3 Computer Graphics and Image Processing (PR)

A program is required to draw an arc from \((0, 1)\) to \((1, 0)\) of the circle centred at the origin with unit radius.

\((a)\) One approach would be to draw a segment of the cubic Overhauser curve defined by \((-1, 0), (0, 1), (1, 0)\) and \((0, -1)\).

\((i)\) Explain how a segment of an Overhauser curve in general can be represented as an Hermite cubic and so as a Bézier cubic. [4 marks]

\((ii)\) Derive the formula for the resulting Bézier curve, \(P(t)\). [3 marks]

\((iii)\) Calculate the coordinates of \(P\left(\frac{1}{2}\right)\). How large is the error? \([Hint: \sqrt{2} \approx 1.414.\] [3 marks]

\((b)\) Calculate revised control points for the Bézier curve so that it models the circular arc more accurately. [4 marks]

\((c)\) Describe in outline an alternative way of drawing the arc by calculating the pixels that lie on it directly. [6 marks]