CS156 (Introduction to AI), Spring 2022

Homework 1 submission

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Any special notes or anything you would like to communicate to me about this homework submission goes in here.

References and sources

List all your references and sources here. This includes all sites/discussion boards/blogs/posts/etc. where you grabbed some code examples.

Solution

Load libraries and set random number generator seed

In [ ]:
```python
import numpy as np
```

In [ ]:
```python
np.random.seed(42)
```

Code the solution

In [1]:
```python
#import libraries
import sympy as sym
from IPython.display import display, Math

x = sym.symbols("x")

# the given function --- f(x) = 5x^3 - 20x + 2
func = 5*x**3 - 20*x + 2
# print the function
display(Math(r'f(x) = 5x^3 - 20x + 2'))

# derive the function
deriv = sym.Derivative(func, x).doit()
deriv = sym.lambdify(x, deriv, "math")

# initialize the value of x
cur_x = 0.1

#precision
```

```
precision_val = 0.000000001

#number of iterations
max_iter = 1000

#initialize learning rate
learning_rate = 0.01
# initialize current iteration
cur_iter = 0
# initialize previous step size
prev_step_size = 0.5

while prev_step_size > precision_val and cur_iter < max_iter:
    prev_x = cur_x
    cur_x = cur_x - learning_rate * deriv(prev_x)
    prev_step_size = abs(cur_x - prev_x)
    cur_iter += 1
    print(cur_iter, cur_x)

print(f"The global minima occured at {cur_x}")
```

$$f(x) = 5x^3 - 20x + 2$$

```
1 0.2985
2 0.4851346625
3 0.6498313163861517
4 0.7864892054227278
5 0.8937044148857568
6 0.9738982777078129
7 1.0316265994094762
8 1.0719885833181022
9 1.0996146549034493
10 1.1182417965116846
11 1.1306720891918327
12 1.1389091832002192
13 1.1443420640635507
14 1.1479142501257664
15 1.1502581812794963
16 1.1517940987394342
17 1.1527996518557864
18 1.153457596257963
19 1.1538879323031832
20 1.1541693282559458
21 1.1543533025129287
22 1.154473570459553
23 1.1545521867261088
24 1.154603573945003
25 1.1546371620000169
26 1.154659115619299
27 1.1546734646268877
28 1.1546828431398686
29 1.154688972903633
30 1.1546929792818459
31 1.1546955978214282
32 1.1546973092772004
33 1.1546984278693995
34 1.15469915897079
35 1.1546996368116125
36 1.154699949123682
37 1.154700153247747
38 1.154700286611915
39 1.154700373858876
40 1.154700430850419
41 1.1547004680994863
42 1.1547004924451105
43 1.1547005083571635
44 1.154700518757198
45 1.1547005255544256
46 1.1547005299970756
47 1.1547005329007465
48 1.1547005347985564
49 1.1547005360389455
```

```
50 1.1547005368496512
The global minima occured at 1.1547005368496512
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

In [ ]: