

Homework10

GUOZHEN SHE 15307130224

Contents

1	Question 1	1
2	Question 2	1

1 Question 1

$f(x) = e^x$ isn't a strong convex function, Because $f''(x) = e^x$, so for $\forall m > 0$, we can find the very small x which satisfy the $f''(x) < m$.

$f(x) = e^{x^2}$ is a strong convex function. Because $f''(4x^2 + 2)e^{x^2} > 2$, we can choose $m=1$. So $f(x)$ is a strong convex function.

2 Question 2

```
gamma = 0.1;
beta = 0.7;
x = randn(2,1);
iterations = 1000;
alpha_0 = 0.1;
handler = @f;
for k = 1:iterations
    current_grad = grad(handler, x);
    alpha = alpha_0;
    while f(x - alpha*current_grad) > f(x) - alpha*gamma*
        current_grad'*current_grad
        alpha = beta * alpha;
    end
    x = x - alpha*current_grad;
end
x
f(x)
```

```

x =
    -3.4659e-01
    -5.0000e-04
ans =    2.5593

```

Loss Function

```

function [result] = f(x)
    a = [1;3];
    b = [1;-3];
    c = [-1;0];
    result = exp(a'*x-0.1) + exp(b'*x-0.1) + exp(c'*x-0.1);
end

```

Gradient Function

```

function [result] = grad(f, x)
    a = [1;3];
    b = [1;-3];
    c = [-1;0];
    result = zeros(size(x));
    minor = 0.001;
    for i = 1:size(x,1)
        x_new = x;
        x_new(i,1) = x(i) + minor;
        result(i,1) = (f(x_new)-f(x))/minor;
    end

    % result = exp(a'*x-0.1)*a + exp(b'*x-0.1)*b + exp(c'*x
    %           -0.1)*c;
end

```