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from math import sqrt

print("Введите номер примера")

inp = int(input())

if inp == 1:

x0=[1,1,0,0,0]

a=[2,-1,1,0,1]

b=[0,1,3,0,-2]

else:

x0=[1,1,0,0]

a=[1,2,3,-1]

b=[-1,2,0,3]

beta = 0.125

l1 = 0

l2 =2

l0 = [l1, l2]

xk = x0

eps =0.001

iteracii = 0

def J(x):

j=0

for i in range(len(x)):

j+=(x[i]-a[i])\*\*2

return j

def J\_x(x):

j\_shtrix=[]

for i in range(len(x)):

j\_shtrix.append(2\*(x[i] - a[i]))

return j\_shtrix

def normab\_2(x):

norma\_b = 0

for i in range(len(b)):

norma\_b += b[i]\*\*2

return norma\_b

def b\_x(x):

bx = 0

for i in range(len(b)):

bx += b[i]\*x[i]

return bx

def normax\_2(x):

norma\_x =0

for i in range(len(x)):

norma\_x += x[i]\*\*2

return norma\_x

def g\_1(x):

norma\_x = normax\_2(x)

bx = b\_x(x)

g1 = norma\_x - 2\*bx

return g1

def g\_2(x):

g\_2 =0

bx = b\_x(x)

norma\_b = normab\_2(x)

g2 = norma\_b - bx

return g2

def g1\_shtrix(x):

g1\_shtrix= []

for i in range(len(b)):

g1\_shtrix = x[i]-b[i]

g1\_shtrix = 2\*g1\_shtrix

return g1\_shtrix

def g2\_shtrix(x):

g2shtrix = []

for i in range(len(b) ):

g2shtrix.append(- b[i])

return g2shtrix

def L\_x(xk):

l\_x=[]

for i in range(len(x0)):

t = 2\*(xk[i] - a[i]) +l1\*2\*(xk[i] - b[i]) - l2\*b[i]

l\_x.append(t)

return l\_x

def L\_l(xk):

l\_l=[]

g1 = g\_1(xk)

g2 = g\_2(xk)

l\_l = [g1, g2]

return l\_l

x\_k = []

l\_k = []

xk = x0

xk\_minus1 =[]

xk\_1 = []

lk\_1 = []

x\_k\_1 = []

l\_k\_1 = []

lk = l0

l\_x = L\_x(xk)

while True :

for i in range(len(xk)):

x\_k\_1.append(xk[i] - beta \* l\_x[i])

x\_k = x\_k\_1

x\_k\_1 = []

l\_l = L\_l(xk)

for i in range(len(l0)):

l\_k\_1.append(lk[i] + beta \* l\_l[i])

l\_k = l\_k\_1

l\_k\_1 =[]

if l\_k[i] < 0:

l\_k[i] = 0

xk\_k\_1=[]

l\_x = L\_x(x\_k)

xk\_minus1 = xk

for i in range(len(x0)):

xk\_1.append(xk[i] - beta \* l\_x[i])

xk= xk\_1

xk\_1 = []

l\_l = L\_l(x\_k)

for i in range(len(lk)):

lk\_1.append( lk[i] + beta \* l\_l[i])

lk = lk\_1

lk\_1=[]

j\_raznost\_1 = J(xk)

j\_raznost\_2 = J(xk\_minus1)

j\_raznost = j\_raznost\_1 - j\_raznost\_2

if j\_raznost < 0:

j\_raznost= - j\_raznost

norma\_shtrix =normax\_2(xk)

norma\_shtrix= sqrt(norma\_shtrix)

for i in range(len(xk)):

xk\_k\_1.append(xk[i]- xk\_minus1[i])

norma\_xk\_k\_1 = normax\_2(xk\_k\_1)

norma\_xk\_k\_1 = sqrt(norma\_xk\_k\_1)

iteracii+=1

if j\_raznost <= eps or norma\_shtrix <= eps or norma\_xk\_k\_1 <= eps:

break

xk\_k=[]

for i in range(len(xk)):

xk\_k.append(int(xk[i]\*10000) / 10000)

print("Решение")

print(xk\_k)

print("Количество итераций = ", iteracii)

Пример 1

При β = 0.125

|  |  |  |  |
| --- | --- | --- | --- |
| Значение ꜫ | Решение | | Количество итераций |
| ꜫ = 0.1 | [1.9211, 0.0788, 3.6845, 0.0, -0.9211] | | 12 |
| ꜫ = 0.01 | [1.9905, 0.0094, 3.9621, 0.0, -0.9905] | | 22 |
| ꜫ = 0.0001 | | [1.9999, 0.0, 3.9996, 0.0, -0.9999] | 44 |

При ꜫ = 0.001

|  |  |  |
| --- | --- | --- |
| Значение β | Решение | Количество итераций |
| β = 0.125 | [1.999, 0.0009, 3.9963, 0.0, -0.999] | 33 |
| β = 0.25 | [1.9996, 0.0003, 3.9985, 0.0, -0.9996] | 23 |
| β = 0.3 | [1.9998, 0.0001, 3.9995, 0.0, -0.9998] | 49 |

Пример 2

При β = 0.125

|  |  |  |  |
| --- | --- | --- | --- |
| Значение ꜫ | Решение | | Количество итераций |
| ꜫ = 0.1 | [0.0788, 3.7634, 2.7634, 1.8422] | | 12 |
| ꜫ = 0.01 | [0.0076, 3.977, 2.977, 1.9846] | | 23 |
| ꜫ = 0.0001 | | [0.0, 3.9997, 2.9997, 1.9998] | 45 |

При ꜫ = 0.001

|  |  |  |
| --- | --- | --- |
| Значение β | Решение | Количество итераций |
| β = 0.125 | [0.0007, 3.9977, 2.9977, 1.9985] | 34 |
| β = 0.25 | [0.0003, 3.9989, 2.9989, 1.9992] | 23 |
| β = 0.3 | [0.0, 4.0002, 3.0002, 2.0001] | 50 |

Количествоитераций

**Пример 2**

Значение

Количествоитераций

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