25.02.2016

Geometrie computationala: Laborator 2

Problema 1.

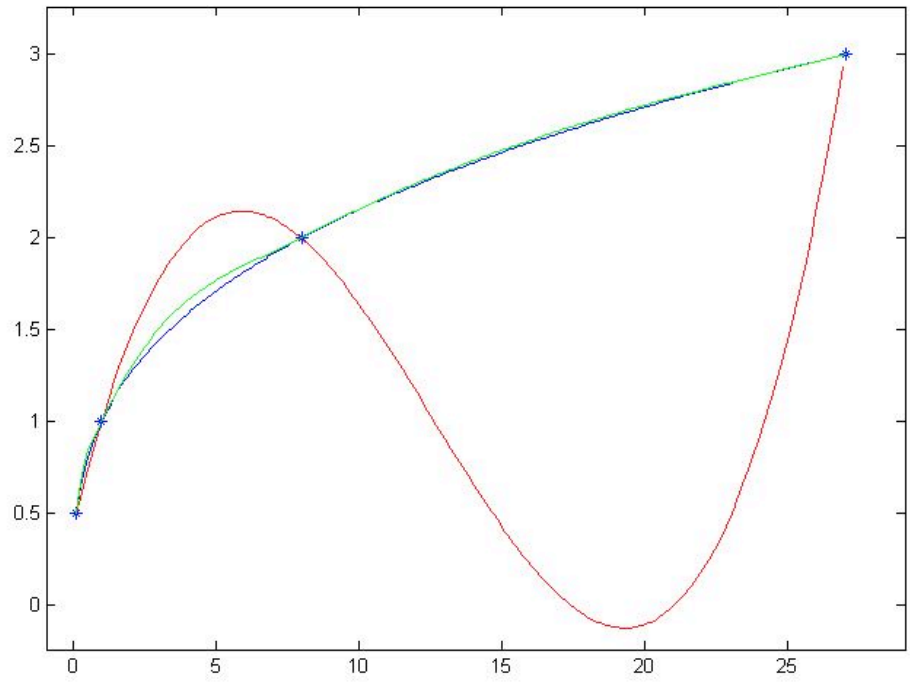
Fie punctele P0, P1, P2, si P3, unde x0=1/8, x1=1, x2=8, x3=27, y0=1/2, y1=1, y2=2, y3=3. Fie v0=4/3,v1=1/3, v2=1/12, v3=1/27. Notatiile sunt cele uzuale. Pentru aceste date:

i) determinati polinomul de interpolare Lagrange;
ii) comparati curba interpolatoare cu graficul functiei f(x)=x^(1/3);
iii) reprezentati grafic functia f de la ii) pe intervalul [1/8,27];
iv) reprezentati graficul lui L (Lagrange);
v) reprezentati graficul lui “H pe portiuni” (interpolare Hermite).

