
Assignment No: 4

Title Name: Implement Gradient Descent Algorithm.

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Class : BE

Div: 1

Batch: A

Roll No: 405A008

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In [1]: cur_x = 3 # The algorithm starts at x=3
rate = 0.01 # Learning rate
precision = 0.000001 #This tells us when to stop the algorithm
previous_step_size = 1 #
max_iters = 10000 # maximum number of iterations
iters = 0 #iteration counter
df = lambda x: 2*(x+5) #Gradient of our function
```

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In [2]: while previous_step_size > precision and iters < max_iters:
prev_x = cur_x #Store current x value in prev_x
cur_x = cur_x - rate * df(prev_x) #Grad descent
previous_step_size = abs(cur_x - prev_x) #Change in x
iters = iters+1 #iteration count
print("Iteration",iters,"\nX value is",cur_x) #Print iterations
print("The local minimum occurs at", cur_x)
```

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Iteration 1
X value is 2.84
The local minimum occurs at 2.84
Iteration 2
X value is 2.6832
The local minimum occurs at 2.6832
Iteration 3
X value is 2.529536
The local minimum occurs at 2.529536
Iteration 4
X value is 2.37894528
The local minimum occurs at 2.37894528
Iteration 5
X value is 2.2313663744
The local minimum occurs at 2.2313663744
Iteration 6
X value is 2.0867390469119997
The local minimum occurs at 2.0867390469119997
Iteration 7
X value is 1.9450042659737599
The local minimum occurs at 1.9450042659737599
Iteration 8
X value is 1.8061041806542846
The local minimum occurs at 1.8061041806542846
Iteration 9
X value is 1.669982097041199
The local minimum occurs at 1.669982097041199
Iteration 10
X value is 1.5365824551003748
The local minimum occurs at 1.5365824551003748
Iteration 11
X value is 1.4058508059983674
The local minimum occurs at 1.4058508059983674
Iteration 12
X value is 1.2777337898784
The local minimum occurs at 1.2777337898784
Iteration 13
X value is 1.152179114080832
```

Iteration 17
X value is 0.6745741294451669
The local minimum occurs at 0.6745741294451669
Iteration 18
X value is 0.5610826468562635
The local minimum occurs at 0.5610826468562635
Iteration 19
X value is 0.44986099391913825
The local minimum occurs at 0.44986099391913825
Iteration 20
X value is 0.3408637740407555
The local minimum occurs at 0.3408637740407555
Iteration 21
X value is 0.23404649855994042
The local minimum occurs at 0.23404649855994042
Iteration 22
X value is 0.1293655685887416
The local minimum occurs at 0.1293655685887416
Iteration 23
X value is 0.026778257216966764
The local minimum occurs at 0.026778257216966764
Iteration 24
X value is -0.07375730792737258
The local minimum occurs at -0.07375730792737258
Iteration 25
X value is -0.1722821617688251
The local minimum occurs at -0.1722821617688251
Iteration 26
X value is -0.2688365185334486
The local minimum occurs at -0.2688365185334486
Iteration 27
X value is -0.36345978816277963
The local minimum occurs at -0.36345978816277963
Iteration 28
X value is -0.45619059239952403
The local minimum occurs at -0.45619059239952403
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X value is -0.5470667805515336
The local minimum occurs at -0.5470667805515336
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X value is -0.6361254449405029
The local minimum occurs at -0.6361254449405029
Iteration 31
X value is -0.7234029360416929
The local minimum occurs at -0.7234029360416929
Iteration 32
X value is -0.8089348773208591
The local minimum occurs at -0.8089348773208591
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X value is -0.8927561797744419
The local minimum occurs at -0.8927561797744419
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X value is -0.9749010561789531
The local minimum occurs at -0.9749010561789531
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The local minimum occurs at -1.055403035055374
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The local minimum occurs at -1.1342949743542665
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The local minimum occurs at -1.2116090748671813
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X value is -1.2873768933698377
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Iteration 39
X value is -1.361629355502441
The local minimum occurs at -1.361629355502441

Iteration 40
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The local minimum occurs at -1.4343967683923922
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The local minimum occurs at -1.6440827632367725
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Iteration 63
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Iteration 221
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Iteration 222
X value is -4.909784992258436
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X value is -4.911589292413267
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Iteration 576
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The local minimum occurs at -4.999929317876933
Iteration 577
X value is -4.999930731519394
The local minimum occurs at -4.999930731519394
Iteration 578
X value is -4.999932116889006
The local minimum occurs at -4.999932116889006
Iteration 579
X value is -4.999933474551226
The local minimum occurs at -4.999933474551226
Iteration 580
X value is -4.999934805060202
The local minimum occurs at -4.999934805060202
Iteration 581
X value is -4.999936108958998
The local minimum occurs at -4.999936108958998
Iteration 582
X value is -4.999937386779818
The local minimum occurs at -4.999937386779818
Iteration 583
X value is -4.999938639044221
The local minimum occurs at -4.999938639044221
Iteration 584
X value is -4.999939866263337
The local minimum occurs at -4.999939866263337
Iteration 585
X value is -4.99994106893807
The local minimum occurs at -4.99994106893807
Iteration 586
X value is -4.999942247559309
The local minimum occurs at -4.999942247559309
Iteration 587
X value is -4.999943402608123
The local minimum occurs at -4.999943402608123
Iteration 588
X value is -4.9999445345559606
The local minimum occurs at -4.9999445345559606
Iteration 589
X value is -4.999945643864842
The local minimum occurs at -4.999945643864842
Iteration 590
X value is -4.999946730987545
The local minimum occurs at -4.999946730987545
Iteration 591
X value is -4.999947796367794
The local minimum occurs at -4.999947796367794

```
Iteration 592
X value is -4.999948840440438
The local minimum occurs at -4.999948840440438
Iteration 593
X value is -4.999949863631629
The local minimum occurs at -4.999949863631629
Iteration 594
X value is -4.999950866358997
The local minimum occurs at -4.999950866358997
Iteration 595
X value is -4.9999518490318176
The local minimum occurs at -4.9999518490318176
```

In []: