

LAPORAN OBSERVASI
Tugas Pemrograman 01
CTI-2G3 Sistem Cerdas



Oleh:

Alfan Cahyo Wicaksono (1303184065)

Deni Saputra Hermawan (1303180074)

Mohammad Rizqi Akmaludin (1303184031)

PROGRAM STUDI S1 TEKNOLOGI INFORMASI

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DESKRIPSI

Dalam mengimplementasikan algoritma genetika, terdapat beberapa bagian, yaitu inisiasi populasi yang terdiri dari 10 buah gen menggunakan generate kromosom, evaluasi dengan menghitung fitness dan error, crossover dengan menggabungkan antara 2 parent yang telah digenerate, mutasi menggunakan random mutation dengan range 0 hingga panjang kromosom, seleksi dan regenerasi, dan membuat populasi baru dari hasil seleksi dan regenerasi.

DATASETS

Datasets diambil dari STOCK PRICE DATA

Top 10 leading IT Stock price data from NSE India stock exchange. Below are the 10 stocks listed in dataset :

- 1 Tata Consultancy Services- TCS
- 2 Infosys- INFY
- 3 Wipro- WIPRO
- 4 HCL Tech- HCLTECH
- 5 Tech Mahindra- TECHM
- 6 Larsen & Toubro Infotech- LTI
- 7 MindTree- MINDTREE
- 8 Oracle Financial Services Software- OFSS
- 9 Mphasis- MPHASIS
- 10 L&T Technology Services- LTTS

Justifikasi : Kami mengambil data prev closenya saja dari tanggal 5 maret 2019 hingga 8 agustus 2019 dengan total row 110.

Sumber : Kaggle

IMPLEMENTASI FUNGSI

1. Library

```
1  from random import choices, randint, uniform
2  from typing import List
3  import numpy as np
4  import pandas as pd
5  from math import sqrt
```

Library yang digunakan pada program ini ada beberapa diantaranya adalah Random, pandas, numpy, math. Setiap library mempunyai fungsi masing-masing seperti pengacakan angka, pemrosesan atau operasi bilangan dan pengaksesan file dataset.

2. Pengenalan list dan ukuran dari populasi serta generasi yang diinginkan

```
6
7 Nilai_saham = List[int]
8 Kromosom = List[int]
9 Populasi = List[Kromosom]
10 max_pop = 200 # DAPAT DIRUBAH SESUAI DENGAN MAX POPULASI YANG DIINGINKAN
11 max_generation = 1000
12
```

Pada program terdapat beberapa variabel yang digunakan. Diantaranya adalah yang sudah di tuliskan pada gambar diatas, dimana tiap variabel akan menampung data berupa list ataupun integer yang akan diolah pada fungsi atau prosedur yang ada.

3. Generate Kromosom

```
14 v def generate_kromosom() -> Kromosom:
15     # melakukan generate nilai dari a1 sampai a10
16     return [uniform(-1, 1) for i in range(11)]
17
```

Fungsi def generate_kromosom digunakan untuk melakukan generate nilai dari a1 hingga ke a10. Nilai yang digenerate sesuai dengan yang ada pada dataset yang digunakan.

4. Harga Saham

```
19 v def harga_saham(konstanta: Kromosom, nilai: Nilai_saham):
20     # dari soal  $f(x) = a_0 + a_1.y_1 + a_2.y_2 + a_3.y_3 + \dots + a_{10}.y_{10}$ 
21     #  $a = konstanta, y = nilai$ 
22     nilai = np.insert(nilai, 0, 1)
23     return sum(np.multiply(konstanta, nilai))
24
```

Fungsi def harga_saham digunakan untuk melakukan operasi hingga menghasilkan nilai $f(x)$. Rumus yang digunakan yaitu $f(x)=a_0 + a_1.y_1 + a_2.y_2 + a_3.y_3 + \dots + a_{10}.y_{10}$.

5. Hitung Fitness

[illegible]

Fungsi def hitung_fitness digunakan untuk menghitung nilai fitness dengan menghitung prediksi harga saham, serta menghitung nilai error.

6. Populasi Awal

```
35 def populasi_awal() -> Populasi:
36     # untuk melakukan generate populasi awal dengan range hingga makpop (sesuai yang diinginkan)
37     return [generate_kromosom() for i in range(max_pop)]
38
```

Fungsi def populasi_awal digunakan untuk melakukan generate populasi dimana populasi akan digenerate hingga nilai maksimal pop yang diberikan. Pada kasus ini maksimal popnya adalah 100.

7. Regenerasi Populasi

```
39  def regen_pop(populasi: Populasi, parent: Populasi, pc: int) -> Populasi:
40      # menampilkan regenerate populasi berdasarkan mutasi yang dilakukan
41      populasi = populasi[:len(populasi)-pc]
42      populasi += crossover(parent[0], parent[1], pc)
43      return [mutasi(kromosom) for kromosom in populasi]
44
```

Fungsi `def regen_pop` digunakan untuk menampilkan hasil regenerate populasi berdasarkan mutasi yang sudah dilakukan.

8. Parent Selection

```
45 def parent_selection(populasi: Populasi, saham: Nilai_saham, fit: Populasi) -> Populasi:
46     # memilih parent berdasarkan populasi
47     return choices(
48         populasi,
49         weights=fit,
50         k=2
51     )
52
```

Fungsi def parent_selection digunakan untuk melakukan proses pemilihan parent berdasarkan populasi yang ada.

9. Crossover

```
53 def crossover(parentA: Kromosom, parentB: Kromosom, pc: int) -> Populasi:
54     # mengawinkan parent
55     offspring = []
56     for x in range(0, pc-1, 2):
57         i = randint(1, 10)
58         offspring += [parentA[0:i] + parentB[i:], parentB[0:i] + parentA[i:]]
59     if pc % 2:
60         i = randint(1, 10)
61         offspring += choices([parentA[0:i] + parentB[i:],
62                             parentB[0:i] + parentA[i:]], k=1)
63     return offspring
64
```

Fungsi def crossover digunakan untuk menggabungkan parent berdasarkan 2 kromosom

10. Mutasi

```
71 def mutasi(kromosom: Kromosom) -> Kromosom:
72     for i in range(0, len(kromosom)):
73         if np.random.random_sample() < pm:
74             kromosom[i] = uniform(-1, 1)
75     return kromosom
```

Fungsi def mutasi Menghasilkan individu atau populasi baru dengan gen yang berbeda dari hasil random sample. Populasi atau parent dipilih secara random. Banyaknya individu yang dihasilkan bergantung pada nilai uniform.

11. Fungsi Main

```
78 # fungsi main
79 pop = populasi_awal()
80 print('Populasi Awal: ', pop)
81
82 # Probabilitas operasi genetik (Pc dan Pm)
83 pm = 1/(len(pop)*len(pop[0])) # probabilitas mutasi = 1 / banyak gen
84 pc = round(0.4 * max_pop)
85
86 gen = 0
87 # membaca datasets yang ada pada excel
88 dataset = pd.read_excel('datasets.xlsx', usecols='B')
89 awal = 20
90 saham = dataset.values[awal:awal+21]
91 harga = saham[0]
92 nilai = saham[1:11]
93 error = 1
94 while gen < max_generation:
95     gen += 1
96     fit = [hitung_fitness(kromosom, saham) for kromosom in pop]
97     pop = [x for _, x in sorted(zip(fit, pop), reverse=True)]
98     fit = sorted(fit, reverse=True)
99     print(fit[0])
100     if (fit[0] > error):
101         break
102
103     parent = parent_selection(pop, saham, fit)
104
105     pop = regen_pop(pop, parent, pc)
106
107     fit = [hitung_fitness(kromosom, saham) for kromosom in pop]
108     pop = [x for _, x in sorted(zip(fit, pop), reverse=True)]
109
110     print('Generasi: ', gen)
111     print('Pilihan Kromosom Terbaik: ', pop[0])
112     print('Prediksi Harga Saham: ', round(harga_saham(pop[0], saham[:10])))
113     |
```

Implementasi seluruh fungsi dengan pemanggilan dan output hasil yang diharapkan yakni berupa prediksi harga saham pada akhir baris kode.

HASIL PENGUJIAN

Setiap hasil uji coba command window. Dimana akan menampilkan populasi awal, regenerate populasi, Hasil pemilihan Kromosom terbaik dan Prediksi saham.