Observati diferentele!

```
clear;
x0=1/8;
x1=1;
x2=8;
x3=27;
y0=1/2;
y1=1;
y2=2;
y3=3;
h=0.1;
x=x0:h:x3;
n0=(x0-x1)*(x0-x2)*(x0-x3);
L0=((x-x1).*(x-x2).*(x-x3))/n0;
n1=(x1-x0)*(x1-x2)*(x1-x3);
L1=((x-x0).*(x-x2).*(x-x3))/n1;
n2=(x2-x0)*(x2-x1)*(x2-x3);
L2=((x-x0).*(x-x1).*(x-x3))/n2;
n3=(x3-x0)*(x3-x1)*(x3-x2);
L3=((x-x0).*(x-x1).*(x-x2))/n3;
L=y0*L0+y1*L1+y2*L2+y3*L3;
plot(x,L,'r')
hold on
plot(x0,y0,'*b');
plot(x1,y1,'*b');
plot(x2,y2,'*b');
plot(x3,y3,'*b');
plot(x,x.^(1/3),'b')
hold on
```

```
x=x0:h:x1;
n0=x0-x1;
n1=x1-x0;
H0=(3*x0-x1-2*x).*((x-x1).^2)/((n0).^3);
H1=(3*x1-x0-2*x).*((x-x0).^2)/((n1).^3);
Hb0=(x-x0).*((x-x1).^2)/((n0).^2);
Hb1=(x-x1).*((x-x0).^2)/((n1).^2);
v0=4/3;
v1=1/3;
v2=1/12;
v3=1/27;
H=y0*H0+y1*H1+v0*Hb0+v1*Hb1;
plot(x,H,'g')
hold on
x=x1:h:x2;
n0=x1-x2;
n1=x2-x1;
H0=(3*x1-x2-2*x).*((x-x2).^2)/((n0).^3);
H1=(3*x2-x1-2*x).*((x-x1).^2)/((n1).^3);
Hb0=(x-x1).*((x-x2).^2)/((n0).^2);
Hb1=(x-x2).*((x-x1).^2)/((n1).^2);
v0=4/3;
v1=1/3;
v2=1/12;
v3=1/27;
H=y1*H0+y2*H1+v1*Hb0+v2*Hb1;
plot(x,H,'g')
hold on
x=x2:h:x3;
n0=x2-x3;
n1=x3-x2;
H0=(3*x2-x3-2*x).*((x-x3).^2)/((n0).^3);
H1=(3*x3-x2-2*x).*((x-x2).^2)/((n1).^3);
Hb0=(x-x2).*((x-x3).^2)/((n0).^2);
Hb1=(x-x3).*((x-x2).^2)/((n1).^2);
v0=4/3;
v1=1/3;
v2=1/12;
v3=1/27;
H=y2*H0+y3*H1+v2*Hb0+v3*Hb1;
plot(x,H,'g')
hold on
```

