COMPUTER SCIENCE TRIPOS  Part IB – 2016 – Paper 4

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 efficiently drawing the arc by calculating the pixels that lie on it directly. [6 marks]