1. Uji Coba Populasi

Ukuran populasi yang diujikan adalah pada interval [200, 1000] dengan kelipatan 400.

Kombinasi kromosom dan mutasi yang digunakan adalah -1:1.

a. Populasi 200

```
[Running] python -u "d:\PROGRAMMING\SisCer\source.py"
Populasi Awal: [[-0.1538166500078011, 0.6655117904019947, -0.17781906401657643, -0.9670776846728322, -0.815357233254462, 0.16941998261935676, -0.8052100528723851,
-0.5763343951853841, 0.9466280150072781, -0.7493208108889524, 0.0986501874433261], [-0.1359362862470197, -0.9280371594148051, -0.08471513892997717, 0.
026588382097659125, 0.45399497232880726, 0.44594610061596796, 0.6155953459348054, -0.3773931490518341, 0.16845990312331427, 0.3293441364515233, -0.2606233782683347],
[-0.09056724658084359, 0.4412492682534519, -0.29920775802107413, -0.22632466998839784, 0.7746183900954173, -0.1637378772936251, 0.9457139652440469, -0.
21050091018532302, 0.8168376591922026, -0.04243201723710066, 0.0655281141886157], [-0.9291328573584268, -0.9005661345219398, 0.2531642964460963, -0.
28213782763027506, -0.7610378678642746, 0.03322341213215707, -0.06342437363079978, -0.06112842538491802, -0.704972503403388, 0.43668800353381476, 0.4236392099937998]
, [0.608788698728863, 0.6217647943541027, 0.12521964738392755, -0.28864677748445344, -0.5769833159716307, -0.3877950255465952, -0.55258703824227811, 0.
6203462104426718, 0.2248209407145978, -0.3626421502106414, 0.37860097111329893], [-0.315077289302248, -0.12367593414116462, 0.20688708871231198, 0.07033718316308013,
0.5213072904033449, -0.29059789892301335, -0.3320345394281867, 0.6972182587325841, -0.8240688160321334, -0.7681393908248417, 0.09748571965050723], [0.
00030025148395718126, -0.33751517159009574, 0.4483518184629447, 0.7608788603703975, -0.9451537717569152, -0.7875733843467314, 0.9860689062578469, -0.6802357439727917,
0.15672196409989825, 0.8084599903273155, -0.009011589529415609], [-0.9782227217055641, -0.6241293491953606, -0.30813240902913686, 0.6636190920728322, 0.
09387940360926117, -0.07772873364799882, 0.2649795741224248, -0.2190089835363214, -0.44663957969599477, 0.6923437076470706, -0.9417980641535946], [0.
07612625768686262,
Generasi: 1000
Pilihan Kromosom Terbaik: [-0.9647455646358938, 0.5755301177804695, -0.8597759770537785, 0.6184862505862954, -0.7952466596426726, 0.5573124931746087, 0.
1318728184874985, 0.972783227807527, -0.31313189637856853, -0.35462343845089284, 0.4376490387541421]
Prediksi Harga Saham: 2040
```

