9.02871842e-11

```

-2.65691642e-10 -1.14999605e-15 7.24832880e-16 1.51774217e-05
 -1.98388483e-06 -8.89410681e-09 7.75813361e-10]

[4.42294831e-02 -7.33889268e-13 -8.52008253e-14 7.48533995e-11
 -2.79383504e-10 -1.20257156e-15 9.40648250e-16 2.36686812e-05
 -2.14017171e-06 -7.99191426e-09 1.01597611e-09]

[-3.01916550e-02 -1.92699535e-12 1.92930887e-14 8.21090715e-11
 -2.68274156e-10 -1.71331473e-15 9.11019898e-16 2.97683641e-05
 -1.37262834e-06 -5.21337136e-09 9.59825804e-10]

[-1.63477460e-02 -1.65938269e-12 -6.54156728e-14 1.13878711e-10
 -2.14949467e-10 -1.16493403e-15 5.70331318e-16 3.03415200e-05
 -2.86009983e-06 -6.60523054e-09 8.04777934e-10]

[0.00000000e+00 -1.79083416e-12 -3.55969195e-14 6.58001955e-11
 -1.22494731e-10 -1.55330475e-15 7.53898304e-16 3.36511879e-05
 -1.91932755e-06 -1.26914772e-08 7.75813361e-10]

[4.89023092e-01 -1.42046245e-12 -9.64876741e-14 7.48533995e-11
 -2.12290301e-10 -1.39529845e-15 1.07573061e-15 2.36686812e-05
 -1.09937196e-06 -7.99191426e-09 1.05452688e-09]

[-1.91218101e-02 -1.45399442e-12 1.15577845e-14 8.21090715e-11
 -2.44375317e-10 -1.71331473e-15 7.65124392e-16 2.17423771e-05
 -2.03715993e-06 -5.95498426e-09 5.23484739e-10]

[-9.60346457e-03 -1.55353558e-12 -3.84152372e-14 1.15709565e-10
 -2.71008014e-10 -2.22975227e-15 1.24986172e-15 2.51577815e-05
 -2.01564919e-06 -8.78655039e-09 8.65254322e-10]

[-4.02006800e-01 -1.87909950e-12 -6.42481857e-14 8.05782978e-11
 -1.57095060e-10 -1.17733037e-15 4.23223001e-16 2.12279676e-05
 -2.65778746e-06 -1.24598433e-08 7.75813361e-10]

[0.00000000e+00 -1.08693118e-12 -5.58889889e-14 7.48533995e-11
 -1.24476253e-10 -1.85393522e-15 8.29324485e-16 2.36686812e-05
 -2.59602681e-06 -7.99191426e-09 7.86013968e-10]

[-2.72651430e-02 -1.64952613e-12 1.94468454e-14 5.20796953e-11
 -2.05771661e-10 -1.79724836e-15 8.80442563e-16 2.17423771e-05
 -2.86509707e-06 -3.68705425e-09 8.99712997e-10]

[-1.63477460e-02 -7.71235753e-13 -7.99669862e-14 8.65145467e-11
 -2.14949467e-10 -1.83607564e-15 1.03789531e-15 2.96244012e-05
 -2.49822791e-06 -9.93219255e-09 8.04777934e-10]

[2.81548562e-01 -1.37835007e-12 -7.72173153e-14 6.58001955e-11

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-2.83241997e-10 -1.61527907e-15 1.09640259e-15 1.85728031e-05
-1.64697261e-06 -8.89410681e-09 7.07640232e-10]

[ 0.00000000e+00 -1.13501337e-12 -7.79887455e-14 1.07120864e-10
-1.98810050e-10 -1.63655968e-15 1.03382959e-15 2.01693687e-05
-2.12178184e-06 -7.99191426e-09 6.66371122e-10]

[-3.01916550e-02 -1.56753813e-12 1.94468454e-14 8.21090715e-11
-1.16218700e-10 -2.56187160e-15 7.06766021e-16 2.17423771e-05
-1.95079042e-06 -4.43193171e-09 1.15986324e-09]

[-1.63477460e-02 -1.33878277e-12 -4.49872810e-14 8.65145467e-11
-2.14949467e-10 -2.73544285e-15 7.68254586e-16 2.51577815e-05
-1.16942788e-06 -1.23149520e-08 8.04777934e-10]

[ 0.00000000e+00 -2.04992004e-12 -8.01043966e-14 6.58001955e-11
-2.50125666e-10 -1.61527907e-15 7.76300673e-16 2.40519294e-05
-2.18600911e-06 -8.89410681e-09 7.75813361e-10]

[ 0.00000000e+00 -1.42831575e-12 -1.06209764e-13 1.03924270e-10
-1.14793423e-10 -2.36388145e-15 7.52193208e-16 3.45570778e-05
-1.98903173e-06 -1.16459336e-08 4.77393535e-10]

```

```

[20]: for member in starting_population_mat:
        member=member.tolist()
        details.insert_one({
            'generation': CURR_GEN_NUM,
            'try_vector': member, #after mutation
            'errors': [-1,-1],
            'mother_vec': member,
            'father_vec': member,
            'before_mutation': member,
            'beta': -1,
            'cross_over_point': -1,
            'desc' : TODAY
        })

```

```

[21]: trace_arr=[]
        trace_now=[]

        for i in range(0,POP_SIZE):
            vec=copy.deepcopy(starting_population_mat[i])
            vec=vec.tolist()
            obj_to_store={
                'generation': CURR_GEN_NUM,
                'try_vector': vec, #after mutation
                'errors': [-1,-1],

```

```

        'mother_vec':vec,
        'father_vec': vec,
        'before_mutation':vec,
        'beta': -1,
        'cross_over_point': -1,
        'desc' : TODAY,
        'survived':False
    }
    trace_now.append(obj_to_store)

print(*trace_now, sep='\n\n')

```

```

{'generation': 1, 'try_vector': [0.0, -1.3783500660791644e-12,
-6.424818573634483e-14, 6.580019545565703e-11, -2.0984549655895666e-10,
-1.6152790712010518e-15, 7.763006729384186e-16, 2.2757658578306265e-05,
-1.9193275505106666e-06, -8.894106807593951e-09, 7.758133607867065e-10],
'errors': [-1, -1], 'mother_vec': [0.0, -1.3783500660791644e-12,
-6.424818573634483e-14, 6.580019545565703e-11, -2.0984549655895666e-10,
-1.6152790712010518e-15, 7.763006729384186e-16, 2.2757658578306265e-05,
-1.9193275505106666e-06, -8.894106807593951e-09, 7.758133607867065e-10],
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-1.3387827712968235e-12, -4.498728098919121e-14, 8.651454674726037e-11,
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March, STINT_2, Sorted on 0.95 x max + 0.05 x min | ', 'survived': False}
```

```
{'generation': 1, 'try_vector': [0.0, -2.049920040485864e-12,
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-1.6152790712010518e-15, 7.763006729384186e-16, 2.4051929392992844e-05,
-2.1860091092803635e-06, -8.894106807593951e-09, 7.758133607867065e-10],
'father_vec': [0.0, -2.049920040485864e-12, -8.010439656322192e-14,
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7.763006729384186e-16, 2.4051929392992844e-05, -2.1860091092803635e-06,
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-2.5012566552865027e-10, -1.6152790712010518e-15, 7.763006729384186e-16,
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```

```
March, STINT_2, Sorted on 0.95 x max + 0.05 x min | ', 'survived': False}

{'generation': 1, 'try_vector': [0.0, -1.4283157461634843e-12,
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-2.3638814454360466e-15, 7.521932081253182e-16, 3.455707784689977e-05,
-1.989031728863744e-06, -1.1645933632208159e-08, 4.773935347095261e-10],
'errors': [-1, -1], 'mother_vec': [0.0, -1.4283157461634843e-12,
-1.0620976442560712e-13, 1.0392427045666308e-10, -1.1479342286646585e-10,
-2.3638814454360466e-15, 7.521932081253182e-16, 3.455707784689977e-05,
-1.989031728863744e-06, -1.1645933632208159e-08, 4.773935347095261e-10],
'father_vec': [0.0, -1.4283157461634843e-12, -1.0620976442560712e-13,
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7.521932081253182e-16, 3.455707784689977e-05, -1.989031728863744e-06,
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3.455707784689977e-05, -1.989031728863744e-06, -1.1645933632208159e-08,
4.773935347095261e-10], 'beta': -1, 'cross_over_point': -1, 'desc': 'PROPER 5th
March, STINT_2, Sorted on 0.95 x max + 0.05 x min | ', 'survived': False}
```

```
[22]: mut_magnitude=0.05

if type(starting_population_mat)!=np.ndarray:
    raise TypeError("Mismatch of starting pop mat")

for itr_num in range(0, MAX_ITR+1):
    #print("args being sent are \n")
    #print(*generation_info[-1]["members"],sep='\n')
    parents_now, sorted_fitness_vals, unsorted_errors_main, sorted_indices = \
    ↪sort_generation_members(generation_info[-1]["members"], CURR_GEN_NUM)

    for i in range(POP_SIZE):
        print("TYPE IS ", type(unsorted_errors_main[i]))
        trace_now[i]["errors"]=unsorted_errors_main[i]

        '''if unsorted_errors_main[i]!=list:
            raise TypeError("Pitts ERROR")'''

    trace_tmp=copy.deepcopy(trace_now)

    for i in range(0,POP_SIZE):
        trace_now[i]=copy.deepcopy(trace_tmp[sorted_indices[i]])
```

```

trace_arr.append(copy.deepcopy(trace_now))

#[{obj}] -> obj -> errors -> fitness value

generation_info[-1]["avg_fitness"]=np.average(sorted_fitness_vals)
generation_info[-1]["min_fitness"]=np.min(sorted_fitness_vals)
generation_info[-1]["gen_number"]=CURR_GEN_NUM
generation_info[-1]["fitness_vals_stored"]=sorted_fitness_vals
print(f'Avg fitness is {generation_info[-1]["avg_fitness"]}' )
print(f'MIN fitness is {generation_info[-1]["min_fitness"]}' )
print(f"fitness vals are: -> \n")
print(*sorted_fitness_vals, sep='\n')

#stop_or_not = input("Enter y to continue.")
stop_or_not = 'y'
if stop_or_not!='y' or itr_num==MAX_ITR:
    break

↳ #####

CURR_GEN_NUM+=1
# https://stackoverflow.com/a/7851237/6427607
matings_pending=num_matings_per_itr
probs=get_probabilities(POP_SIZE)
cum_probs=np.cumsum(probs)
# https://numpy.org/doc/stable/reference/generated/numpy.hstack.html
cum_probs=np.hstack(([0],cum_probs))
#print(f"Probs are {probs}\nCumProbs are {cum_probs}")

'''Selection
'''

pick_1=np.random.uniform(low=0, high=1, size=(matings_pending))
pick_2=np.random.uniform(low=0, high=1, size=(matings_pending))

#print(f"PICK_1 is {pick_1} \n AND \nPICK_2 is {pick_2} ")
mother_idx=[]
father_idx=[]

```

```

for ic in range(0, matings_pending):
    for idx in range(1, POP_SIZE+1):
        if pick_1[ic] <= cum_probs[idx] and pick_1[ic] > cum_probs[idx-1]:
            mother_idx.append(idx-1)
        if pick_2[ic] <= cum_probs[idx] and pick_2[ic] > cum_probs[idx-1]:
            father_idx.append(idx-1)

new_parents = parents_now.copy()
for i in range(0, surviving_members_num):
    details.insert_one({
        'generation': CURR_GEN_NUM,
        'try_vector': new_parents[i], #after mutation
        'errors': [-1, -1],
        'mother_vec': new_parents[i],
        'father_vec': new_parents[i],
        'before_mutation': new_parents[i],
        #'beta': -1,
        #'cross_over_point': -1,
        'desc': TODAY
    })
#trace_now = copy.deepcopy(trace_prev)

for mating_num in range(0, matings_pending):
    par_one_idx = mother_idx[mating_num]
    par_two_idx = father_idx[mating_num]

    child_one = parents_now[par_one_idx].copy()
    child_two = parents_now[par_two_idx].copy()

    child_one, child_two = crossover(child_one, child_two)

    '''CrossOver
    '''
    '''special_cell_idx = random.randint(0, NUM_FEATURES-1)

    beta = random.random()

    xy = parents_now[par_one_idx][special_cell_idx] - \
        parents_now[par_two_idx][special_cell_idx]

    child_one[special_cell_idx] = parents_now[par_one_idx][special_cell_idx]
    ↪ - beta*xy
    child_two[special_cell_idx] = parents_now[par_two_idx][special_cell_idx]
    ↪ + beta*xy

```



```

if special_cell_idx!=NUM_FEATURES-1:
    #print("CHILD ONE IS ", child_one)
    #print("CHILD TWO IS ", child_two)
    child_one[:] = np.hstack((child_one[:special_cell_idx] \
                              ,   child_two[special_cell_idx:]   ))

    child_two[:] = np.hstack((child_two[:special_cell_idx] \
                              ,   child_one[special_cell_idx:]   ))    '''

new_parents[surviving_members_num + 2* mating_num] = child_one
new_parents[surviving_members_num + 2* mating_num + 1] = child_two

if type(child_one)!=list:
    raise TypeError("NOT A LIST")

if type(parents_now[par_one_idx])!=list:
    raise TypeError("IT ALSO NOT A LIST")

obj_one={
'generation': CURR_GEN_NUM,
'try_vector': child_one, #after mutation
'errors': [-1,-1],
'mother_vec':parents_now[par_one_idx],
'father_vec': parents_now[par_two_idx],
'before_mutation': child_one,
#'beta': beta,
#'cross_over_point': special_cell_idx,
'desc' : TODAY,
'survived':False
}

obj_two={
'generation': CURR_GEN_NUM,
'try_vector': child_two, #after mutation
'errors': [-1,-1],
'mother_vec':parents_now[par_one_idx],
'father_vec': parents_now[par_two_idx],
'before_mutation': child_two,
#'beta': beta,
#'cross_over_point': special_cell_idx,
'desc' : TODAY,
'survived':False
}

trace_now[surviving_members_num + 2* mating_num]=obj_one

```

```

        trace_now[surviving_members_num + 2* mating_num + 1] =obj_two
        details.insert_one(copy.deepcopy(obj_one))
        details.insert_one(copy.deepcopy(obj_two))

