**Computer Graphics Lab Experiment No: - 06**

**Aim: Implement curve: Bezier for n**

**Bezier Curve**

Bezier Curve may be defined as-

•Bezier Curve is parametric curve defined by a set of control points.

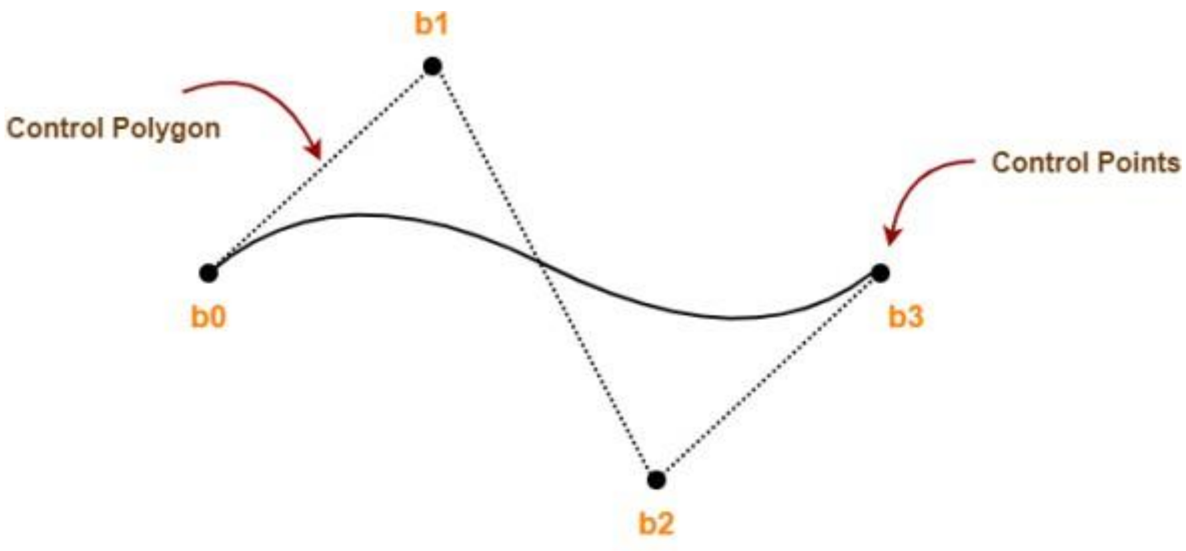
• Two points are ends of the curve.

• Other points determine the shape of the curve.

The concept of bezier curves was given by Pierre Bezier.

Bezier Curve Example

The following curve is an example of a bezier curve:




Bezier Curve Example

Here,

• This bezier curve is defined by a set of control points b0, b1, b2 and b3.

• Points b0 and b3 are ends of the curve.

• Points b1 and b2 determine the shape of the curve.

Bezier Curve PropertiesFew important properties of a bezier curve are

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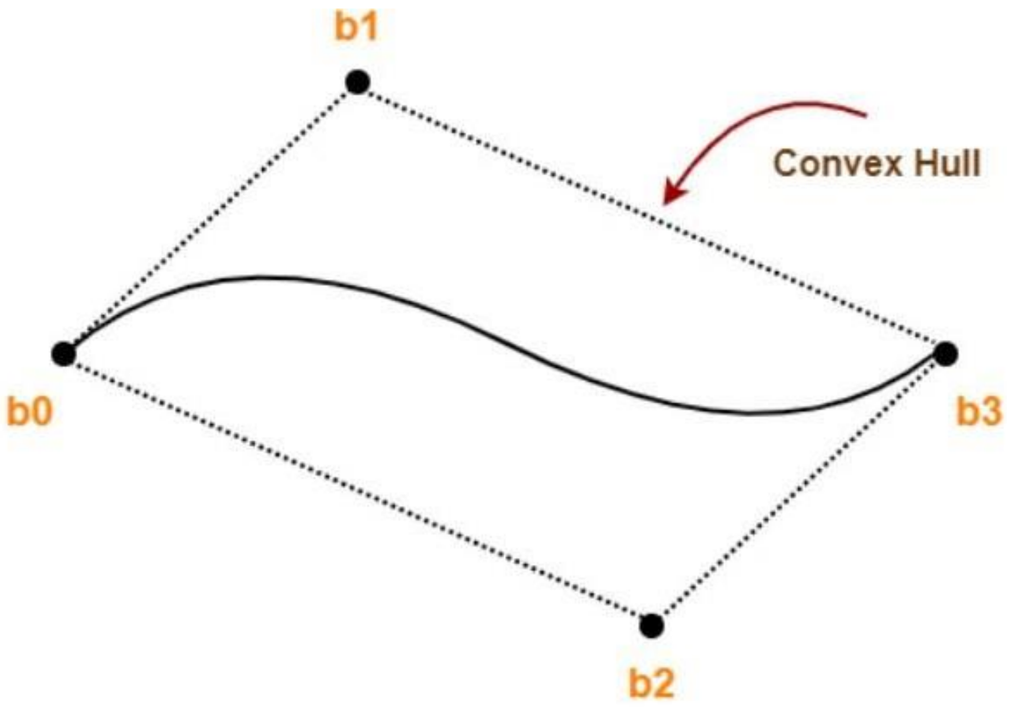
Property-01:

Bezier curve is always contained within a polygon called as convex hull of its control points.