b. Populasi 600

```
[Running] python -u "d:\PROGRAMMING\SisCer\source.py"
Populasi Awal: [[-0.12161940049009412, -0.050760119780652646, -0.689173886739816, 0.3436952157816029, 0.6539261811965345, 0.40420789008738334, 0.47565266145282425,
-0.7074906166152881, 0.10746233008842321, 0.43768753600489885, -0.7118588377844828], [0.73536141892442, -0.1909641232362953, -0.5325541891167618, 0.6613551958055452,
-0.208645311032208, 0.6656457829398306, -0.626610639374277, 0.34891987212661757, 0.49155579373676894, 0.3026833087940477, 0.7950112470476454], [-0.6894021802495611,
-0.3852971472098232, -0.8827850452142496, 0.6867005431149993, -0.9982095258063821, -0.06903890631255827, -0.8518029465083952, 0.031684804276377765, 0.
009142572317140107, 0.20633914029175582, 0.31891300585796656], [0.8221199736350395, 0.45450469451313213, 0.7707784562357372, 0.6128398369584958, -0.9327324912231669,
0.47522757881160205, 0.6751728755003361, 0.2046931058572694, -0.65275105158228882, -0.035454272449650714, -0.5742496451919381], [-0.20030949666930686, -0.
33854546290615596, 0.1871181577321026, 0.8984184175016927, 0.8259784711379301, 0.010041737870797984, -0.22482912617610173, 0.6074029204668082, 0.8729258471820385, -0.
8957534051142106, -0.3246389630798934], [0.7112994643022186, 0.9126314401176407, -0.338205154317615, -0.7355276743223156, -0.30092283127698316, -0.941601470046542, 0.
9732597752643966, 0.0946440243842281, -0.492958808534973, 0.9008824616947007, 0.17074703510153322], [-0.8183319129971613, 0.24176106513567408, 0.7449739871103611,
-0.06920838686262664, -0.2725926905205118, -0.9015100852249682, -0.124785767458564, 0.14977043821821434, 0.9789272907653934, -0.4793755873683485, 0.
41347713125158804], [0.9138484761864409, 0.09486488461691778, -0.8559465939829307, 0.3626749038239696, -0.8536445764165512, -0.8807846396056012, 0.4885840201842897,
0.07326169743634403, -0.28477744272897065, 0.8173618560361224, 0.27809352817726237], [-0.8415135286646838, 0.01121410884062879, 0.2550952352049678, 0.
3896753609035877, 0.68080287255990506, 0.04296362614452853, -0.12213682581509655, 0.4765360448381024, -0.25841566014498984, -0.6994258162326954, -0.1272706833523145],
[0.4100070251762702, 0.04095115730185792, 0.18501387008902292, 0.9939237639816234, 0.20478005504969765, 0.13305597228864885, -0.4469671176741416, 0.6574804272305625,
-0.6460313127038084, 0.34971600755744037, 0.15275675446831571], [-0.41299498566409043, 0.7648959422796129, -0.6962630064516069, 0.5411549234695359, 0.
61447759309569, 0.09201703375769053, 0.69574697408757076, 0.2027175109063931, 0.646572051059055, 0.167670985576541, 0.157550067091516, 0.400941536905106]
Generasi: 1000
Pilihan Kromosom Terbaik: [0.9978511369686429, 0.8177880814009069, -0.33185310539026536, -0.4933733400084872, 0.721341745904994, -0.7427127470758699, 0.
6722640636077379, 0.01808628025727896, -0.33814875125977073, 0.2349122283309204, 0.4048607268401525]
Prediksi Harga Saham: 1908
```

c. Populasi 1000

```
[Running] python -u "d:\PROGRAMMING\SisCer\source.py"
Populasi Awal: [[0.803176187691649, -0.276346516067967, -0.36237241493418826, -0.6984958029121604, 0.7973608462468473, 0.9633831417791272, 0.0663413743665302, 0.
7821160229300579, 0.22718804128486414, -0.09257321673427521, 0.1734782293852819], [-0.2536035150597633, 0.8453845598722729, 0.36830114610673603, 0.21584587757401286,
-0.34224675658211745, 0.7933804553422301, 0.9539046432311677, 0.8375370590360072, 0.1982300325956563, -0.9765124896703743, 0.9757849361430915], [0.3177043406990532,
-0.27862330360038756, 0.3305374708672199, -0.35956207655495254, -0.4929658311476599, -0.389272768520758, 0.6638710589864611, 0.9767068549197528, -0.
42189854029943685, 0.2318117512500602, -0.5037062754500778], [0.7807037403220987, 0.8795687391511557, -0.8387850786794842, 0.4807036260313593, 0.051547630412277945,
-0.07549092867015772, -0.6773597397789748, 0.3326281089430734, -0.8912034991667135, -0.14222898798781558, -0.5757076658187659], [-0.38690565894822515, 0.
11350753338995001, 0.7661783552805939, 0.16932947008221144, -0.8169488678795365, -0.2518021358260716, -0.26340689927685124, 0.8087276172035773, 0.6163862850372377,
-0.14383739477414337, 0.45467266124754135], [0.4890567125639502, -0.5633678897421235, -0.9762191082966456, -0.35319372420028894, 0.44815737355420815, -0.
1738951155270707, 0.8754947702590137, -0.7394804899272436, -0.7764430899762178, -0.5797513107072398, -0.44332076799381115], [0.6853442142341624, -0.7574362584046186,
0.07995526834870303, -0.11432900875319874, -0.12698903207508594, 0.15208636799273134, 0.6351387833331057, 0.8744230528948271, 0.8508321242418051, 0.3685786441499157,
-0.03997491807736653], [-0.8393140495944116, -0.6586344764968517, -0.45919498097138245, 0.29523193896710387, -0.058359963236250145, 0.05671362111783185, -0.
6801581942236921, -0.6739455597240707, 0.7887140224097084, 0.19678825063876082, 0.8858360299563375], [-0.3002399258200722, -0.1375792276255663, -0.7673807880698158,
-0.605490905504241, 0.3510587462628636, 0.7477355927301974, -0.3300809825600117, -0.5710153116830898, 0.8547890486452243, -0.8063332072435307, -0.7244877624334289],
[0.6818380784703446, 0.11007689592590952, -0.5334040919421295, -0.26687170181316633, 0.1710466232269013, -0.7099077711212842, 0.32520164219792136, 0.
65447759309569, 0.09201703375769053, 0.69574697408757076, 0.2027175109063931, 0.646572051059055, 0.167670985576541, 0.157550067091516, 0.400941536905106]
Generasi: 1000
Pilihan Kromosom Terbaik: [-0.0512597317303598, 0.7128601584913545, -0.527300280159998, 0.8057260288730324, 0.2622125205417438, -0.7581856631062247, 0.
36097990829627924, 0.3306978117972324, -0.7946557630972464, 0.10102119353698069, 0.4822756073338399]
Prediksi Harga Saham: 1996
```

