**Requirement**

Write a program that calculates the points on a cubic Bezier curve, given four control points and the number of intervals.

Take as input 4 control points and the number of intervals.

Generate as output cubic Bezier points for values of t between 0 and 1 using the input parameters.

To solve the problem the solution should be written using C#.

**Analysis**

Looking into what a “cubic Bezier curve” is it appears that there are three kinds of Bezier curve, Linear, Quadratic and Cubic where the calculation for the points differs for each type (see below). Whilst the requirements states that this should only be for cubic, there should be room for future expansion of the program to produce the points for Linear and Quadratic Bezier curve types.

*Linear Bezier (two points)*

P(t) = (1 – t)P0 + tP1

*Quadratic Bezier (three points)*

P(t) = (1 – t)2P0 + 2t(1 – t)P1 + t2P2

*Cubic Bezier (four points)*

P(t) = (1 – t)3P0 + 3t(1 – t)2P1 + 3t2(1 – t)P2 + t3P3

An interesting point is mentioned in one article on the topic that if two identical control points are entered at the same location (say P1) then the curve gets closer to the *control polygon* and as such would produce different plottable points. (I am assuming that this scenario is out of scope for the purpose of this exercise).

Diagram

Description automatically generated

For this exercise, to make sure that the four control points entered are indeed related directly to the bounding *control polygon* for a Cubic Bezier curve the input should be validated to make sure that none of the four control points are equal and thus they are all separate points.

***Resources used***

<https://en.wikipedia.org/wiki/B%C3%A9zier_curve>

<https://www.sciencedirect.com/topics/engineering/cubic-bezier-curve>