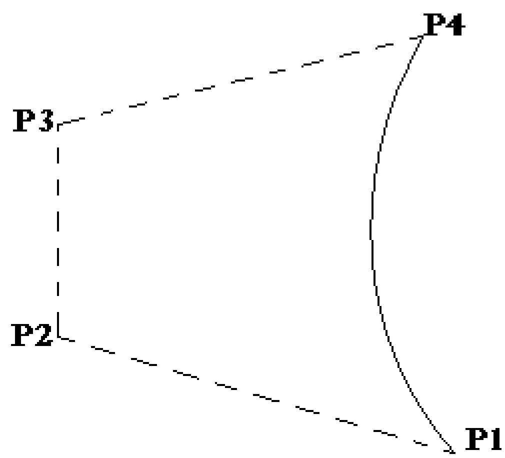
EXPERIMENT NO. 08

AIM: To implement Bezier curve.

SOFTWARE AND HARDWARE REQUIRED: TurboC and Pentium IV and above.

THEORY:

A Bezier curve is determined by defining polygon. They have a compiler no of properties that make them lengthy useful & convenient for curve and surface design.



Picture above shows the Bezier curve and its flood control point. Bezier curve begin at the first control pts and ends at the fourth. This means if we want to connect two Bezier curve. We have to make first control point of the second curve to match the last control point of first curve. To observe line connecting1st and second control points.

Similarly at the end of the curve, the curve is tangent to the arc connecting third and fourth points. We have to place the third and fourth control point at the first curve on the same line specified by this and second control point g curve.

The equations for Bezier curve are as follows:

$$X = x_4a^3 + 3x_3a^2 (1-a) + 3x_2a(1-a)^2 + x_1(1-a)^3$$
$$Y = y_4a^3 + 3y_3a^2 (1-a) + 3y_2a(1-a)^2 + y_1(1-a)^3$$
$$Z = z_4a^3 + 3z_3a^2 (1-a) + 3z_2a(1-a)^2 + z_1(1-a)$$

BEZIER CURVES HAVE THE FOLLOWING PROPERTIES –

- They generally follow the shape of the control polygon, which consists of the segments joining the control points.
- They always pass through the first and last control points.
- They are contained in the convex hull of their defining control points.
- The degree of the polynomial defining the curve segment is one less that the number of defining polygon point. Therefore, for 4 control points, the degree of the polynomial is 3.
- A Bezier curve generally follows the shape of the defining polygon.

- The direction of the tangent vector at the end points is same as that of the vector determined by first and last segments.
- The convex hull property for a Bezier curve ensures that the polynomial smoothly follows the control points.
- No straight line intersects a Bezier curve more times than it intersects its control polygon.
- They are invariant under an affine transformation.
- Bezier curves exhibit global control means moving a control point alters the shape of the whole curve.
- A given Bezier curve can be subdivided at a point t=t0 into two Bezier segments which join together at the point corresponding to the parameter value t=t0.

ALGORITHM:

1. Start
2. Read no g control points as n.
3. Read the control point as P(x,y)
4. Draw the convex polygon by joining two points.
5. The Bezier formation is calculated using the point as $P(1)=\sum P(k)\ B_k\ n(4)$

   Where n varies from 0.001 to 1 be small interval

   $B(k)=n(u) = (n,k) - u^k(1-u)^{n-k}$ and $(n,k) = n! / (k!\ (n-k)!)$
6. Plot the point (x,y)
7. u=u+0.01
8. repeat step 5 & 7 until u<1
9. stop

CONCLUSION- Successfully implemented cubic Bezier curve using 4 given control points.

SIGN **GRADE**

DATE