6 Further Graphics (pb355)

(a) Consider the b-spline curve $P(t)$ with knot vector \([0, 1, 2, 3, 3, 3]\) and $k = 3$.

(i) In a single sentence, explain the effect on $P(t)$ of repeating a knot value $k$ times. \([1 \text{ mark}]\)

(ii) State the equations that define $P(t)$. \([3 \text{ marks}]\)

(iii) State the equation and sketch the graph for each of the three quadratic basis functions $N_{i,3}(t)$ of $P(t)$. \([8 \text{ marks}]\)

(iv) Plot the path of $P(t)$ for control points $P_0 = (0, 0)$, $P_1 = (4, 0)$, $P_2 = (4, 4)$. \([4 \text{ marks}]\)

(b) Consider an embedded closed manifold surface with 48 vertices, 48 faces, and 100 edges.

(i) What is the genus of this surface, and what is the formula to find it? \([2 \text{ marks}]\)

(ii) What is the total angle deficit of this surface, and what is the formula to find it? \([2 \text{ marks}]\)