Contents

CS375 HOMEWORK 9

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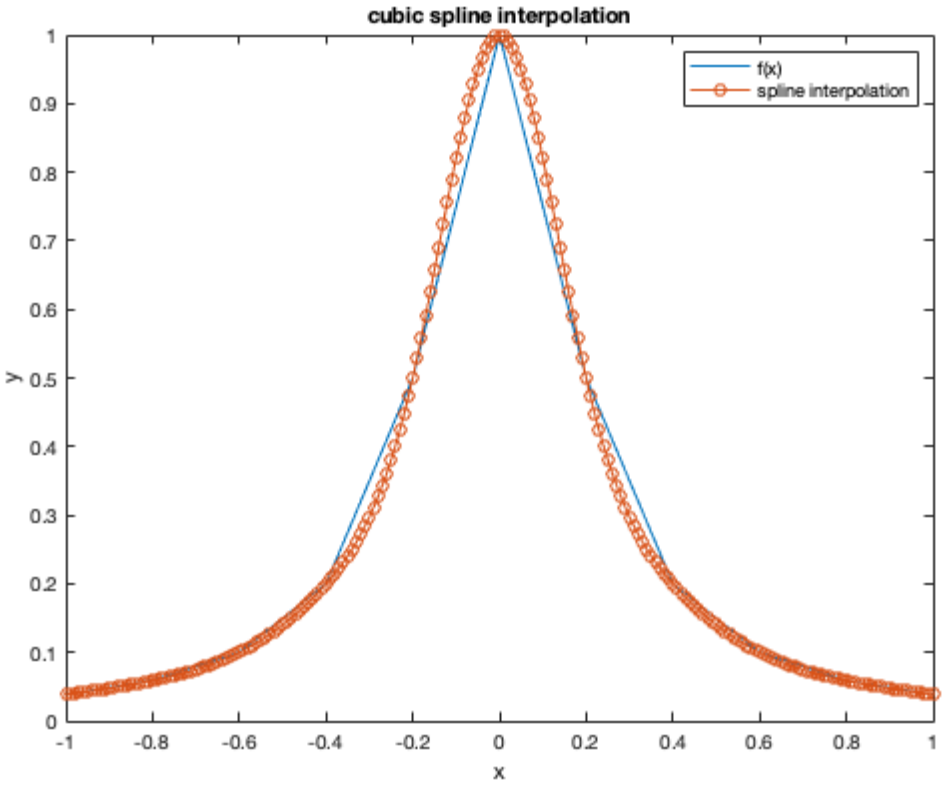
```
clear all;clc;close all;
format long g;
```

Problem 1

```
t=linspace(-1,1,11);
f=@(x) 1./(1+25*x.^2);
y=f(t);

z=spline3_coeff(t,y);

x_eval=-1:0.01:1;
y_eval=zeros(1,length(x_eval));
for i=1:length(x_eval)
    y_eval(i)=eval_spline(x_eval(i),t,y,z);
end

plot(t,y);
hold on
plot(x_eval,y_eval,'-o');
xlabel('x')
ylabel('y')
title('cubic spline interpolation')
legend('f(x)','spline interpolation')

fprintf('the spline interpolation works really well near the endpoints and does not\n')
fprintf('appear to have the same issues as the lagrange or polynomial interpolation\n')
fprintf('with equispaced points.\n ')
```

```
the spline interpolation works really well near the endpoints and does not
appear to have the same issues as the lagrange or polynomial interpolation
with equispaced points.
```



Problem 2

```
% 2.a see attachments

% 2.b see attachments

% 2.c

f_x=@(x) x*sin(x);
exact_int = sin(pi)-pi*cos(pi);

n=[4, 8, 16, 32];
h=(pi-0)./n;
integrals= zeros(1,length(n));
error=zeros(1,length(n));

for i=1:length(n)
    integrals(i)=comp_trap_int(f_x,0,pi,n(i));
    error(i) = abs(exact_int-integrals(i));
end

p=zeros(1,length(n)-1);

for i=1:length(n)-1
    p(i)=log(error(i+1)/error(i))/log(h(i+1)/h(i));
end

p=[0 p];

fprintf(" n  approx integral\t    error\t convergence p\n");
fprintf("%2d  %2.10f\t %2.10f\t %2.10f\n",[n;integrals ;error; p])
```

```
fprintf("since the expected convergence for composite trapezoid is 2, it is possible to see\n")
fprintf("that as n increases, the convergence gets closer and closer to 2. indicating that the\n")
fprintf("expected convergence is being found.\n")

% 2.d see attachments
```

```
 n  approx integral         error        convergence p
 4  1.6698795626         1.4717130910    0.0000000000
 8  2.6880135827         0.4535790709    1.6980704688
16  3.0186727993         0.1229198543    1.8836361114
32  3.1097827181         0.0318099355    1.9501686104
since the expected convergence for composite trapezoid is 2, it is possible to see
that as n increases, the convergence gets closer and closer to 2. indicating that the
expected convergence is being found.
```

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