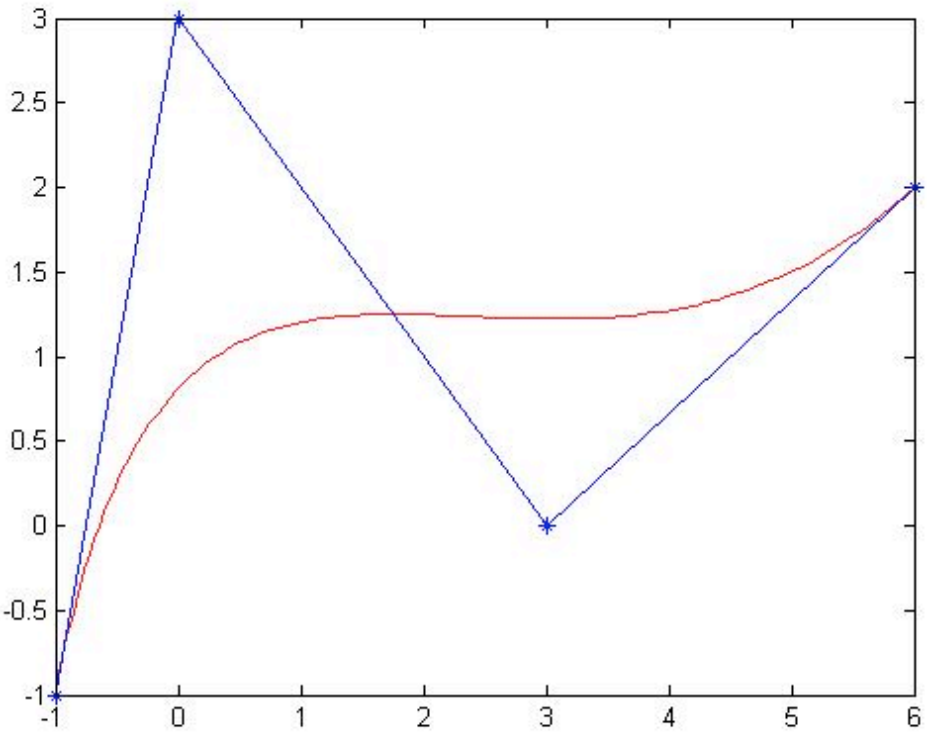


Problema 2

Fie punctele $P_0(-1,-1)$, $P_1(0,3)$, $P_2(3,0)$ si $P_3(6,2)$. Sa se reprezinte in Matlab: poligonul de control $P_0\ P_1\ P_2\ P_3$ si curba Bezier.
Indicatie: t in intervalul [0,1]. Pentru n=3, cunoastem: $b_0=(1-t)^3$, $b_1=3t(1-t)^2$, $b_2=3t^2(1-t)$, $b_3=t^3$, $x=x_0b_0+x_1b_1+x_2b_2+x_3b_3$ si $y=y_0b_0+y_1b_1+y_2b_2+y_3b_3$.

```
clear
x0=-1;
x1=0;
x2=3;
x3=6;
y0=-1;
y1=3;
y2=0;
y3=2;
h=0.01;
t=0:h:1;
b0=(1-t).^3;
b1=3*t.*(1-t).*(1-t);
b2=3*t.*t.*(1-t);
b3=t.^3;
x=x0*b0+x1*b1+x2*b2+x3*b3;
y=y0*b0+y1*b1+y2*b2+y3*b3;
```

```
plot(x,y,'r')
plot(x0,y0,'*b');
plot(x1,y1,'*b');
plot(x2,y2,'*b');
plot(x3,y3,'*b');
hold on
X=[x0 x1 x2 x3];
Y=[y0 y1 y2 y3];
plot(X,Y,'b')
```

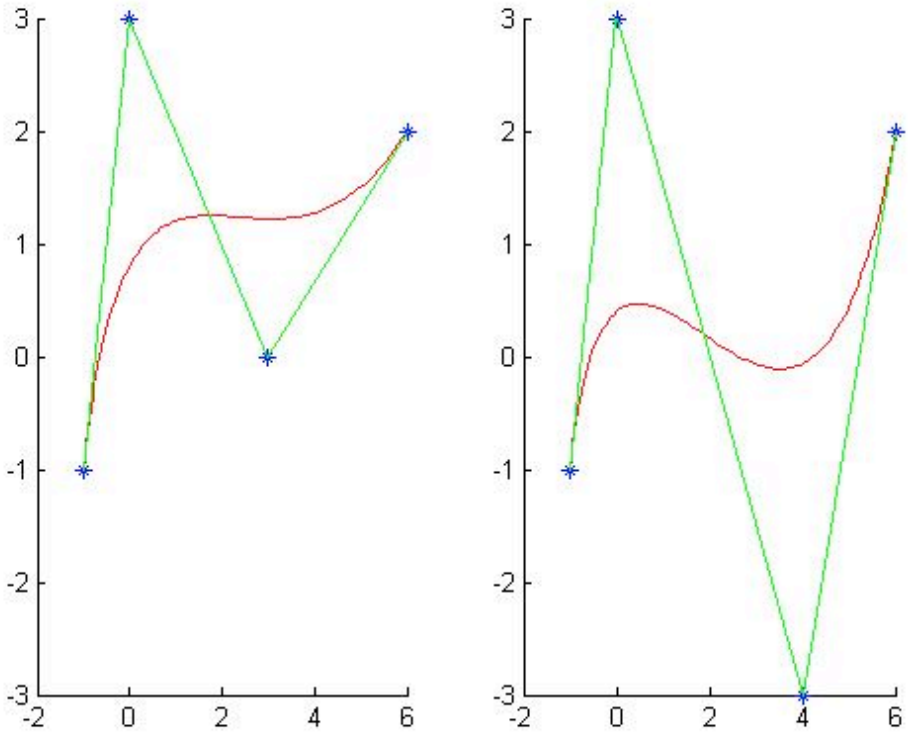


Problema 2'

Consideram punctul P_2'(4,-3), celelalte fiind date in problema precedenta. Sa se deseneze (folosind subplot) in 2 sub-ferestre distincte curbele Bezier si sa se compare.