#print("OLD Parents  are \n")
#print(*parents_now, sep='\n')
#print("NEW Parents  are \n")
#print(*new_parents, sep='\n')

'''
%-----
% Mutate the population
'''

#mut_rows=np.random.uniform(low=0, high=1, size=(num_cells_mutate))
#mut_rows*=(POP_SIZE-1)
# https://numpy.org/doc/stable/reference/random/generated/numpy.random.
→randint.html
mut_rows=np.random.randint(POP_SIZE, size=num_cells_mutate)
for i in range(0,len(mut_rows)):
    # mut_rows[i]=int(math.round(mut_rows[i]))
    assert(mut_rows[i]<POP_SIZE)
mut_rows.sort()

# mut_cols=np.random.uniform(low=0, high=1, size=(num_cells_mutate))
# mut_cols*=(NUM_FEATURES-1)

mut_cols=np.random.randint(NUM_FEATURES, size=num_cells_mutate)

for i in range(0,len(mut_cols)):
    #mut_cols[i]=int(math.round(mut_cols[i]))
    assert(mut_cols[i]<NUM_FEATURES)

for i in range(0,num_cells_mutate):
    row_c=int(mut_rows[i])
    col_c=int(mut_cols[i])
    #print(f"Contenders are {row_c}:{col_c}")
    #new_parents[row_c][col_c]=random.random()*(UB_LIMIT-LB_LIMIT)+LB_LIMIT
    CHNG = mut_magnitude * (new_parents[row_c][col_c])
    add=random.uniform(-CHNG,CHNG)
    print(f"mut mag is {mut_magnitude}\tChange is {CHNG} and \tadd is_
→{add}")

    upd_val = new_parents[row_c][col_c] + add
    upd_val = max(LB_LIMIT, upd_val)

```

```

    upd_val = min(UB_LIMIT, upd_val)

    old_vec= copy.deepcopy(new_parents[row_c])
    new_parents[row_c][col_c] = upd_val
    details.update_one({"before_mutation": old_vec},
                      {"$set": {"try_vector": new_parents[row_c]}})

    ##////////////////////////////////////
    ↪////////

    for i in range(POP_SIZE):
        if type(new_parents[i])!=list:
            raise TypeError("Pegasus type error")
            #trace_now[i]["try_vector"]=new_parents[i]
        trace_now[i]["try_vector"]=copy.deepcopy(new_parents[i])
        if i< surviving_members_num:
            trace_now[i]["survived"]=True
    ##////////////////////////////////////
    ↪////////

    print("Generation info is ", generation_info)

    □
    ↪#####3
    x_c=[]
    y_min=[]
    y_avg=[]
    print(len(generation_info))
    for j in range(0,len(generation_info)):
        x_c.append(j)
        y_min.append(generation_info[j]["min_fitness"])
        y_avg.append(generation_info[j]["avg_fitness"])

    plt.figure(figsize=(10,10))
    plt.plot(x_c, y_min, label="min")
    plt.show()
    plt.plot(x_c, y_avg, label="avg")
    #print('Min: ',y_min[-1])
    #print('Avg: ',y_avg[-1])

```


[illegible]

30078744456160.1
 31735254088938.33
 35583433170039.35
 55536670004170.77
 55781834366587.66
 58388115153653.88
 58835547552123.234
 65402879209934.72
 74783517707224.03
 111620717464440.61
 135928738047228.84
 156780483257156.0
 256632871562429.6
 364326490813415.3
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 -6.424818573634483e-14, 8.05782978296473e-11, -1.5709505987681515e-10,
 -1.1773303691599587e-15, 4.2322300051787333e-16, 2.122796755113771e-05,
 -2.6577874624596677e-06, -1.2459843320836643e-08, 7.758133607867065e-10]
 parent 2 is [-0.016347746048917644, -1.3387827712968235e-12,
 -6.541567279446175e-14, 8.651454674726037e-11, -2.1494946650019876e-10,
 -1.8360756358315474e-15, 1.1093211039965001e-15, 2.515778146953262e-05,
 -2.015649193094959e-06, -8.786550389563894e-09, 8.047779335648933e-10]
 CHILD 1 is [-5.15824409e-01 -2.03856045e-12 -6.39036312e-14 7.88263627e-11
 -1.40020781e-10 -9.82918207e-16 2.20738333e-16 2.00681814e-05
 -2.84729849e-06 -1.35439237e-08 7.67265193e-10]
 CHILD 2 is [9.74698623e-02 -1.17932182e-12 -6.57602274e-14 8.82664819e-11
 -2.32023745e-10 -2.03048780e-15 1.31180577e-15 2.63175676e-05
 -1.82613817e-06 -7.70247000e-09 8.13326102e-10]
 #-----
 parent 1 is [0.0, -1.457990220064754e-12, -9.648767410168089e-14,
 7.485339950833092e-11, -1.9881004961860312e-10, -1.5962350118384506e-15,
 7.521932081253182e-16, 2.3668681206269528e-05, -1.989031728863744e-06,
 -7.991914261771e-09, 7.860139677568573e-10]
 parent 2 is [0.17221165539910088, -1.3717037849537701e-12,
 -4.934494295646811e-14, 9.028718415566519e-11, -2.656916418589733e-10,
 -1.149996046523432e-15, 7.248328796296383e-16, 1.5177421673656721e-05,
 -1.98388482794409e-06, -8.894106807593951e-09, 7.758133607867065e-10]
 CHILD 1 is [1.62935618e-02 -1.44982635e-12 -9.20273314e-14 7.63136452e-11
 -2.05137957e-10 -1.55401474e-15 7.49604549e-16 2.28652927e-05
 -1.98854476e-06 -8.07727393e-09 7.85048852e-10]
 CHILD 2 is [1.55918094e-01 -1.37986765e-12 -5.38052857e-14 8.88269385e-11
 -2.59363735e-10 -1.19221631e-15 7.27421538e-16 1.59808102e-05
 -1.98437179e-06 -8.80874714e-09 7.76778477e-10]
 #-----
 parent 1 is [0.0, -1.1350133651684026e-12, -7.798874553400996e-14,
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 1.033829593266337e-15, 2.0169368679748805e-05, -2.121781836003422e-06,
 -7.991914261771e-09, 6.663711216445907e-10]

```

parent 2 is [0.17221165539910088, -1.3717037849537701e-12,
-4.934494295646811e-14, 9.028718415566519e-11, -2.656916418589733e-10,
-1.149996046523432e-15, 7.248328796296383e-16, 1.5177421673656721e-05,
-1.98388482794409e-06, -8.894106807593951e-09, 7.758133607867065e-10]
CHILD 1 is [-2.34190289e-03 -1.13179462e-12 -7.83782720e-14 1.07349785e-10
-1.97900528e-10 -1.64317645e-15 1.03803163e-15 2.02372541e-05
-2.12365709e-06 -7.97964536e-09 6.64882819e-10]
CHILD 2 is [1.74553558e-01 -1.37492253e-12 -4.89554165e-14 9.00582633e-11
-2.66601163e-10 -1.14337928e-15 7.20630839e-16 1.51095363e-05
-1.98200957e-06 -8.90637571e-09 7.77301664e-10]
#-----
parent 1 is [-0.016347746048917644, -1.3387827712968235e-12,
-6.541567279446175e-14, 8.651454674726037e-11, -2.1494946650019876e-10,
-1.8360756358315474e-15, 1.1093211039965001e-15, 2.515778146953262e-05,
-2.015649193094959e-06, -8.786550389563894e-09, 8.047779335648933e-10]
parent 2 is [-0.030191655016508116, -1.370451290585018e-12,
1.944684541618345e-14, 8.210907153265034e-11, -2.2255497577166302e-10,
-1.7133147300890716e-15, 7.847853460987011e-16, 2.174237713450648e-05,
-2.0639270090069506e-06, -5.206637844452329e-09, 7.75711723530254e-10]
CHILD 1 is [-1.63808160e-02 -1.33885842e-12 -6.52129555e-14 8.65040231e-11
-2.14967634e-10 -1.83578239e-15 1.10854586e-15 2.51496228e-05
-2.01576452e-06 -8.77799879e-09 8.04708501e-10]
CHILD 2 is [-3.01585851e-02 -1.37037564e-12 1.92441281e-14 8.21195952e-11
-2.22536808e-10 -1.71360798e-15 7.85560589e-16 2.17505358e-05
-2.06381168e-06 -5.21518944e-09 7.75781156e-10]
#-----
parent 1 is [-0.027265143036103855, -1.6495261272545962e-12,
1.944684541618345e-14, 5.2079695344842693e-11, -2.0577166091611458e-10,
-1.7972483635712073e-15, 8.804425625063961e-16, 2.174237713450648e-05,
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parent 2 is [0.04422948312010144, -7.338892684720945e-13,
-8.520082531910816e-14, 7.485339950833092e-11, -2.7938350364697863e-10,
-1.202571556243279e-15, 9.406482497229964e-16, 2.3668681206269528e-05,
-2.140171714423423e-06, -7.991914261771e-09, 1.0159761099417961e-09]
CHILD 1 is [-3.86637912e-02 -1.79550944e-12 3.61312040e-14 4.84488009e-11
-1.94035457e-10 -1.89205985e-15 8.70843751e-16 2.14352595e-05
-2.98067456e-06 -3.00071477e-09 8.81176746e-10]
CHILD 2 is [5.56281313e-02 -5.87905955e-13 -1.01885184e-13 7.84842940e-11
-2.91119707e-10 -1.10776007e-15 9.50247061e-16 2.39757989e-05
-2.02459423e-06 -8.67825374e-09 1.03451236e-09]
#-----
parent 1 is [0.0, -1.457990220064754e-12, -9.648767410168089e-14,
7.485339950833092e-11, -1.9881004961860312e-10, -1.5962350118384506e-15,
7.521932081253182e-16, 2.3668681206269528e-05, -1.989031728863744e-06,
-7.991914261771e-09, 7.860139677568573e-10]
parent 2 is [0.0, -2.049920040485864e-12, -8.010439656322192e-14,
6.580019545565703e-11, -2.5012566552865027e-10, -1.6152790712010518e-15,
7.763006729384186e-16, 2.4051929392992844e-05, -2.1860091092803635e-06,

```

```

-8.894106807593951e-09, 7.758133607867065e-10]
CHILD 1 is [ 0.00000000e+00 -1.54315354e-12 -9.41305461e-14  7.35508787e-11
-2.06193033e-10 -1.59897496e-15  7.55661646e-16  2.37238207e-05
-2.01737166e-06 -8.12171633e-09  7.84546365e-10]
CHILD 2 is [ 0.00000000e+00 -1.96475672e-12 -8.24615245e-14  6.71027163e-11
-2.42742682e-10 -1.61253913e-15  7.72832235e-16  2.39967899e-05
-2.15766918e-06 -8.76430474e-09  7.77280963e-10]
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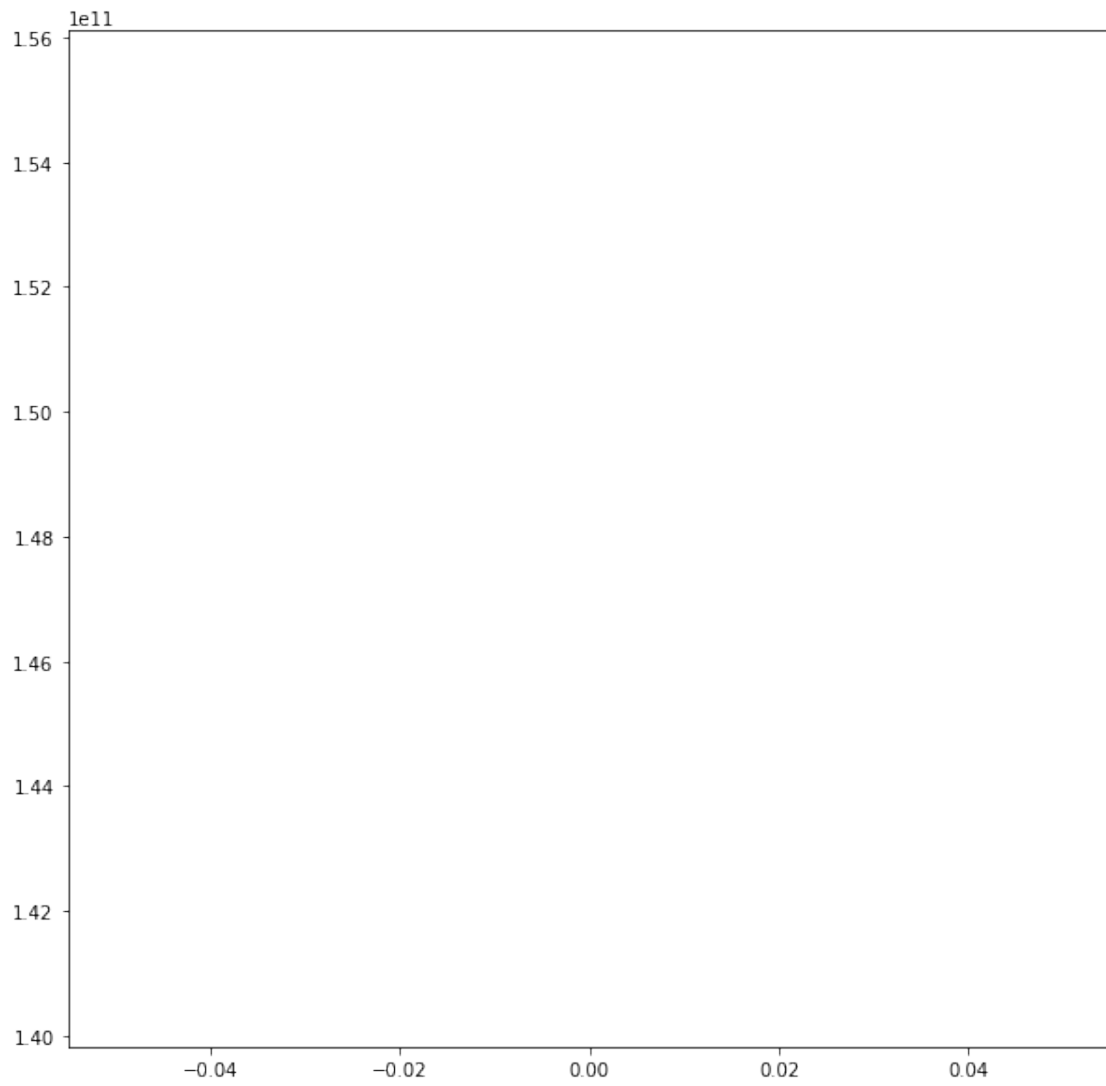
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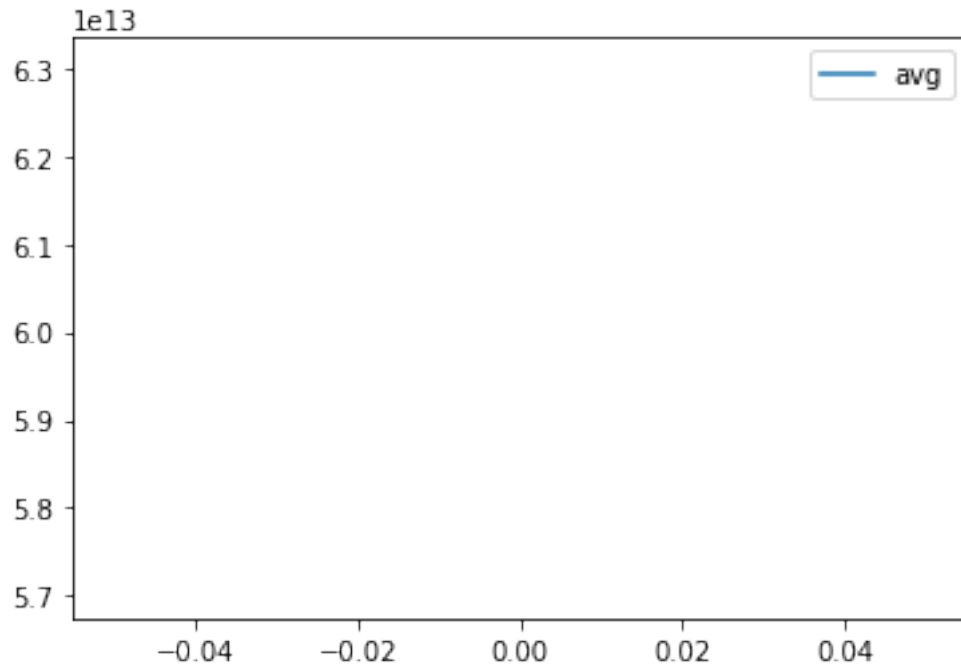
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58835547552123.234, 65402879209934.72, 74783517707224.03, 111620717464440.61,
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1





