CS227 Assignment (15/11/23)

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1. Q. Minimize 4x2 – 8xy + 6y 2 by SD Method with Initial Point (1,1)

```
syms x1 x2
function_1 = 4*x1^2 - 8*x1*x2 +6*x2^2 ; %the function we need to minimize
funcx = inline(function_1); %making this function operable
funcobjec = @(x) funcx(x(:,1), x(:,2));
grad = gradient(function_1);
gradfuncx =inline(grad);
Hess1 = hessian(function_1);
Hessx=inline(Hess1);
x0 = [1 1]; % initial value
maxiter =3; % maximum number of iterations
tolerance = 5e-3; %tolerance to check
iterator =0;
X=[]; %vector to save next data
gradx= @(x) gradfuncx(x(:,1), x(:,2));
while norm(gradx(x0)) > tolerance && iterator < maxiter
X= [X;x0];
Step_length = -gradx(x0);
H = Hessx(x0);
lambda = Step_length' *Step_length./(Step_length'*H*Step_length); %getting the optimum lambda
Xnew = x0 + lambda.*Step_length';
x0 =Xnew;
iterator = iterator +1; %looping
end
fprintf("The optimum Solution is =  [%f, %f] \n", x0(1), x0(2));
fprintf("The optimum value of f(x) is=  %f \n", funcobjec(x0));
```

The Output Obtained:

```
>> exam
The optimum Solution is =  [0.666667, 0.444444]
The optimum value of f(x) is=  0.592593
>>
```

2. Q. Minimize x - y + 2x 2 + 2xy + y 2 by SD Method with Initial Point (0,0)

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```
3
4   syms x1 x2
5   function_1 = x1 - x2 +2*x1^2 +2*x1*x2 +x2^2 ; %the function we need to minimize
6   funcx = inline(function_1); %making this function operable
7   funcobjec = @(x) funcx(x(:,1), x(:,2));
8   grad = gradient(function_1);
9   gradfuncx =inline(grad);
10  Hess1 = hessian(function_1);
11  Hessx=inline(Hess1);
12  x0 = [0 0]; % initial value
13  maxiter =5; % maximum number of iterations
14  tolerance = 1e-3; %tolerance to check
15  iterator =0;
16  X=[]; %vector to save next data
17  gradx= @(x) gradfuncx(x(:,1), x(:,2));
18  while norm(gradx(x0)) > tolerance && iterator < maxiter
19  X= [X;x0];
20  Step_length = -gradx(x0);
21  H = Hessx(x0);
22  lambda = Step_length' *Step_length./(Step_length'*H*Step_length); %getting the optimum lambda
23  Xnew = x0 + lambda.*Step_length';
24  x0 =Xnew;
25  iterator = iterator +1; %looping
26  end
27  fprintf("The optimum Solution is =  [%f, %f] \n", x0(1), x0(2));
28  fprintf("The optimum value of f(x) is=  %f \n", funcobjec(x0));
29
30
```

The required Output with value of X over the iterations:

```
>> exam
The optimum Solution is =  [-1.000000, 1.480000]
The optimum value of f(x) is=  -1.249600
>> X

X =

         0         0
   -1.0000    1.0000
   -0.8000    1.2000
   -1.0000    1.4000
   -0.9600    1.4400

fx >>
```