[Done] exited with code=0 in 331.569 seconds

2. Uji Coba rentang uniform dari kromosom dan mutasi

Ukuran populasi yang diujikan adalah 100. Kombinasi kromosom dan mutasi yang digunakan adalah -1:1, -10:10, -100:100

a. Uniform -1:1

```
[Running] python -u "d:\PROGRAMMING\SiCScsSource.py"
Populasi Awal: [[-0.173067240209544562, 0.2178161196373093, -0.798613052949223, 0.19568993759960708, -0.22301539947123117, 0.72325540149852, -0.18468178324979734,
-0.9540664754908017, -0.06736731268390662, 0.2295944661337203, -0.29517549378431844], [0.936541913671178, 0.03805763670701358, -0.394102569759588, 0.
774571553503422, -0.6346211029478035, 0.223815833535672, -0.9401742146512384, -0.72778850631312, -0.312248840199288, -0.120275501629183, -0.47761937354703354],
[-0.02807376495763303, -0.40380159664495663, -0.087262903979609, -0.560702419554944, -0.4573515117598473, 0.5896353485838577, 0.72831752215586154,
986702875985101, -0.0640362465024177, -0.9100080315319239, 0.5208864406411285], [-0.361923379543261, -0.90666606880547308, -0.0693109227328422, -0.
17861787092590512, -0.8748777414634044, -0.24257522804674592, 0.4011998404270176, -0.07234092965570703, 0.593291937380533, -0.85632483389495, -0.902559864355233],
[-0.44914662527345, -0.25401144423299076, 0.266582145462055, -0.79404606069506354, 0.421311510664539, -0.7220971306163626, 0.8093670674144577, -0.9945810306579497,
0.949146215879105, 0.214312994090883, -0.5863904404591213], [-0.0841718067808363, -0.8753614312820863, -0.399733271135047, -0.799673880943471, 0.
8754148366714183, -0.0902813459467462, 0.14758106380533565, -0.23637109875712858, 0.916082490067307, 0.404417204776662, 0.3725260330134113], [0.7611737220883199,
0.083523306515819, 0.9435772907755584, 0.4225284798615845, -0.7334900254525993, 0.6787426803720669, -0.2972133833171504, 0.5515859013909613, -0.6922802762693664,
-0.6783051437709121, 0.16057675842770478], [-0.5670401888060108, -0.5531351120268571, 0.22163376797032496, -0.51313017973918, -0.15878820957506434,
47274804204201915, 0.964567111710830723, -0.5100529830055864, 0.16017479575662996, -0.16882499735425216, -0.068763819670571344], [0.2223405267995826, 0.
6072330598483384, -0.886085703084702, -0.9358986543503685, 0.9309015048203138, 0.5945839966274462, 0.1047226448226334, 0.7206765189042166, 0.6648467370426103, -0.
6916327419160273, -0.7631511008103127], [0.8602462515314616, -0.9034920234215248, -0.5462829405318137, -0.5182570174966121, -0.4043299639820561, -0.43911333100071803,
-0.8952437474443931, -0.8324912501117285, 0.55388170284364, 0.3925754918120963, -0.39648387962065196], [0.928216818208528, 0.8258387880400186, -0.279139839279011,
0.01868849836774558]

Generasi: 1000
Pilihan Kromosom Terbaik: [0.4095300100836837, 0.2698038136184342, 0.6482341312064942, -0.5557596376282263, -0.445904869862884, 0.2755786771766635, -0.
2942623413635504, 0.3888235027404743, -0.46717532455618294, 0.403296444671393, 0.7259842149944651]

Prediksi Harga Saham: 1934
```