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Enter mutation magnitude:0.3

/home/annmolagarwal/anaconda3/lib/python3.7/site-
packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use
Collection.count_documents instead.
  # This is added back by InteractiveShellApp.init_path()

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 -2.03173029e-06 -7.99191426e-09 7.86013968e-10]
 CHILD 2 is [0.00000000e+00 -1.45799022e-12 -9.64876741e-14 7.48533995e-11
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 -1.60263873e-06 -8.77865027e-09 7.10820241e-10]
 CHILD 2 is [-6.23990203e-02 -1.33267286e-12 -6.36949029e-14 8.98053478e-11
 -2.05285509e-10 -1.85780387e-15 1.11041140e-15 2.61654411e-05
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 -2.10378427e-10 -1.64398181e-15 8.11072955e-16 2.30082671e-05
 -1.92938496e-06 -8.88287632e-09 7.78837693e-10]
 CHILD 2 is [-1.46407984e-02 -1.31312128e-12 -6.81672048e-14 8.43516607e-11
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 -2.05402336e-06 -8.42732775e-09 8.80492642e-10]
 CHILD 2 is [2.16869078e-03 -1.40673961e-12 -4.14799515e-14 9.65614215e-11
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CHILD 2 is [2.23186371e-04 -1.79640207e-12 -3.56169350e-14 6.55130127e-11
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CHILD 2 is [1.49295281e-01 -8.54176373e-13 -8.17982724e-14 1.00211966e-10
-2.90261100e-10 -2.28420941e-15 1.60228794e-15 2.16485313e-05
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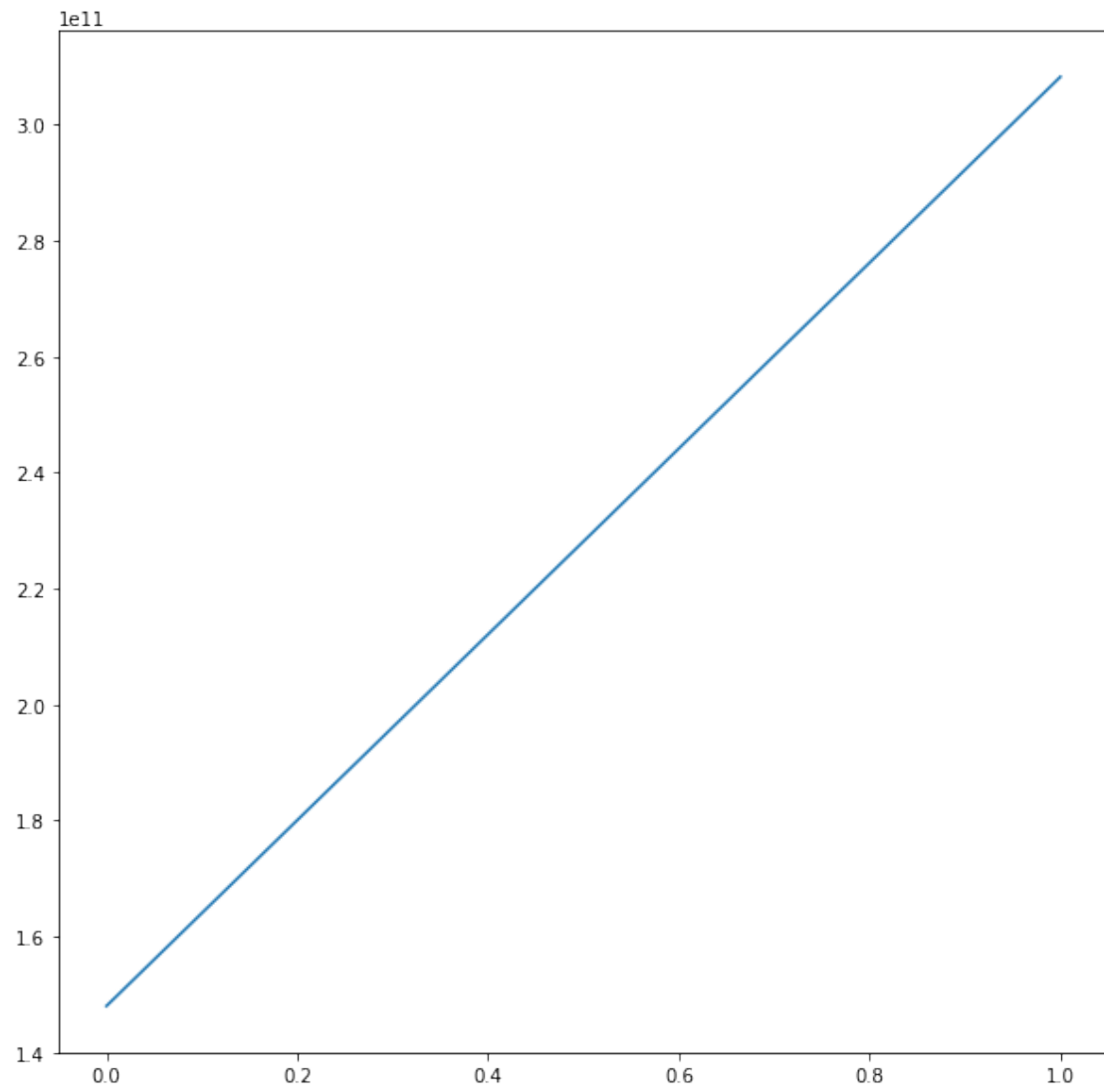
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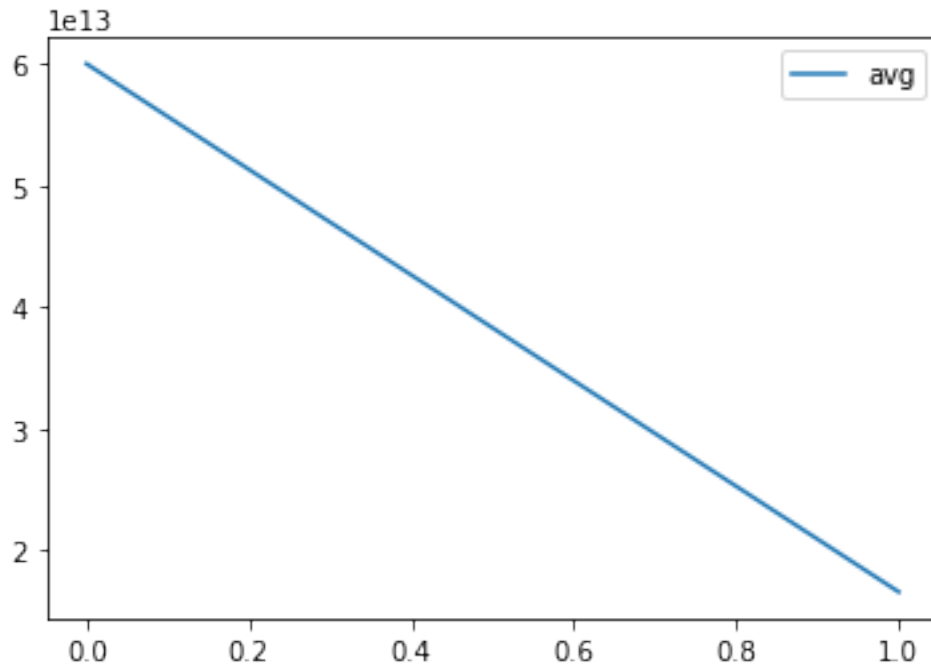
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 -2.0354386222043184e-10, -1.6108081374590638e-15, 7.726279382803225e-16,
 2.3343473022242754e-05, -1.9193275505106666e-06, -9.168055630643466e-09,
 8.455839967280447e-10]], 'mut_magnitude': 0.05, 'avg_fitness':
 16552778924583.018, 'min_fitness': 308228047011.65686, 'gen_number': 2,
 'fitness_vals_stored': [308228047011.65686, 352542779068.2565,
 456705396991.03217, 471974579521.62256, 585919371351.5233, 600002278569.6445,
 611971454313.6708, 659849192658.2906, 726777459234.9279, 821415596176.5024,
 957163516968.9868, 1044564075885.3092, 1515018262870.7417, 1836286306753.5278,
 2705049086326.338, 5865164893954.511, 6949021057464.768, 7877951736739.082,
 8111356814734.597, 9611431913560.707, 11852966990704.428, 33625279298144.668,
 33644505030747.316, 53627257212201.4, 66571151537293.33, 178982698149911.62]]}





Enter mutation magnitude:0.2

/home/anmolagarwal/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use Collection.count_documents instead.

This is added back by InteractiveShellApp.init_path()