Bezier Curve With Convex Hull

Property-02:

•Bezier curve generally follows the shape of its defining polygon.

• The first and last points of the curve are coincident with the first and last points of the defining polygon.

Property-03:

The degree of the polynomial defining the curve segment is one less than the total number of control points.

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Degree = Number of Control Points – 1

Property-04:

The order of the polynomial defining the curve segment is equal to the total number of control points.

Order = Number of Control Points

Property-05:

•Bezier curve exhibits the variation diminishing property.

• It means the curve do not oscillate about any straight line more often than the defining polygon.

**Algorithm**

The parametric equation of a bezier curve is-

$$P(t) = \sum_{i=0}^{n} B_i J_{n,i}(t)$$

Bezier Curve Equation

Here,

• t is any parameter where 0 <= t <= 1

• P(t) = Any point lying on the bezier curve

•Bi = ith control point of the bezier curve

• n = degree of the curve

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• Jn,i(t) = Blending function = C(n,i)ti

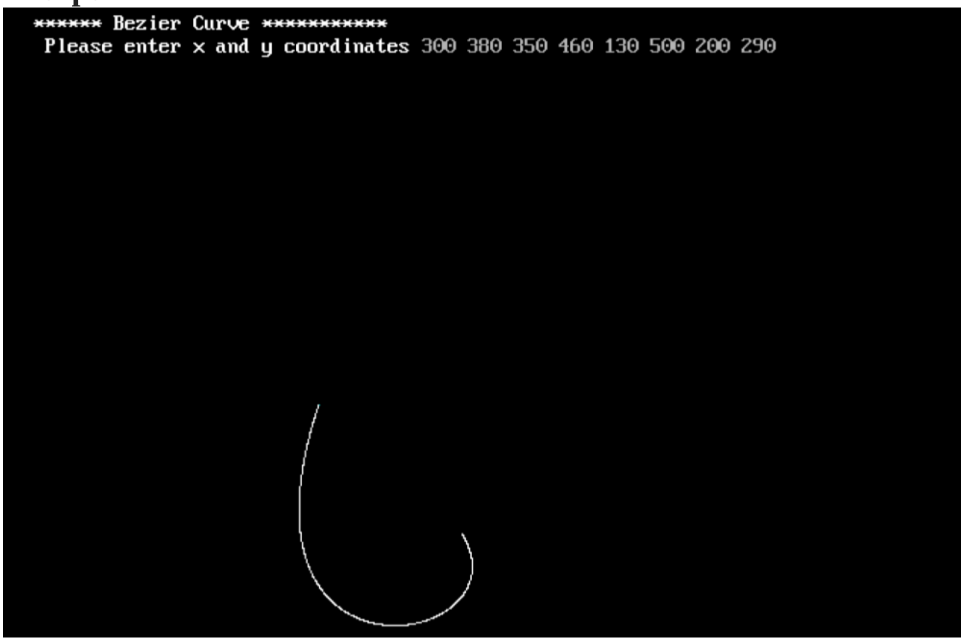
(1-t)n-i where C(n,i) = n! / i!(n-i)!

**Code**

```
#include<graphics.h>

#include<math.h>

#include<conio.h>

#include<stdio.h>

void main()

{

int  x[4],y[4],i;

double put_x,put_y,t;

int gr=DETECT,gm;

initgraph(&gr,&gm,"C:\\TURBOC3\\BGI");

printf("\n****** Bezier Curve ***********");

printf("\n Please enter x and y coordinates ");

for(i=0;i<4;i++)

{

scanf("%d%d",&x[i],&y[i]);

putpixel(x[i],y[i],3); // Control Points

}

for(t=0.0;t<=1.0;t=t+0.001) // t always lies between 0 and 1

{

// Formula to draw curve

put_x = pow(1-t,3)*x[0] + 3*t*pow(1-t,2)*x[1] + 3*t*t*(1-t)*x[2] + pow(t,3)*x[3];
```

```
put_y = pow(1-t,3)*y[0] + 3*t*pow(1-t,2)*y[1] + 3*t*t*(1-t)*y[2] + pow(t,3)*y[3];

putpixel(put_x,put_y, WHITE); // putting pixel

}

getch();

closegraph();

}
```

**Output**




**Conclusion:** LO1,mapped.