b. Uniform -10:10

```
[Running] python -u "d:\PROGRAMING\SiScsa\source.py"
Pilihan Awal: [-9.890238409583213, 7.996634901193396, -4.133099154963373, 1.116507854035822, 9.496668152313597, -5.4822814974823935, 1.9786673491738842, -4.234270197891989, 8.366850341043843, -9.6610511282011, 3.7700905459843383], [5.279480436111896, 8.717516391969678, -8.660295331575076, 0.3521673481889227, 8.471005692023472, -0.5918241595926315, 7.22935479260294, 1.7933131382119853, -4.3817037933705, -1.389034295392996, -4.888575903041259], [-0.9494494758651655, 8.80944592621696, 6.574422388648994, -8.26799778659427, -3.767780672423175, -8.68570385055498, 1.5329899430479426, -3.541156712410743, 3.715484820635231, 2.52814824826834, -9.201067308316473], [-3.564269283561659, -0.65925112160626, -9.44484851596728, 3.7607926090425003, -6.49094124141802, 4.2393494517317314, -1.39204417364585, 8.73042344165452, 1.877064143864007, 9.795842086613249, -7.40620957144024], [3.451157169160673, -6.38954664896815, -0.2624480750449276, 7.16299046446296, -2.008671968473972, -4.423799275483466, -1.326810584088854, -2.280474991367, -6.542837411121645, -9.22603911548095, -3.68185456342063], [-1.308938244525194, -4.83501198023456, 8.33985288157089, -1.3967919872812915, -6.1926958472143845, -4.173641530062615, 8.5800066434567, -0.5370668777787575, -6.2881980454432581, -4.065832093978758, 2.2875206818256917], [0.424778427675621, -6.47561854887299, 0.2721371119519041, 6.296890540708801, 5.952989898413547, 5.9694941497582, 8.36429010131104, 6.752528801956047, 7.71504138563765, -0.5559976278816787, 7.368454561804937], [-6.95459964552184, 1.006378915276506, 3.2652335462676625, 9.971857181424696, -6.8306317484563, -8.52488008417162, 6.978332852784934, -3.79666398070213, 0.3340778672752194, 0.08287673165988984, 3.529378730867075, -4.849791071978293, -9.805847200556176, 5.964765407538447, -7.11479468690412, 0.4014382828297437, 7.832728397567955, -0.2137541763181262, -2.725428174587456, 0.5162952746186437, -1.0428713198769214, -2.9440312543797553], [4.2282134365049418, 0.355566184676338, 5.782428507292426, -3.762162716313596, -5.914757534394, -6.6161839036955, -0.6583187615692, -7.703343904903, -9.206366160662, -0.9066666666666667, 0.001234567890123, 0.00234567890123, 0.0034567890123, 0.004567890123, 0.00567890123, 0.0067890123, 0.007890123, 0.00890123, 0.0090123, 0.01]
Generasi: 1000
Pilihan Kromosom Terbaik: [-9.4879999904413197, -0.73172424653818, -4.238046041479874, 1.873907053954051, -5.683258909644666, 7.851963768859521, 1.6508901544805603, 9.159489376540055, -5.613859782648366, -1.460334286074517, 4.150597025747317]
Prediksi Harga Saham: 1975
```