exist? 0
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exist?    0
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TYPE IS   <class 'list'>
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TYPE IS   <class 'list'>
TYPE IS   <class 'list'>
Avg fitness is 7353384044747.596
MIN fitness is 304775144447.39124
fitness vals are: ->
```

1848742404894.7737
 2546530295809.144
 3698739162522.1245
 3820401759638.0303
 4664389518613.305
 5768335527118.193
 6364554058080.856
 6552523526930.251
 7607490934470.023
 9427297846353.127
 10580753184378.867
 18253097748790.246
 23253789913619.37
 23555248001240.58
 24874629653647.17
 29826658038834.996
 parent 1 is [0.002168690778597967, -1.4067396095601467e-12,
 -4.1479951526106294e-14, 9.656142146573224e-11, -1.9178589555524207e-10,
 -2.5354525936468757e-15, 1.1502016416897128e-15, 2.4787161648980827e-05,
 -2.0033863810922353e-06, -7.896525056949885e-09, 8.812907613659604e-10]
 parent 2 is [-0.051825418258605586, -1.7229135335851064e-12,
 -1.9558874393119102e-14, 5.3854711336352264e-11, -6.425737624376147e-11,
 -1.1014304932892839e-15, 4.750037068461525e-16, 2.7331140253009815e-05,
 -1.5158063626582212e-06, -1.5344167699593706e-08, 7.558675699792697e-10]
 CHILD 1 is [-1.48874771e-02 -1.50661561e-12 -3.45553151e-14 8.30708235e-11
 -1.51500985e-10 -2.08246018e-15 9.36913756e-16 2.55907776e-05
 -1.84936501e-06 -1.02491566e-08 8.41670902e-10]
 CHILD 2 is [-3.47692504e-02 -1.62303754e-12 -2.64835108e-14 6.73453093e-11
 -1.04542286e-10 -1.55442291e-15 6.88291592e-16 2.65275243e-05
 -1.66982773e-06 -1.29915362e-08 7.95487429e-10]
 #-----
 parent 1 is [-0.017410112941667912, -1.302595537958588e-12,
 -6.855138850635515e-14, 8.786067978304086e-11, -2.1528115067677838e-10,
 -1.3571258120446233e-15, 1.1309626122207457e-15, 2.5313754720557015e-05,
 -2.021908705802746e-06, -8.779560779052695e-09, 8.066602115920981e-10]
 parent 2 is [0.26883245491034863, -1.3113801732030231e-12,
 -7.721731529110814e-14, 6.580019545565703e-11, -2.832419967375945e-10,
 -1.3563329255993855e-15, 8.766686963391351e-16, 1.8572803138286373e-05,
 -1.4312941422269475e-06, -8.894106807593951e-09, 7.076402316649349e-10]
 CHILD 1 is [3.05049570e-02 -1.30406603e-12 -7.00020060e-14 8.41679039e-11
 -2.26657337e-10 -1.35699309e-15 1.08839553e-15 2.41853650e-05
 -1.92304382e-06 -8.79873501e-09 7.90084937e-10]
 CHILD 2 is [2.20917385e-01 -1.30990968e-12 -7.57666978e-14 6.94929713e-11
 -2.71865811e-10 -1.35646565e-15 9.19235778e-16 1.97011928e-05
 -1.53015903e-06 -8.87493258e-09 7.24215507e-10]
 #-----
 parent 1 is [-0.051825418258605586, -1.7229135335851064e-12,
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-1.1014304932892839e-15, 4.750037068461525e-16, 2.7331140253009815e-05,
 -1.5158063626582212e-06, -1.5344167699593706e-08, 7.558675699792697e-10]
 parent 2 is [-0.014640798439687373, -1.2889160209687917e-12,
 -6.816720484561107e-14, 8.43516606644845e-11, -1.8334265424753895e-10,
 -1.861467676681666e-15, 1.074548822428237e-15, 2.4907172974711466e-05,
 -2.005591782303624e-06, -1.0885065544000887e-08, 8.017536017635453e-10]
 CHILD 1 is [-4.64829843e-02 -1.66055971e-12 -2.65425897e-14 5.82363062e-11
 -8.13667414e-11 -1.21062748e-15 5.61142283e-16 2.69828811e-05
 -1.58617541e-06 -1.47035141e-08 7.62460164e-10]
 CHILD 2 is [-1.99832324e-02 -1.35126984e-12 -6.11834896e-14 7.99700658e-11
 -1.66233289e-10 -1.75227069e-15 9.88410246e-16 2.52554322e-05
 -1.93522273e-06 -1.15257191e-08 7.95161008e-10]
 #-----
 parent 1 is [-0.016347746048917644, -1.3055163540202696e-12,
 -8.64346380330114e-14, 8.651454674726037e-11, -2.1494946650019876e-10,
 -2.214742731677588e-15, 1.1093211039965001e-15, 2.515778146953262e-05,
 -2.015649193094959e-06, -8.786550389563894e-09, 8.047779335648933e-10]
 parent 2 is [-0.004562281051926418, -1.495056384680146e-12,
 -3.963411309409583e-14, 1.0808264960439462e-10, -2.393904932516134e-10,
 -2.3514778401399803e-15, 1.2131060283268825e-15, 2.5009614074582075e-05,
 -2.0540233576604338e-06, -8.427327752148469e-09, 8.63293717507466e-10]
 CHILD 1 is [-1.54798936e-02 -1.31947361e-12 -8.29883635e-14 8.81027683e-11
 -2.16749243e-10 -2.22481157e-15 1.11696357e-15 2.51468708e-05
 -2.01847497e-06 -8.76009813e-09 8.09086891e-10]
 CHILD 2 is [-5.43013346e-03 -1.48109913e-12 -4.30803877e-14 1.06494428e-10
 -2.37590717e-10 -2.34140901e-15 1.20546356e-15 2.50205248e-05
 -2.05119758e-06 -8.45378002e-09 8.58984760e-10]
 #-----
 parent 1 is [0.30407601539799123, -1.3819327911864188e-12,
 -7.578421336673916e-14, 6.351459788103504e-11, -2.8239102313690963e-10,
 -1.6824314783977562e-15, 1.0955548129655016e-15, 1.807577206569801e-05,
 -1.3238401727653235e-06, -8.77865026967261e-09, 7.108202407909017e-10]
 parent 2 is [-0.017410112941667912, -1.302595537958588e-12,
 -6.855138850635515e-14, 8.786067978304086e-11, -2.1528115067677838e-10,
 -1.3571258120446233e-15, 1.1309626122207457e-15, 2.5313754720557015e-05,
 -2.021908705802746e-06, -8.779560779052695e-09, 8.066602115920981e-10]
 CHILD 1 is [2.82925221e-01 -1.37671314e-12 -7.53083608e-14 6.51163434e-11
 -2.77975818e-10 -1.66102939e-15 1.09788432e-15 1.85519639e-05
