

4. A piece-wise polynomial, Bezier approximation curve of order  $n = 2$  needs to be designed to fit a set of points  $\{\mathbf{p}_k\}$ .

(a) What set of blending functions need to be specified and, hence, what is the parametric form of the curve  $Q(u)$ ? [4]

(b) Using your previous answer, or otherwise, derive a *matrix* form of  $Q(u)$ . [6]

(c) Write down the first derivative of the curve,  $Q'(u)$ , and state the boundary condition which will ensure  $C_1$  continuity for successive piecewise approximations. [4]

(d) Given  $\Delta Q(u) = Q(u + \delta) - Q(u)$  and  $\Delta^2 Q(u) = \Delta Q(u + \delta) - \Delta Q(u)$ , what are the constant terms,

$$\{\Delta^2 Q(0), \Delta Q(0), Q(0)\}$$

needed to accelerate the drawing of  $Q(u)$ ? [8]

(e) How many multiplies and adds would be needed to trace part of a quadratic Bezier patch over one  $u + \delta u$  or  $v + \delta$  step? [3]