

# Programming #1: Part II (4190.562)

Due: March 23, 2016

A cubic Bézier curve  $C(t) = \sum_{l=0}^3 \mathbf{b}_l B_l^3(t) = \sum_{l=0}^3 (x_l, y_l) B_l^3(t) = (x(t), y(t))$ ,  $0 \leq t \leq 1$ , can be used for the deformation of a planar shape given as a point cloud:  $\{\mathbf{p}_k \mid k = 1, \dots, N\}$ .

**Part I:** For each point  $\mathbf{p}_k$ , compute the closest point  $C(t_k)$  and bind  $\mathbf{p}_k$  to the local frame at  $C(t_k)$  (determined by the tangent and normal directions). When we edit the cubic Bézier curve  $C(t)$ , each point  $\mathbf{p}_k$  should move to the corresponding position in the new local frame at  $C(t_k)$  under the shape deformation of  $C(t)$ .

**Part II:** Given two planar shapes, each controlled by a cubic Bézier curve, compute the intersection points between the two shapes and the self-intersection points of each shape.