 -1.36976658e-06 -8.77871017e-09 7.17125619e-10]
 CHILD 2 is [3.74068156e-03 -1.30781519e-12 -6.90272411e-14 8.62589342e-11
 -2.19696356e-10 -1.37852790e-15 1.12863311e-15 2.48375628e-05
 -1.97598229e-06 -8.77950088e-09 8.00354834e-10]
 #-----
 parent 1 is [0.0001733863876741028, -1.7964020706034382e-12,
 -3.5616935000866435e-14, 6.551301274795075e-11, -1.2223078296178448e-10,
 -1.5373262589881874e-15, 7.608520448265907e-16, 3.37528007769498e-05,
 -1.9175555311628825e-06, -1.2756308824659165e-08, 7.742024739977469e-10]
 parent 2 is [-6.693392847579968e-06, -1.7920988949327747e-12,

-3.5334398955071723e-14, 6.576986594693849e-11, -1.221745037367458e-10,
-1.553599288076549e-15, 7.810997421031513e-16, 3.3691080051188815e-05,
-1.919063905405299e-06, -1.2709747909604943e-08, 7.758177938338168e-10]
CHILD 1 is [1.56579756e-04 -1.79600046e-12 -3.55905662e-14 6.55369846e-11
-1.22225530e-10 -1.53884500e-15 7.62741738e-16 3.37470405e-05
-1.91769631e-06 -1.27519633e-08 7.74353230e-10]
CHILD 2 is [1.01132392e-05 -1.79250051e-12 -3.53607677e-14 6.57458941e-11
-1.22179756e-10 -1.55208055e-15 7.79210049e-16 3.36968404e-05
-1.91892313e-06 -1.27140934e-08 7.75667038e-10]
#-----
parent 1 is [0.0, -1.457990220064754e-12, -9.648767410168089e-14,
7.485339950833092e-11, -1.9881004961860312e-10, -1.5373629052628197e-15,
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parent 2 is [-6.693392847579968e-06, -1.7920988949327747e-12,
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-1.919063905405299e-06, -1.2709747909604943e-08, 7.758177938338168e-10]
CHILD 1 is [-1.55388529e-06 -1.53555425e-12 -8.22908121e-14 7.27446380e-11
-1.81018946e-10 -1.54113222e-15 7.58903921e-16 2.96032386e-05
-2.00557455e-06 -9.08716931e-09 7.83646904e-10]
CHILD 2 is [-5.13950756e-06 -1.71453486e-12 -4.95312610e-14 6.78786275e-11
-1.39965608e-10 -1.54982998e-15 7.74389029e-16 3.24551568e-05
-1.94521964e-06 -1.16144929e-08 7.78184857e-10]
#-----
parent 1 is [0.0, -1.457990220064754e-12, -9.648767410168089e-14,
7.485339950833092e-11, -1.9881004961860312e-10, -1.5373629052628197e-15,
7.521932081253182e-16, 2.8367315344506863e-05, -2.0317302851982786e-06,
-7.991914261771e-09, 7.860139677568573e-10]
parent 2 is [-0.0185437793818677, -1.3282155383388518e-12,
-4.387678381508543e-14, 8.966120794415347e-11, -1.0200173089647728e-10,
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-2.0665584758161566e-06, -6.669505345401805e-09, 9.096563421274592e-10]
CHILD 1 is [-9.65942806e-05 -1.45731423e-12 -9.62136247e-14 7.49305332e-11
-1.98305776e-10 -1.54436138e-15 7.54267956e-16 2.83508613e-05
-2.03191170e-06 -7.98502585e-09 7.86658019e-10]
CHILD 2 is [-1.84471851e-02 -1.32889153e-12 -4.41508332e-14 8.95840743e-11
-1.02506004e-10 -2.87390388e-15 1.14842007e-15 2.52249814e-05
-2.06637706e-06 -6.67639375e-09 9.09012291e-10]
#-----
parent 1 is [-0.0017069476092302714, -1.3707451442570193e-12,
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6.50508329342718e-16, 2.3668681206269528e-05, -2.0317302851982786e-06,
-9.187859792280947e-09, 7.860139677568573e-10]

CHILD 1 is [-2.00051644e-03 -1.35574033e-12 -4.59841453e-14 6.67780524e-11
-2.43717587e-10 -1.63986490e-15 8.38687609e-16 2.28946860e-05
-1.91178313e-06 -8.83042384e-09 7.77603483e-10]

CHILD 2 is [2.93568829e-04 -1.47299504e-12 -1.03898891e-13 7.60384286e-11
-1.92220025e-10 -1.67203643e-15 6.22893675e-16 2.37822623e-05
-2.04933211e-06 -9.24031228e-09 7.87248177e-10]

#-----

parent 1 is [0.0010623668927502675, -1.3830832032429018e-12,
-5.672626117882346e-14, 6.445406241987653e-11, -2.0951381238237705e-10,
-1.5974151121476994e-15, 6.092871836012674e-16, 1.711760409961313e-05,
-1.9130680378028796e-06, -8.90109641810515e-09, 7.739310827595017e-10]

parent 2 is [-0.051825418258605586, -1.7229135335851064e-12,
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-1.1014304932892839e-15, 4.750037068461525e-16, 2.7331140253009815e-05,
-1.5158063626582212e-06, -1.5344167699593706e-08, 7.558675699792697e-10]

CHILD 1 is [9.64174899e-03 -1.32795641e-12 -6.27555024e-14 6.61734742e-11
-2.33077107e-10 -1.67787304e-15 6.31070460e-16 1.54607786e-05
-1.97751127e-06 -7.85591046e-09 7.76861320e-10]

CHILD 2 is [-6.04048004e-02 -1.77804033e-12 -1.35296332e-14 5.21352995e-11
-4.06940815e-11 -1.02097257e-15 4.53220430e-16 2.89879657e-05
-1.45136313e-06 -1.63893537e-08 7.52937332e-10]

#-----

mut mag is 0.2 Change is -3.295024234184674e-07 and add is
1.6601231106556422e-08

mut mag is 0.2 Change is -2.7414902885140386e-13 and add is
2.527924492403661e-13

mut mag is 0.2 Change is -1.0679072504395534e-14 and add is
-1.046854602907739e-15

mut mag is 0.2 Change is -0.0003413895218460543 and add is
-6.722562794302795e-05

mut mag is 0.2 Change is -3.835111062325765e-07 and add is
6.5143629602682995e-09

mut mag is 0.2 Change is -2.4446156592356898e-11 and add is
-2.056066326062258e-11

mut mag is 0.2 Change is 1.3102602549590152e-11 and add is
1.2196632820640249e-11

mut mag is 0.2 Change is 1.5516355876676338e-10 and add is
-1.5263803249700356e-10

mut mag is 0.2 Change is -2.4434900747349164e-11 and add is
