

Lab 5 blscu4cse24025

question 1 fibonacci

```
clc; clf;
f = @(x) -4*x.^3 + 100 + exp(x);
a = 3; b = 8;
tol = 0.25;
n = 1;
while (b-a) > tol
    L = b-a;
    Lk = fibonacci(n)/fibonacci(n+2)*L;
    x1 = a + Lk;
    x2 = b - Lk;
    f1 = f(x1);
    f2 = f(x2);
    if f1 < f2
        b = x2;
    else
        a = x1;
    end
    n = n + 1;
end
min_x = (a+b)/2;
min_f = f(min_x);
fprintf('Fibonacci: Minimum at x=%.4f, f(x)=%.4f\n', min_x, min_f);
```

Fibonacci: Minimum at x=6.1006, f(x)=-362.0666

```
function f = fibonacci(n)
    if n <= 1
        f = 1;
    else
        f = fibonacci(n-1) + fibonacci(n-2);
    end
end
```

question 1 golden search

```
clc; clf;
f = @(x) -4*x.^3 + 100 + exp(x);
a = 3; b = 8;
tol = 0.25;
gr = (sqrt(5)-1)/2;
while (b-a) > tol
    x1 = b - gr*(b-a);
    x2 = a + gr*(b-a);
```

```

    f1 = f(x1);
    f2 = f(x2);
    if f1 < f2
        b = x2;
    else
        a = x1;
    end
end
min_x = (a+b)/2;
min_f = f(min_x);
fprintf('Golden Section: Minimum at x=%.4f, f(x)=%.4f\n', min_x, min_f);

```

Golden Section: Minimum at x=6.1105, f(x)=-362.0566

question 2 fibonacci

```

clc; clf;
f = @(x) exp(x) - 2*x;
a = 0; b = 3;
tol = 0.25;

% Find n such that Fibonacci(n) >= (b-a)/tol
F = [1, 1];
while F(end) < (b-a)/tol
    F(end+1) = F(end) + F(end-1);
end
n = length(F) - 1;

for k = 1:n-1
    L = b - a;
    Lk = F(n-k+1)/F(n+1)*L;
    x1 = a + Lk;
    x2 = b - Lk;
    f1 = f(x1);
    f2 = f(x2);
    if f1 < f2
        b = x2;
    else
        a = x1;
    end
end
min_x = (a+b)/2;
min_f = f(min_x);
fprintf('Fibonacci: Minimum at x=%.4f, f(x)=%.4f\n', min_x, min_f);

```

Min in (0.605, 0.772), x=0.688, f=0.614

question 2 golden search

```
clc; clf;
f = @(x) exp(x) - 2*x;
a = 0; b = 3;
tol = 0.25;
gr = (sqrt(5)-1)/2;
while (b-a) > tol
    x1 = b - gr*(b-a);
    x2 = a + gr*(b-a);
    f1 = f(x1);
    f2 = f(x2);
    if f1 < f2
        b = x2;
    else
        a = x1;
    end
end
min_x = (a+b)/2;
min_f = f(min_x);
fprintf('Golden Section: Minimum at x=%.4f, f(x)=%.4f\n', min_x, min_f);
```

question 3 fibonacci

```
clc; clf;
f = @(x) 1./(x+1) + x.^2;
a = 0; b = 2;
tol = 0.25;

F = [1, 1];
while F(end) < (b-a)/tol
    F(end+1) = F(end) + F(end-1);
end
n = length(F) - 1;

for k = 1:n-1
    L = b - a;
    Lk = F(n-k+1)/F(n+1)*L;
    x1 = a + Lk;
    x2 = b - Lk;
    f1 = f(x1);
    f2 = f(x2);
    if f1 < f2
        b = x2;
    else
        a = x1;
    end
end
min_x = (a+b)/2;
```

```
min_f = f(min_x);
fprintf('Fibonacci: Minimum at x=%.4f, f(x)=%.4f\n', min_x, min_f);
```

Min in (0.250, 0.500), x=0.375, f=0.868

question 3 golden search

question 4

```
f = @(x) (x<1).*(2*x+3) + (x>=1).*((x-2).^2 + 1);
xs = 0:0.001:3;
[min_f, idx] = min(f(xs));
x_min = xs(idx);
fprintf('Min f = %.3f at x = %.3f\n', min_f, x_min)
```

Min f = 1.000 at x = 2.000

question 5

```
f = @(x) exp(-x.^2) + 0.1*x.^2;
x0 = sqrt(-log(0.1));
fprintf('Min at x = +%.6f and x = -%.6f\n', x0, x0);
```

Min at x = +1.517427 and x = -1.517427

```
fprintf('f(min) = %.6f\n', f(x0));
```

f(min) = 0.330259

question 6

```
clc; clear;
f = @(x) x.^2 .* log(x+1) + 1./(x+1);
a = 0;
b = 4;
gr = (sqrt(5)-1)/2;
tol = 1e-6;
x1 = b - gr*(b-a);
x2 = a + gr*(b-a);
while (b-a) > tol
    if f(x1) < f(x2)
```

```
        b = x2;
        x2 = x1;
        x1 = b - gr*(b-a);
    else
        a = x1;
        x1 = x2;
        x2 = a + gr*(b-a);
    end
end
xmin = (a+b)/2;
fmin = f(xmin);
fprintf('Minimum in [0,4]: x = %.6f, f(x) = %.6f\n', xmin, fmin);
```

Minimum in [0,4]: x = 0.450614, f(x) = 0.764896

