

2008 Paper 5 Question 5

Computer Graphics and Image Processing

- (a) Describe in detail an algorithm that returns the minimum distance from a point to a line segment in two dimensions. Ensure that you include all of your assumptions and all necessary mathematical calculations. [7 marks]
- (b) A quadratic Bézier curve is defined by three points, P_1 , P_2 , P_3 , and a parameter, t :

$$P(t) = (1 - t)^2 P_1 + 2t(1 - t)P_2 + t^2 P_3, 0 \leq t \leq 1$$

Describe an algorithm that draws the quadratic Bézier curve, using straight lines only, to within a tolerance τ . You may use the algorithm from part (a) and you may assume that you already have an algorithm for drawing a straight line. [8 marks]

- (c) Consider the control of detail in a curve that is represented by a sequence of many straight line segments. Describe how Douglas and Pücker's algorithm can be used to remove superfluous points. You may use the algorithm from part (a). [5 marks]