-1.506308256440393e-11

mut mag is 0.2 Change is 1.2463595226736267e-10 and add is
-8.955478771398813e-11

mut mag is 0.2 Change is -4.2989893300039755e-11 and add is
-1.2603195626300043e-11

mut mag is 0.2 Change is -3.698730021805914e-07 and add is
-2.0904326988863007e-08

mut mag is 0.2 Change is -3.74053867578364e-07 and add is
-2.7779621207774956e-07

mut mag is 0.2 Change is -3.339655465695e-07 and -9.734601836190855e-08	add is
mut mag is 0.2 Change is 1.3765831844040842e-16 and -6.181264266537287e-17	add is
mut mag is 0.2 Change is -2.6081320529747594e-13 and -1.8234127230842506e-13	add is
mut mag is 0.2 Change is 1.6833580780659167e-11 and -7.0149397666412586e-12	add is
mut mag is 0.2 Change is -1.759747001909477e-09 and 4.158069649677973e-10	add is
mut mag is 0.2 Change is -3.060318051600625e-07 and -2.7603446223155557e-07	add is
mut mag is 0.2 Change is 1.1222845663452658e-16 and -8.53237453854636e-17	add is
mut mag is 0.2 Change is 5.396576214572283e-06 and 1.9113676826863274e-06	add is
mut mag is 0.2 Change is -2.4212549630486984e-16 and -1.761700182022118e-17	add is
mut mag is 0.2 Change is -3.3211194283473767e-13 and 3.5635345966037435e-14	add is
mut mag is 0.2 Change is -0.003996646488745883 and -0.00046168470086101285	add is
mut mag is 0.2 Change is -2.7025396807604193e-13 and -6.482442919639458e-14	add is
mut mag is 0.2 Change is -4.449623131740243e-16 and -2.6050881276574967e-16	add is
mut mag is 0.2 Change is -4.33498486160118e-11 and 4.256151673117856e-12	add is
mut mag is 0.2 Change is -0.0030959787284769707 and 0.0019622958861585586	add is
mut mag is 0.2 Change is -2.962198254017119e-13 and 3.378053085434724e-14	add is
mut mag is 0.2 Change is -2.894637192308424e-13 and 7.650628177878903e-14	add is
mut mag is 0.2 Change is -5.559516365202648e-11 and -1.403727222123021e-11	add is
mut mag is 0.2 Change is -2.739533167728234e-07 and 2.1307887266622774e-07	add is
mut mag is 0.2 Change is -2.7534262769615594e-13 and -1.231002334039375e-13	add is
mut mag is 0.2 Change is 1.4342512373755363e-10 and 9.661334488589049e-11	add is
mut mag is 0.2 Change is -2.313375422395778e-07 and 9.589610430775498e-08	add is
mut mag is 0.2 Change is 6.749408090980113e-06 and 1.4802652986745763e-06	add is
mut mag is 0.2 Change is -7.07215354174955e-15 and -4.409514356641638e-15	add is

mut mag is 0.2 Change is -1.817433862082876e-09 and add is
 1.024837189555582e-10
 mut mag is 0.2 Change is -3.10777058119938e-07 and add is
 1.424224258607619e-07
 mut mag is 0.2 Change is -3.620378914706471e-11 and add is
 -1.755030786531268e-11
 mut mag is 0.2 Change is -2.322898572192313e-09 and add is
 -7.996798510980978e-10
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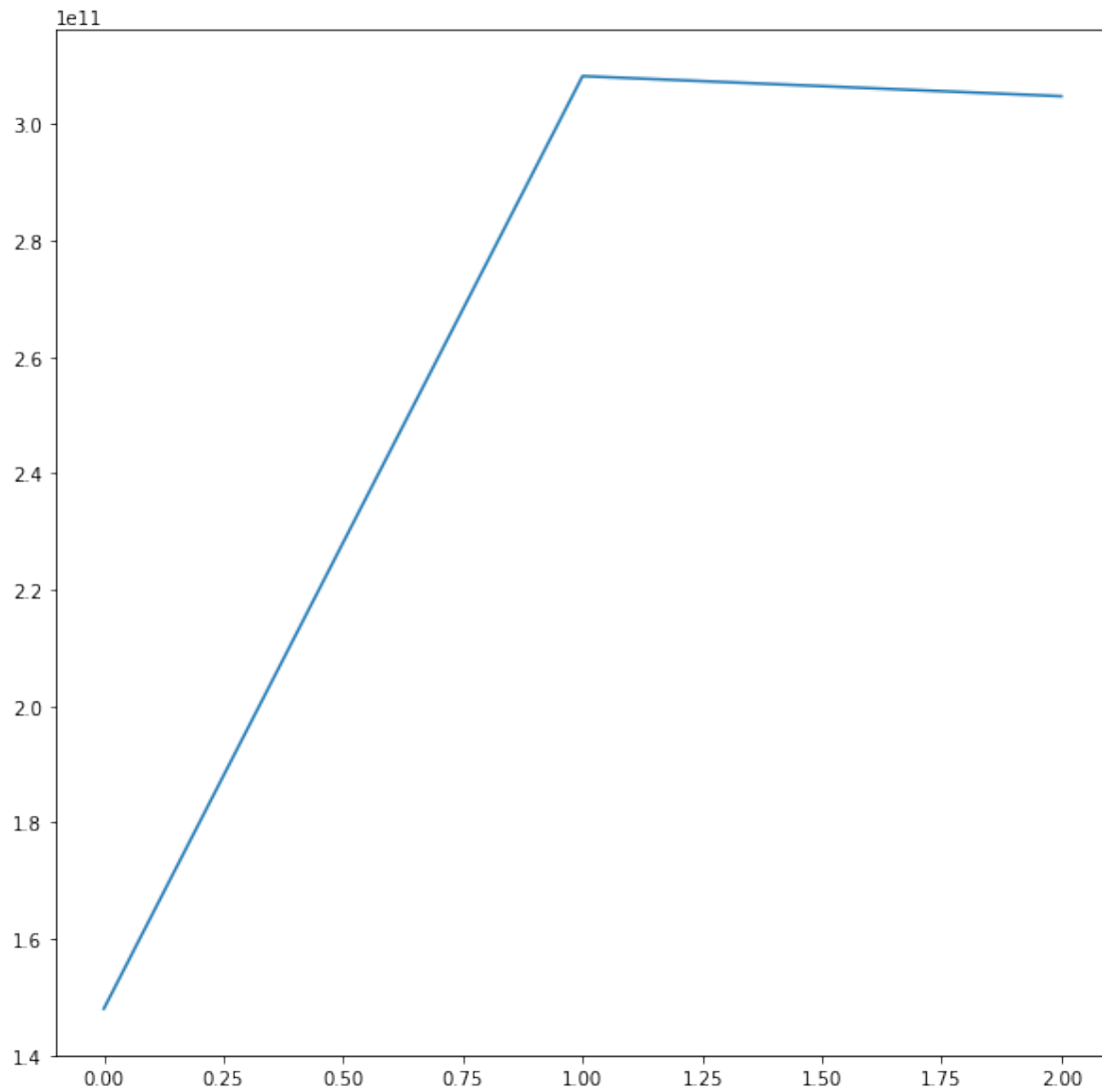
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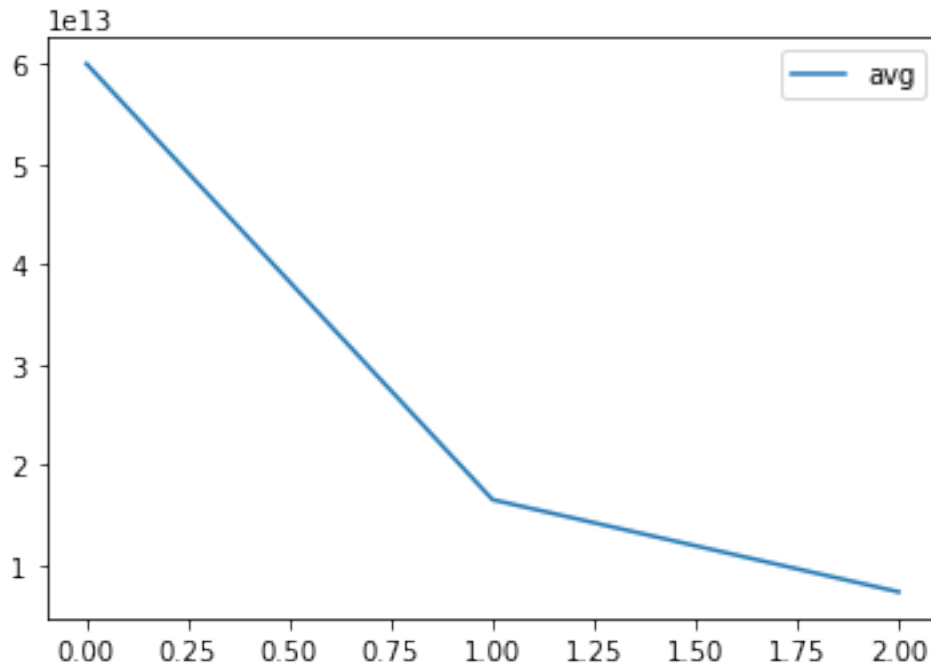
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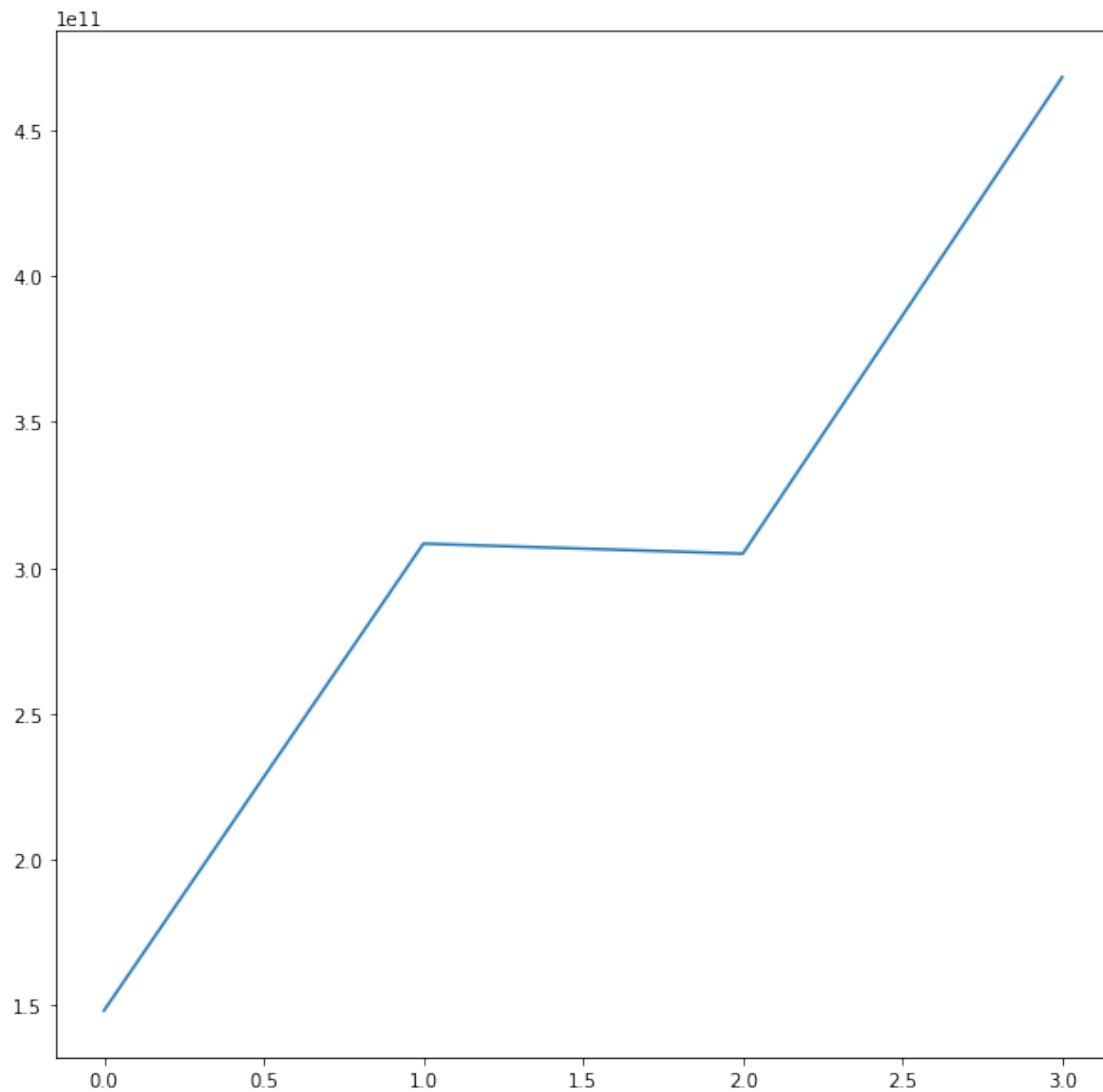
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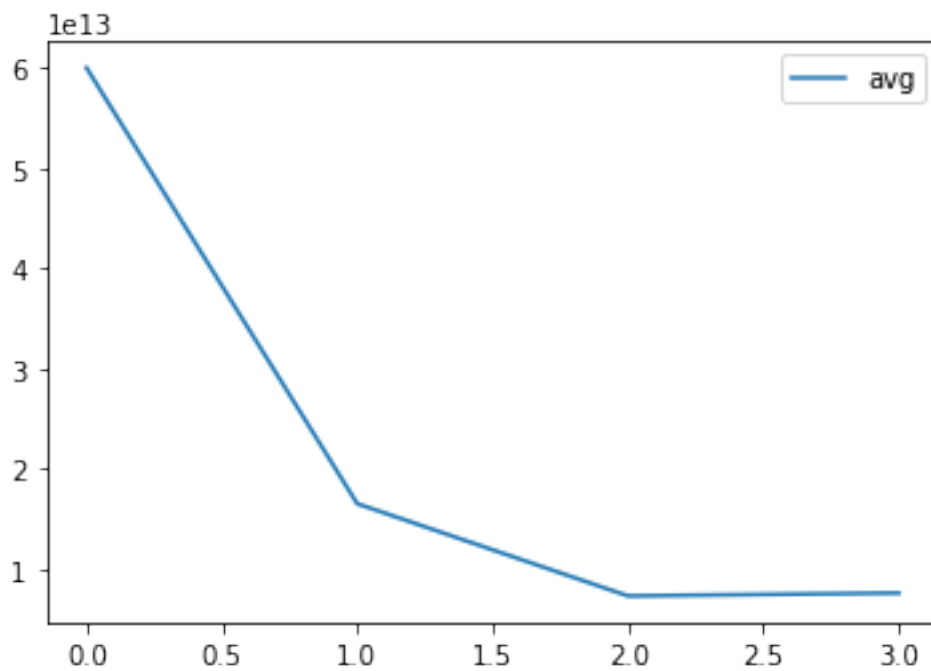
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4





Enter mutation magnitude:0.3

/home/anmolagarwal/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use Collection.count_documents instead.

This is added back by InteractiveShellApp.init_path()

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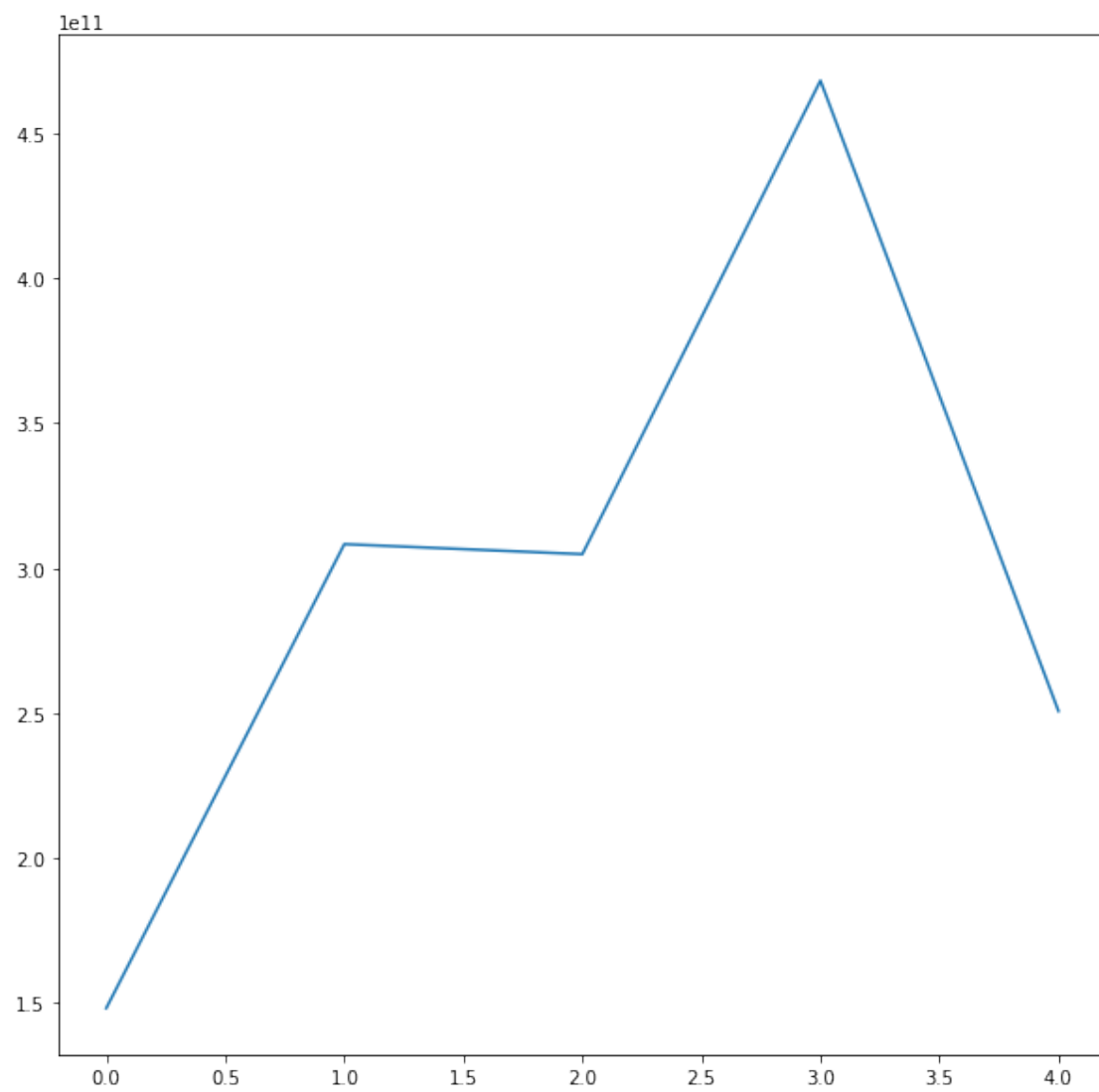
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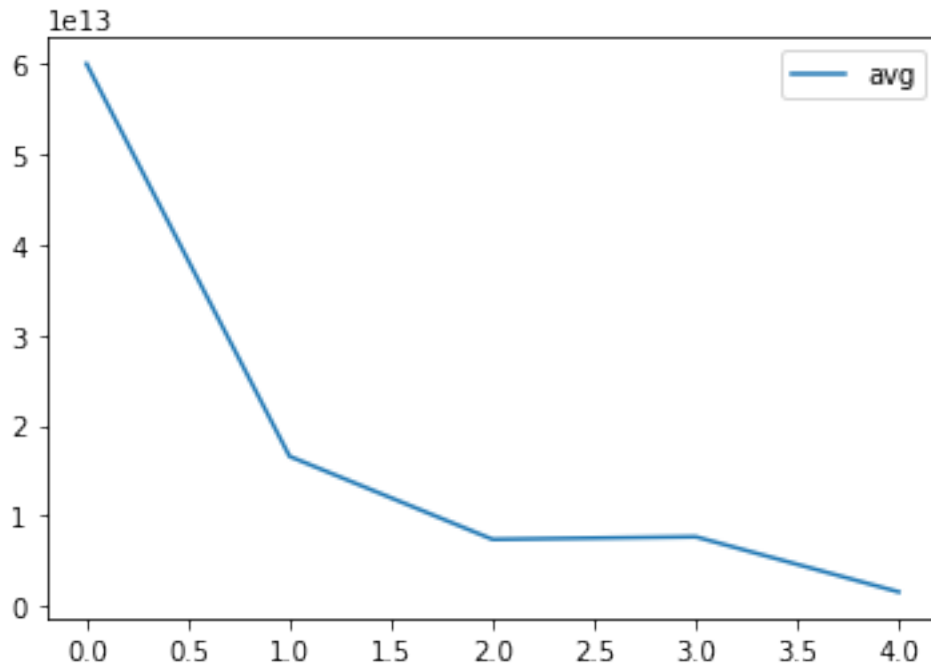
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5





Enter mutation magnitude:0.2

/home/anmolagarwal/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use Collection.count_documents instead.

This is added back by InteractiveShellApp.init_path()

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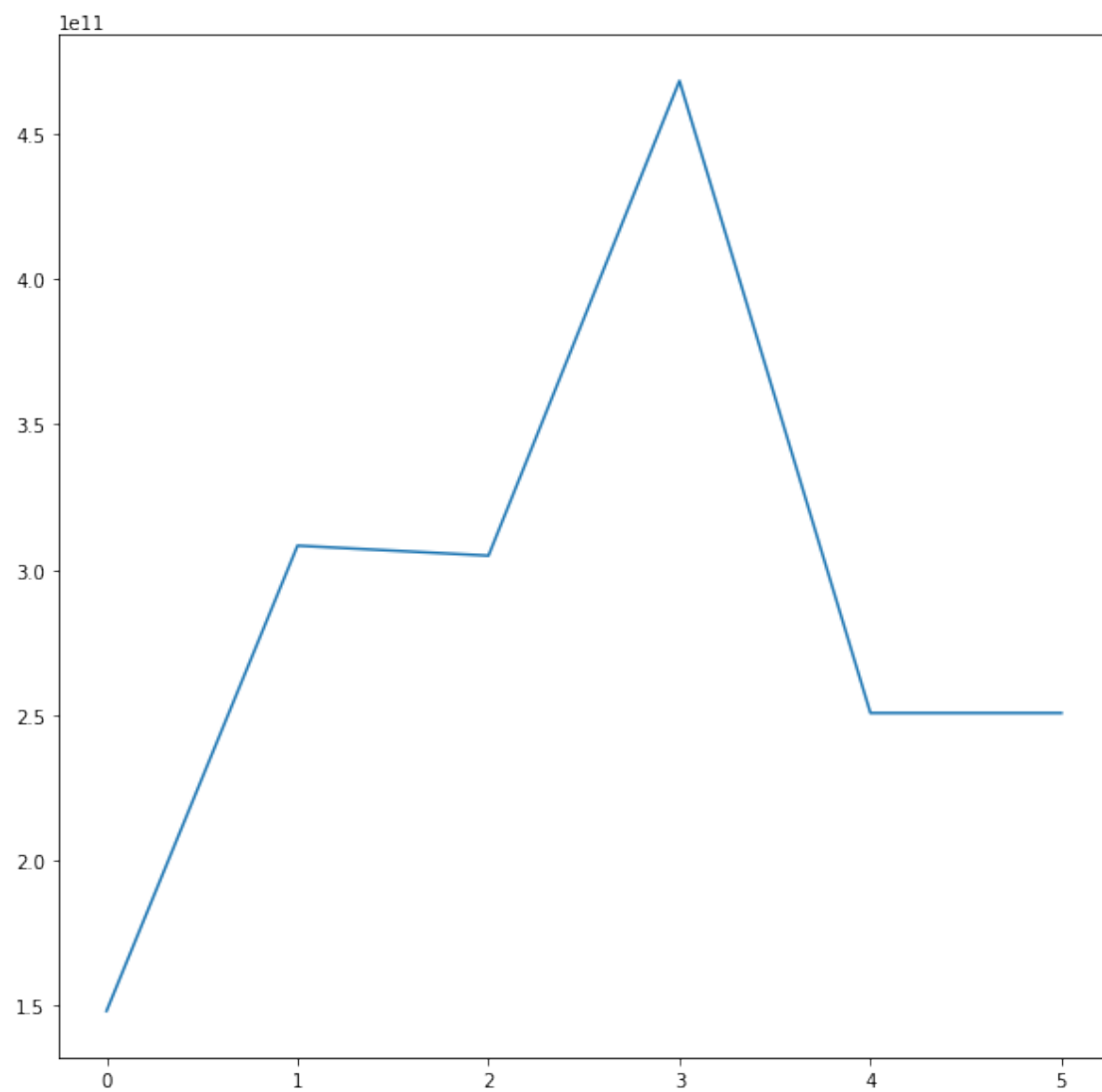
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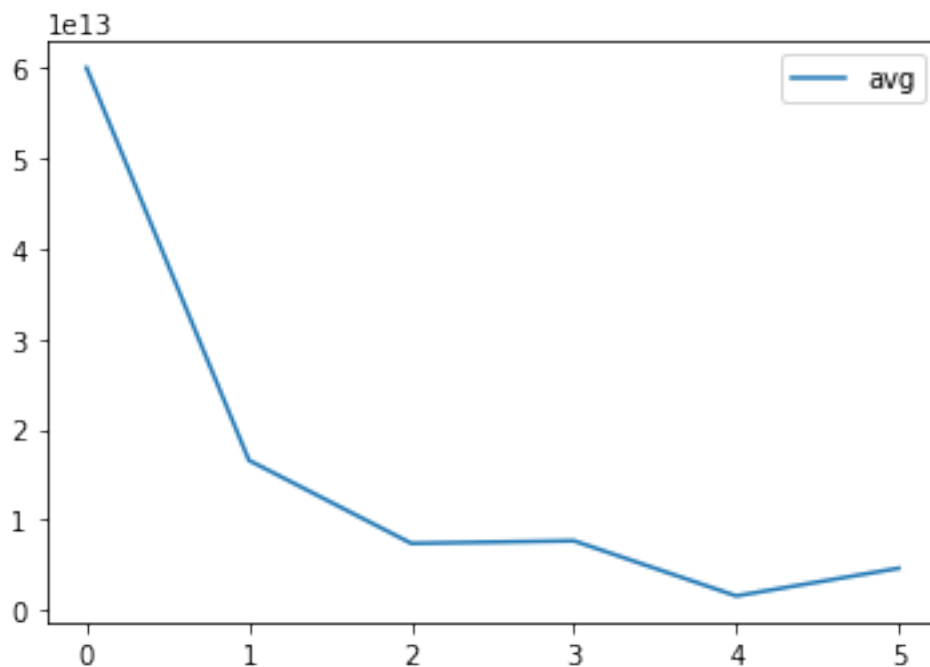
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6





Enter mutation magnitude:0.2

/home/anmolagarwal/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use Collection.count_documents instead.

This is added back by InteractiveShellApp.init_path()

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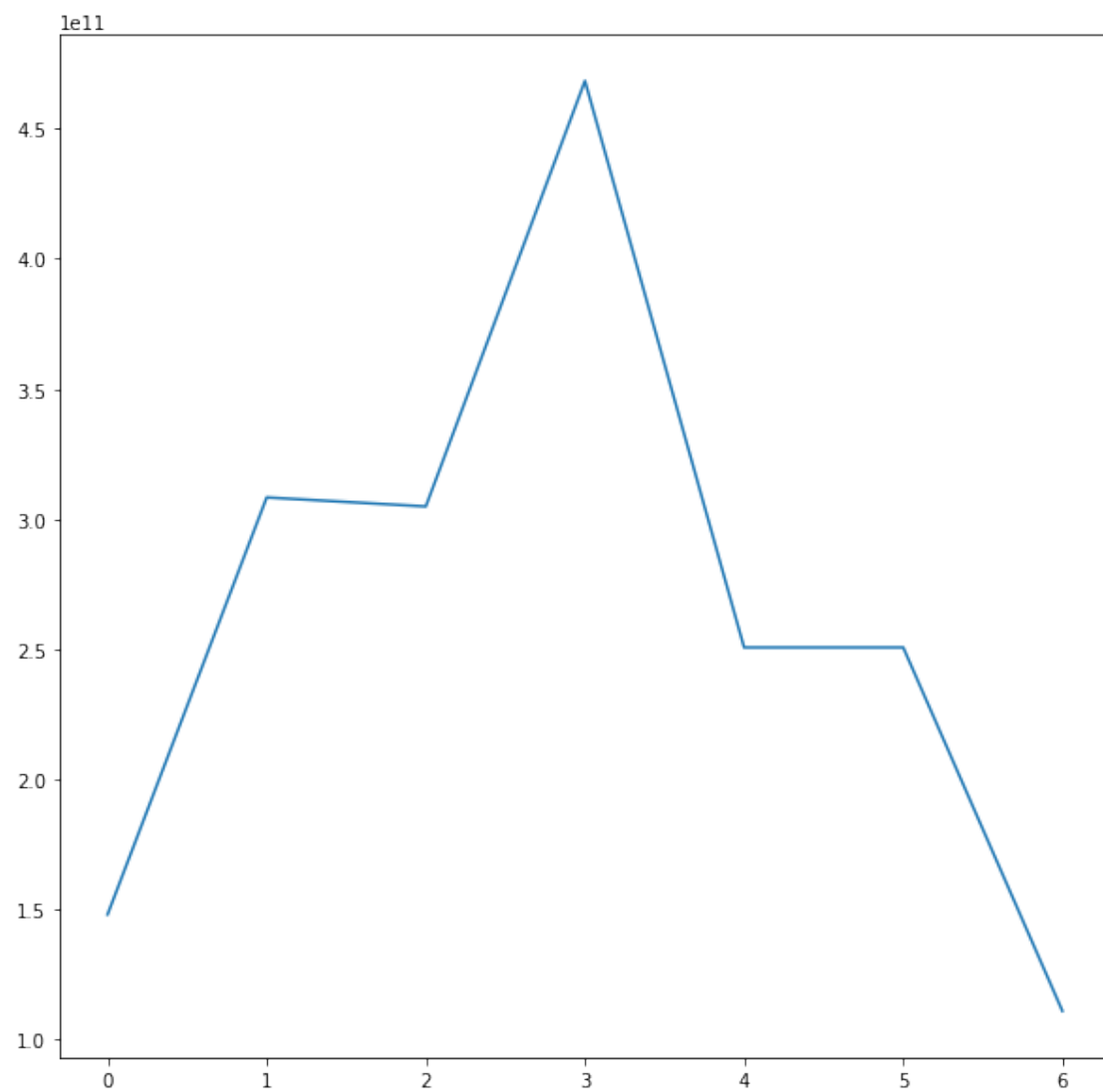
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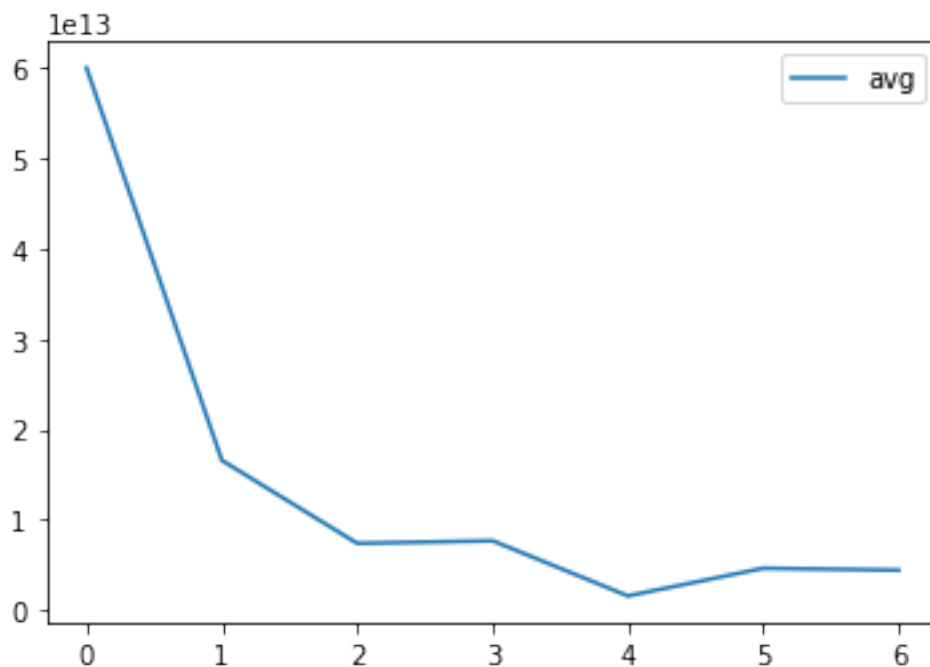
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```

7





Enter mutation magnitude:0.3

/home/anmolagarwal/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use Collection.count_documents instead.

This is added back by InteractiveShellApp.init_path()

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exist?    0
exist?    0
exist?    0
exist?    0
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Avg fitness is 1504105341109.043
MIN fitness is 110918847558.58076
fitness vals are: ->

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 2398833867499.3677
 3618314718929.9854
 4814387775178.897
 6809930831760.892
 8868884937244.547