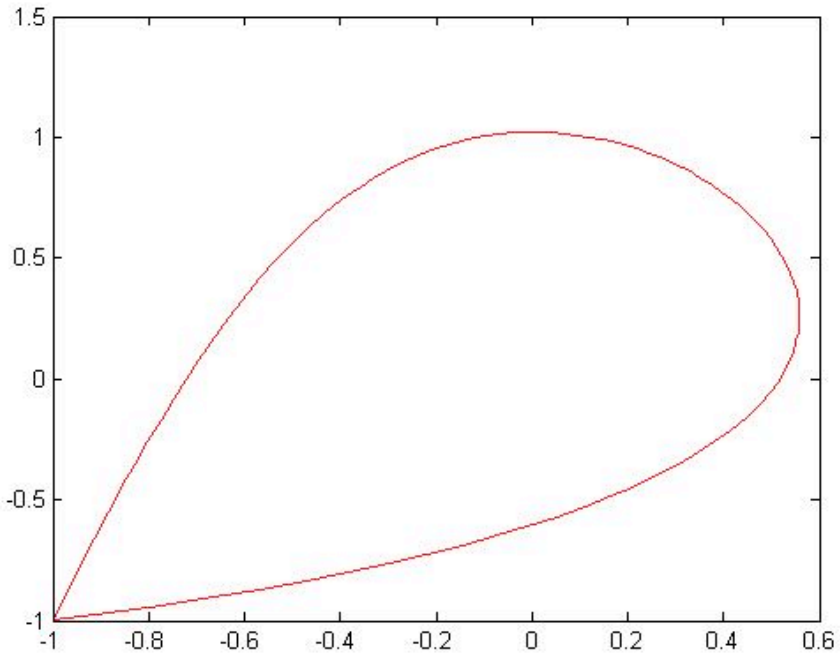
```
clear
x0=-1;
x1=0;
x2=3;
x3=6;
y0=-1;
```

```
y1=3;
y2=0;
y3=2;
h=0.01;
x=x0:h:x3;
y=y0:h:y3;
t=0:h:1;
b0=(1-t).^3;
b1=3*t.*(1-t).*(1-t);
b2=3*t.*t.*(1-t);
b3=t.^3;
subplot(1,2,1);
x=x0*b0+x1*b1+x2*b2+x3*b3;
y=y0*b0+y1*b1+y2*b2+y3*b3;
xlim([-2 6])
ylim([-3 3])
hold on
plot(x,y,'r');
plot(x0,y0,'*b');
plot(x1,y1,'*b');
plot(x2,y2,'*b');
plot(x3,y3,'*b');

hold on
X =[x0 x1 x2 x3];
Y =[y0 y1 y2 y3];
plot(X,Y,'y')
subplot(1,2,2);
x2=4;
y2=-3;
x=x0*b0+x1*b1+x2*b2+x3*b3;
y=y0*b0+y1*b1+y2*b2+y3*b3;
hold on
plot(x,y,'r');
plot(x0,y0,'*b');
plot(x1,y1,'*b');
plot(x2,y2,'*b');
plot(x3,y3,'*b');

hold on
X =[x0 x1 x2 x3];
Y =[y0 y1 y2 y3];
plot(X,Y,'y')
```



Problema 3.

Adaptati codul Matlab de la Problema 2 pentru a obtine curba de mai jos (ca forma).



```
clear
t=0:0.01:1;
x0=-1;
x1=0;
x2=3;
x3=-1;
y0=-1;
y1=3;
y2=0;
y3=-1;
b0=(1-t).^3;
b1=3*t.*(1-t).*(1-t);
b2=3*t.*t.*t.*(1-t);
b3=t.^3;
x=x0*b0+x1*b1+x2*b2+x3*b3;
y=y0*b0+y1*b1+y2*b2+y3*b3;
plot(x,y,'r')
```