c. Uniform -100:100

```
[Running] python -u "d:\PROGRAMMING\SiScs\source.py"
Populasi Awal: [[-9.079652190254478, 82.7406643355979, -56.57846049335298, -71.785528451101, -70.82059356471663, 45.42532517650153, 84.13706253106119, -24.619891838660223, -40.2759046308788, -63.4466192365709, 88.2356650598103], [-9.27594331182641, 36.635368994359254, -53.452723972554764, 31.90793369569542, 31.0004827190088, -29.51158634045177, 29.86439231599618, 76.09436045991106, -51.886156828874654, -65.7228627622963, 86.89199481803436], [-38.79697644801525, 95.0420870368639, -47.72471343913129, -33.0958153943975, 54.33990247401197, 58.76449534864204, 7.40066093418971, 40.18889455576132, 66.51613235592436, 22.744017921862365, -11.8189623188825], [-65.54388069645414, -66.87604431248977, -22.718842966464357, -90.3700552355913, -47.957417184441354, 8.098095895695704, -10.58891161676432, -86.0215426859547, -21.80058915292444, -98.26454250991554, 87.76592144013472], [-70.49138894728216, 27.918118966027406, -4.047084213886504, -65.06624903812454, 84.92334527178642, -10.376483619467749, -8.87807647287768, -74.92762463173632, 42.75281317310346, -85.90124894314985, 36.543582424619075], [-40.676022727636342276]]
Generasi: 1000
Pilihan Kromosom Terbaik: [92.24564004094042, -29.45222783398674, 8.291264593279507, -36.6889469747302, -35.401551406687275, 60.23922435044784, 64.93837282932495, -35.23370092439413, -41.3200413169662, 34.64320156233766, 8.813525156129359]
Prediksi Harga Saham: -2527
```