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 CHILD 1 is [2.56870868e-01 -1.19777204e-12 -7.45386147e-14 6.95248959e-11
 -3.06093763e-10 -1.13022535e-15 8.72649315e-16 1.70613996e-05
 -1.72062331e-06 -7.64234208e-09 7.15746603e-10]
 CHILD 2 is [1.77096659e-02 -1.11559921e-12 -6.38134217e-14 4.66202068e-11
 -3.18028532e-10 -1.62469621e-15 6.26945505e-16 2.34632583e-05
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 CHILD 1 is [3.25161224e-03 -1.18983172e-12 -6.90772639e-14 8.22343798e-11
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 -1.96775520e-06 -8.68096066e-09 7.95118415e-10]
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 CHILD 1 is [2.53205781e-01 -1.22456793e-12 -7.25986396e-14 5.47741231e-11
 -2.93796695e-10 -1.18450586e-15 1.01449343e-15 1.72820716e-05
 -1.72553276e-06 -8.06315717e-09 7.17869932e-10]
 CHILD 2 is [3.01053164e-02 -1.34335031e-12 -4.73856998e-14 7.30140061e-11
 -1.97141293e-10 -1.75723198e-15 7.27129063e-16 2.59030321e-05
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 -1.93479679e-06 -1.37242891e-08 7.74044233e-10]
 CHILD 2 is [2.69477398e-01 -1.22546337e-12 -7.45055043e-14 7.13605923e-11
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 -1.9293849613020016e-06, -8.124800196660345e-09, 7.788376925880543e-10]
 CHILD 1 is [-2.23639137e-03 -1.11564581e-12 -5.83378893e-14 6.88418365e-11
 -3.45625132e-10 -1.81830647e-15 8.38743206e-16 1.80598186e-05
 -1.92528511e-06 -4.98388321e-09 7.79730761e-10]
 CHILD 2 is [-1.83541698e-03 -1.11873729e-12 -5.31172670e-14 6.76642098e-11
 -2.63171347e-10 -1.37793186e-15 8.31771162e-16 2.46912750e-05
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CHILD 1 is [ 2.08100662e-01 -1.38680777e-12 -6.89607687e-14  6.73501388e-11
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-1.69751693e-06 -9.35276178e-09  7.18715359e-10]
CHILD 2 is [ 2.67559413e-01 -1.24593516e-12 -7.45270784e-14  5.54660293e-11
-2.97138345e-10 -1.19408793e-15  1.04513804e-15  1.72212874e-05
-1.70293868e-06 -7.92063389e-09  7.11891115e-10]
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CHILD 1 is [ 1.80219932e-01 -1.40516664e-12 -6.66708080e-14  7.03484460e-11
-2.52898834e-10 -1.60110576e-15  9.95393215e-16  2.25150538e-05
-1.71059531e-06 -9.63307019e-09  7.24156520e-10]
CHILD 2 is [ 1.01504245e-02 -1.13701168e-12 -5.52536835e-14  6.81213699e-11
-2.82027145e-10 -1.49708823e-15  8.44280845e-16  2.29755384e-05
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CHILD 1 is [ 1.13369786e-01 -1.24892899e-12 -5.72178365e-14  6.21083217e-11
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CHILD 2 is [ 2.33540566e-01 -1.22035960e-12 -7.04999895e-14  5.51809129e-11
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CHILD 1 is [1.81856750e-02 -1.74039337e-12 -5.01861704e-14 6.20925213e-11
-1.39881275e-10 -1.41615186e-15 7.12471516e-16 3.48904773e-05
-1.93815933e-06 -1.22396273e-08 7.72263375e-10]

CHILD 2 is [-1.16800381e-02 -1.19817534e-12 -5.57325131e-14 7.25870525e-11
-2.36975970e-10 -1.55365708e-15 8.69367740e-16 1.91112681e-05
-1.86012871e-06 -9.44829403e-09 7.85936595e-10]

#-----

parent 1 is [0.14428537068323463, -1.3603655202019635e-12,
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parent 2 is [0.2811368634297478, -1.201704636746657e-12, -7.53844055944393e-14,
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1.0551044832586086e-15, 1.645518972621183e-05, -1.7001169252675895e-06,
-7.518378138842424e-09, 7.098072411962449e-10]

CHILD 1 is [1.42109288e-01 -1.36288840e-12 -6.80587379e-14 7.09005549e-11
-2.37288084e-10 -1.75602098e-15 1.03390900e-15 2.66271723e-05
-1.76335968e-06 -1.03011742e-08 7.38465564e-10]

CHILD 2 is [2.83312946e-01 -1.19918176e-12 -7.54990682e-14 5.40545777e-11
-3.07401989e-10 -1.01433719e-15 1.05543624e-15 1.62959762e-05
-1.69912704e-06 -7.47482135e-09 7.09358676e-10]

#-----

mut mag is 0.3 Change is 2.131930319231437e-10 and add is
-8.263916581312411e-11

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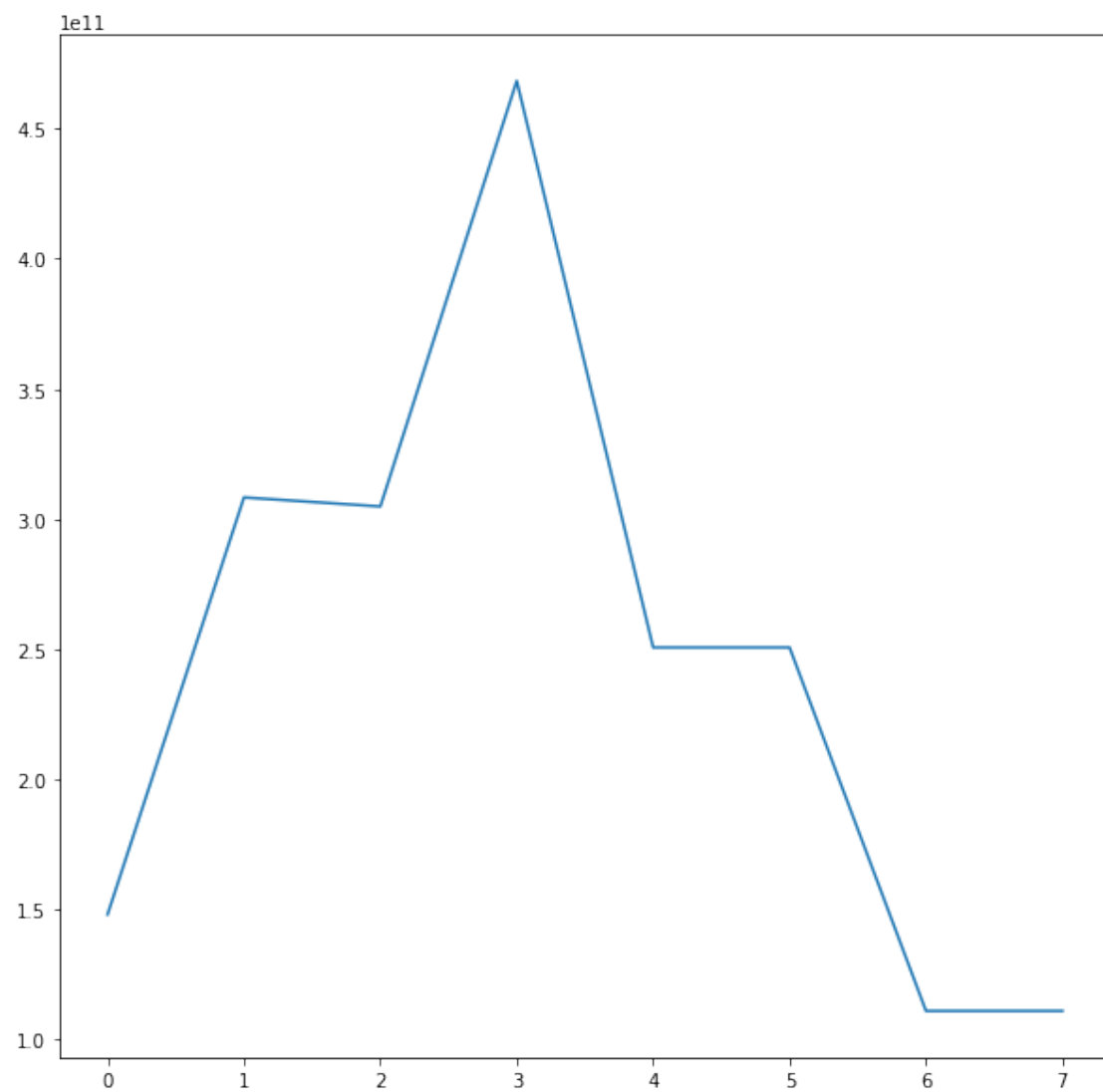
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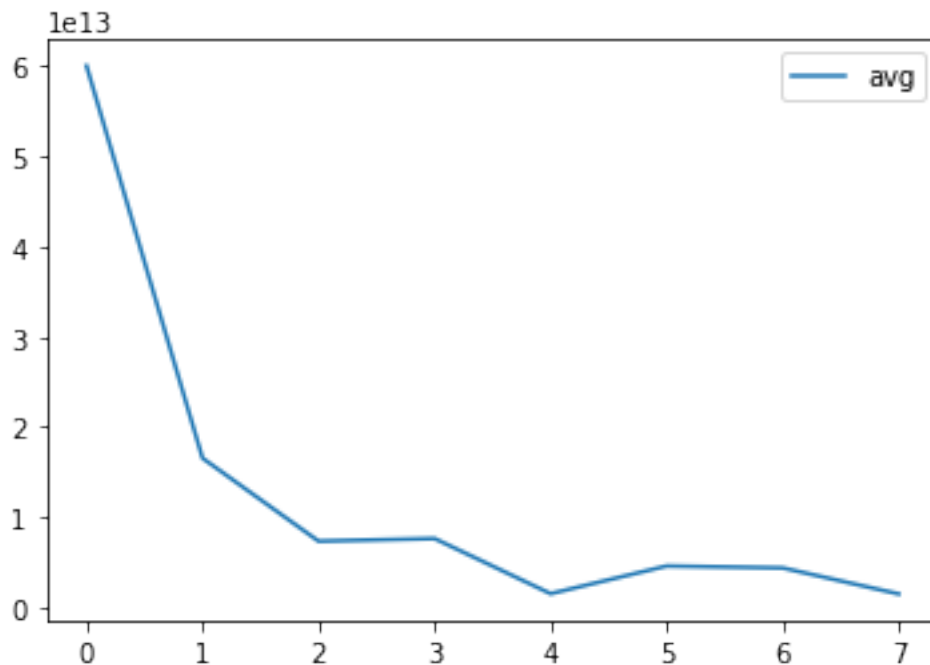
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8





Enter mutation magnitude:0.3

/home/anmolagarwal/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use Collection.count_documents instead.

This is added back by InteractiveShellApp.init_path()

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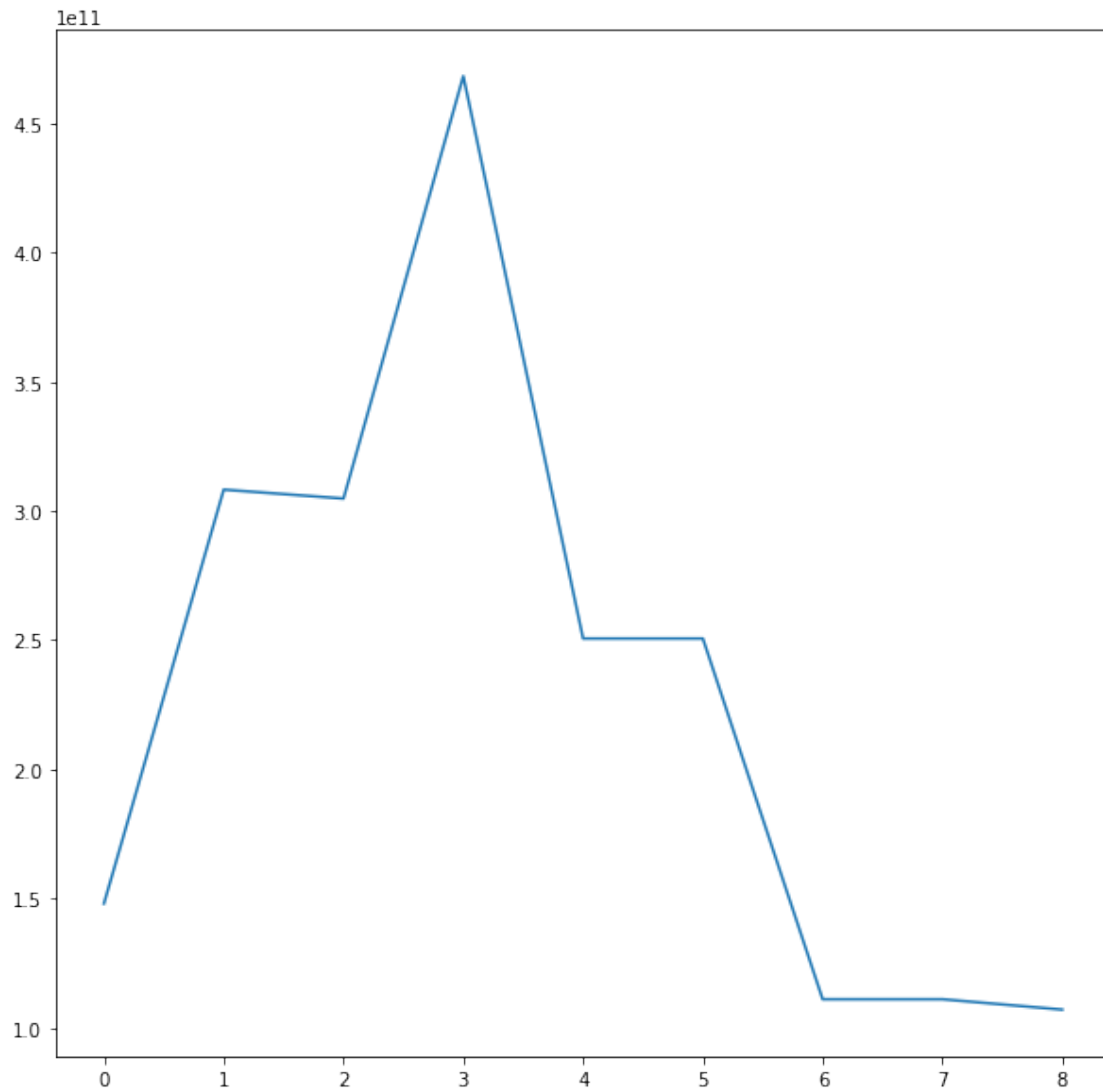
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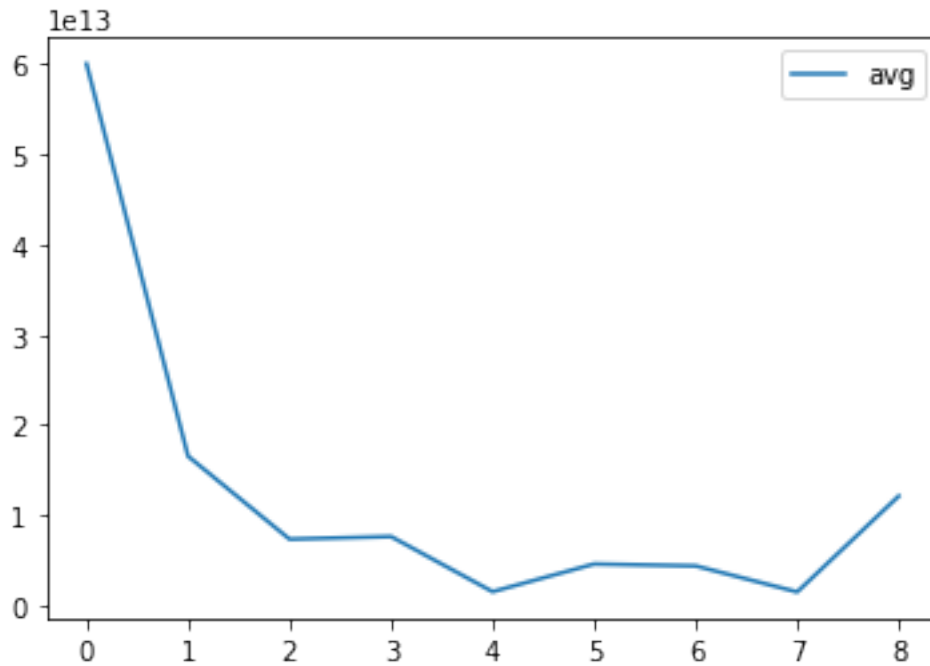
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9





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/home/anmolagarwal/anaconda3/lib/python3.7/site-packages/ipykernel_launcher.py:11: DeprecationWarning: count is deprecated. Use Collection.count_documents instead.

This is added back by InteractiveShellApp.init_path()

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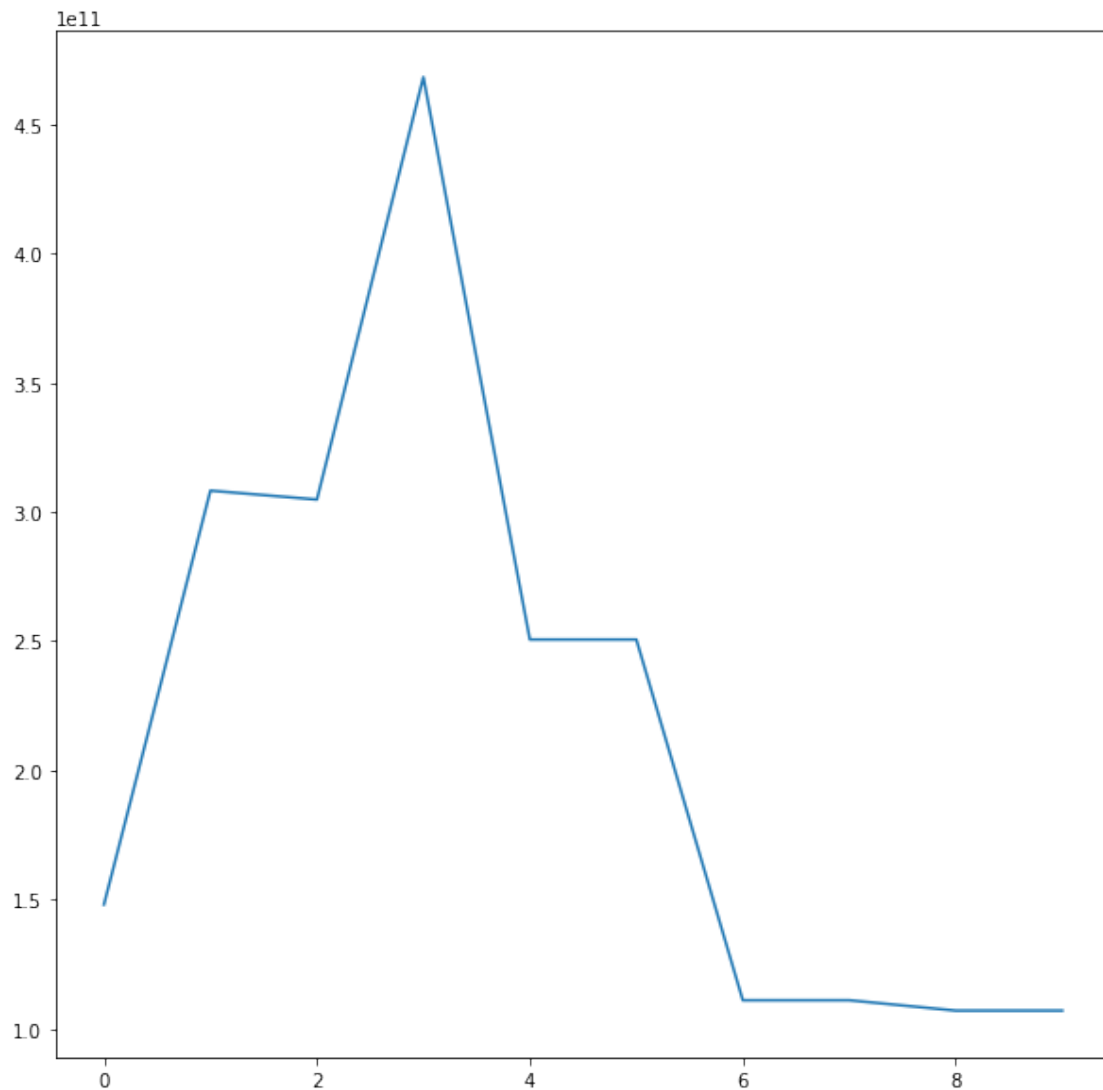
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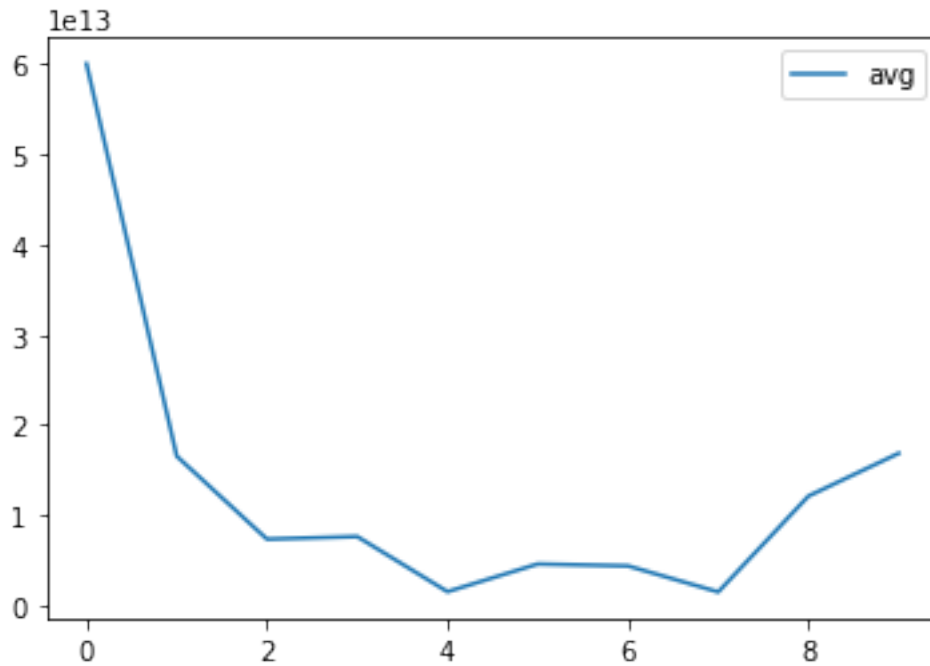

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```

10