HASIL REVISI

Problem : Tidak menampilkan secara selesai prediksi 50 data saham baru

Solving : Berdasarkan revisi yang dibutuhkan yakni nilai prediksi atau forecast saham dalam 50 hari. Algoritma baru ini akan mengecek best kromosom dahulu selama 50 hari. Dengan rule 10 hari sebelumnya sesuai fungsi pada soal. Pada output forecast saham dapat dilihat prediksi dengan format yakni [Hari ke berapa, harga prediksi, harga sebenarnya, selisih harga]. Untuk hasilnya sendiri dapat dilihat masih terdapat selisih yang cukup besar diatas 200, untuk itu masih belum akurat.


```
[Running] python -u "d:\PROGRAMING\siscer\source.py"
best kromosom hari ke- 1 : [0.9890500750353806, 0.42142277129537953, 0.43651733682969073, -0.5596177058680261, -0.45706988477284805, 0.7294642873365129, 0.3742011462330
best kromosom hari ke- 2 : [-0.0609135304971194, 0.11906804497106993, 0.16273348151730138, 0.27447757658968275, 0.4650977832936105, -0.0677328451339434, 0.8196225528395
best kromosom hari ke- 3 : [-0.7539998680896152, -0.08877334628086929, -0.4475926999054105, -0.2992261231999451, 0.1481247251451916, 0.9615138780425154, -0.41237339361
best kromosom hari ke- 4 : [-0.6797624803693812, -0.44111065506591785, 0.380530645983715, 0.3505610758559332, -0.14579682288554818, -0.6673186681166847, -0.3270285899531
best kromosom hari ke- 5 : [-0.1300083288576046, -0.22355978431025236, -0.4344144317748139, -0.3993764061617251, 0.746188581605423, 0.4573850587624855, 0.92149915976615
best kromosom hari ke- 6 : [-0.459427066490822, 0.39487655788766285, 0.7644414347017554, 0.20322673782807692, -0.34244195502183117, -0.37117076670141746, 0.0813558720017
best kromosom hari ke- 7 : [0.627186868661415, -0.16246719987981284, 0.2445055663046911, 0.4079083272352735, 0.8409974826293507, -0.7581123431414518, 0.38925487715561
best kromosom hari ke- 8 : [0.306768579248289, -0.26160614817611553, -0.09250918531956365, 0.7330253249185887, -0.8727782730476359, 0.6379746256601090, 0.8999025626081
best kromosom hari ke- 9 : [-0.2683403735953971, 0.42034991349176665, 0.5376079017591771, -0.18907926368735728, 0.12268023451342924, -0.6480455704867958, 0.16645464048
best kromosom hari ke- 10 : [0.6476276645453773, -0.9520160626317613, -0.882649781493658, 0.6346663872516245, 0.8504305622999969, 0.2982807813094872, 0.978985998919651
best kromosom hari ke- 11 : [0.7446107003529885, 0.7834620018668885, 0.8581547655642109, -0.6379383573918344, -0.7245261440619712, -0.2655037224620945, 0.4659409244577
best kromosom hari ke- 12 : [0.9945201176252383, 0.067724697219217, 0.5847003803488325, -0.7341489211762526, 0.3279753350820922, -0.6997107576860131, 0.431146654099018
best kromosom hari ke- 13 : [-0.2766228278275096, -0.8380121145814474, 0.9917841924667236, 0.7937211307580723, -0.8566417389123864, 0.8388518085592121, -0.2615290678604
best kromosom hari ke- 14 : [-0.21332724853352448, 0.7778986695180885, -0.24535387753724214, -0.5104930624813551, -0.10230270185783685, 0.8887321219693588, -0.10645856
best kromosom hari ke- 15 : [0.5141198667758842, 0.8248044514211439, 0.9312466097625788, 0.809521227709247781, -0.00385004539600238, 0.7503680667813604, -0.15821196948
best kromosom hari ke- 16 : [-0.596256059371295, -0.9671485292596478, 0.1568437655351973, 0.5348318958050566, -0.020979163094737574, 0.981795250411115, 0.57062175495
best kromosom hari ke- 17 : [0.42973959907403949, 0.8021737987513542, -0.4249095859088796, 0.26957083546229497, -0.029211647022180376, -0.019842127756669825, -0.6137923
best kromosom hari ke- 18 : [-0.7172779713200265, -0.09375390486530513, 0.4144104928761987, -0.04907375828763483, -0.5986706506844013, 0.6448224177873516, -0.597629480
best kromosom hari ke- 19 : [-0.214738808837295, 0.599798709293929, -0.6666508892991088, 0.07153054165134631, 0.6986926277094305, -0.47878775621754746, -0.313653693258
best kromosom hari ke- 20 : [-0.8383078028230657, -0.19235319597987655, 0.6248620149178385, -0.5872880084648804, 0.6570533308718373, 0.3758488272721512, 0.215579836876
best kromosom hari ke- 21 : [0.06538994820857568, -0.0707361308645758, -0.6804267878944838, 0.6200803775823797, -0.5878253454244176, -0.298062415713887, 0.89313666665
best kromosom hari ke- 22 : [0.1716155440645457, 0.5455532089033386, -0.8204805285803115, 0.58936376466986819, 0.11681897289530494, 0.8391511187568485, 0.02606743965413
best kromosom hari ke- 23 : [-0.902116832396687, 0.3802977974872881, -0.008509931348550683, 0.7184402709789835, -0.7711905424792189, -0.2459133954638088, -0.084294201
best kromosom hari ke- 24 : [-0.5037558360366543, 0.7130067857247432, -0.143277288149938, -0.503381886541285, 0.9027343137111408, -0.6630881418470909, 0.00625300997154
best kromosom hari ke- 25 : [0.19126072040961904, 0.11991145859751717, 0.14583821068274381, -0.30182962419269366, 0.9897030570421648, -0.689564411216451, 0.5901920055
best kromosom hari ke- 26 : [0.7035247518442012, 0.2947757523985963, -0.3659001218384217, -0.06505721657261065, -0.9038421857130134, 0.6846310623097143, -0.8332346742
best kromosom hari ke- 27 : [0.6030938948826829, -0.39154986189186825, 0.083962906729248, 0.3348262360996731, 0.0013503198362969648, 0.8427457654217156, 0.7291409490342
best kromosom hari ke- 28 : [0.40899914376172735, 0.7928630165753576, -0.031684100818504034, 0.4583617085854246, -0.3979745633126637, 0.01847168261163045, 0.0019052517
forecast harga saham: [[1, 2210, 2196, 13], [2, 2091, 2146, 55], [3, 2167, 2107, 59], [4, 1913, 2073, 160], [5, 2352, 2055, 296], [6, 1940, 2048, 108], [7, 1901, 2054,
```

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LINK VIDEO

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