```

KeyboardInterrupt                                Traceback (most recent call
last)

~/anaconda3/lib/python3.7/site-packages/ipykernel/kernelbase.py in
_input_request(self, prompt, ident, parent, password)
    883         try:
--> 884             ident, reply = self.session.recv(self.stdin_socket,
0)
    885         except Exception:

~/anaconda3/lib/python3.7/site-packages/jupyter_client/session.py in
recv(self, socket, mode, content, copy)
    802         try:
--> 803             msg_list = socket.recv_multipart(mode, copy=copy)
    804         except zmq.ZMQError as e:

```

```

~/anaconda3/lib/python3.7/site-packages/zmq/sugar/socket.py in
↳recv_multipart(self, flags, copy, track)
    474         """
--> 475         parts = [self.recv(flags, copy=copy, track=track)]
    476         # have first part already, only loop while more to receive

zmq/backend/cython/socket.pyx in zmq.backend.cython.socket.Socket.recv()

zmq/backend/cython/socket.pyx in zmq.backend.cython.socket.Socket.recv()

zmq/backend/cython/socket.pyx in zmq.backend.cython.socket._recv_copy()

~/anaconda3/lib/python3.7/site-packages/zmq/backend/cython/checkrc.pxd
↳in zmq.backend.cython.checkrc._check_rc()

```

KeyboardInterrupt:

During handling of the above exception, another exception occurred:

```

KeyboardInterrupt                                Traceback (most recent call
↳last)

<ipython-input-22-76a9a0ff0ed8> in <module>
    271         generation_info.append({"members":new_parents, "mut_magnitude":
↳mut_magnitude})
    272
--> 273         mut_magnitude=float(input("Enter mutation magnitude:"))

~/anaconda3/lib/python3.7/site-packages/ipykernel/kernelbase.py in
↳raw_input(self, prompt)
    857         self._parent_ident,
    858         self._parent_header,
--> 859         password=False,
    860     )
    861

~/anaconda3/lib/python3.7/site-packages/ipykernel/kernelbase.py in
↳_input_request(self, prompt, ident, parent, password)

```

```

887             except KeyboardInterrupt:
888                 # re-raise KeyboardInterrupt, to truncate traceback
--> 889                 raise KeyboardInterrupt
890             else:
891                 break

```

KeyboardInterrupt:

```
[23]: print(len(generation_info))
```

11

```
[ ]: generation_info[0]
```

```
[ ]: #print(get_fitness_value(generation_info[0]["members"][0]))
```

```
[ ]: print(anmol_arr)
```

```
[24]: with open('json_dump_test_5th_MARCH_STINT_2.json','w') as fd:
      obj={}
      print(type(anmol_arr[0]["errors_returned"]))
      obj["anmol_arr"]=anmol_arr
      obj["generation_info"]=generation_info
      obj["trace_arr"]=trace_arr
      #print(type(anmol_arr))
      #obj["b"]=[1,2,3,4]
      json.dump(obj, fd)

```

<class 'list'>

```

#print(len(generation_info)) with open('json_dump.txt','w') as fd: for obj in generation_info:
#print(obj) obj = {'members': obj['members'].tolist()} json.dump(obj, fd)

```

1 json.dumps(generation_info)

2 print(generation_info)

```
[25]: print("trace_arr is ", trace_arr)
```

```

trace_arr is [[{'generation': 1, 'try_vector': [0.2815485620788354,
-1.3783500660791644e-12, -7.721731529110814e-14, 6.580019545565703e-11,
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```

```

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```

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'father_vec': [0.018185675026183172, -1.7403933715163084e-12,
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-1.4161518573116421e-15, 7.124715160451761e-16, 3.489047733292708e-05,
-2.460085505911238e-06, -1.2239627320055513e-08, 7.814869046763111e-10],
'before_mutation': [-0.03964876425939043, -1.858874528091433e-12,
-4.4643979058449314e-14, 5.434018866925316e-11, -1.0327381454462898e-10,
-1.502014466178516e-15, 6.371115769635221e-16, 2.7434634633250535e-05,
-2.627235755366368e-06, -1.3278036010203235e-08, 7.61466095033296e-10], 'desc':
'PROPER 5th March, STINT_2, Sorted on 0.95 x max + 0.05 x min | ', 'survived':
False}}]
```

```
data = {} for i in range(0, 11): data[i] = [] data['errors_training'] = [] data['errors_validation'] = []
```

```
for doc in coll.find({}, {'_id': False}):
    # print(doc)
    for i in range(0, 11):
        data[i].append(doc['try_vector'][i])

    data['errors_training'].append(doc['errors'][0])
    data['errors_validation'].append(doc['errors'][1])
```

```
# print(data)

df = pd.DataFrame(data).sort_values(
    by=['errors_training', 'errors_validation'])
print(df)
with open('history.txt', 'w') as f:
    print(df, file=f)
```

[]:

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