MASSACHVSETTS INSTITVTE OF TECHNOLOGY
Department of Electrical Engineering and Computer Science
6.034—Artificial Intelligence
Fall Semester, 1996

Practice Problems – Dec 3, 1996

Problem: Object recognition by image alignment

(a) In this problem, we will examine rigid objects with sharp edges undergoing 3D rotation about the vertical axis. Let P_1 and P_2 be two images of an object O rotating in depth around the vertical y-axis. P_2 is obtained from P_1 by a rotation of angle θ. Let P_u be a third image of the same object obtained from P_1 by a rotation of angle ϕ around y-axis. Let the projections of a point $p = (x, y, z) \in O$ in the three images are given by:

$$\begin{aligned} p_1 &= (x_1, y_1) = (x, y) \\ p_2 &= (x_2, y_2) = (x \cos\theta + z \sin\theta, y) \\ p_u &= (x_u, y_u) = (x \cos\phi + z \sin\phi, y) \end{aligned}$$

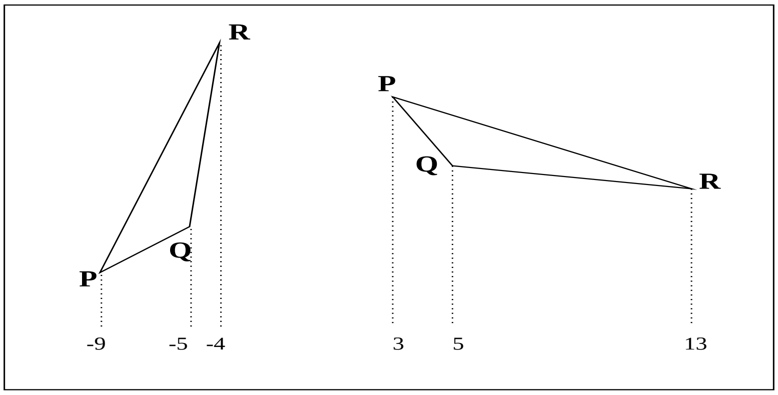
Show that two constants α and β exist such that for every point $p \in P_u$:

$$x_u = \alpha x_1 + \beta x_2$$

Answer:

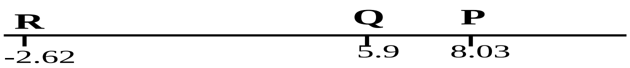
(b) Recognizing a triangle on a plane

Consider the following two views of a triangle which differ only by a rotation.

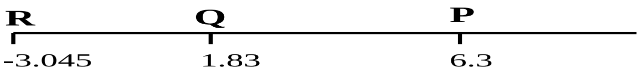


Which of the following 1D projections are consistent with a rotation of the above triangle?

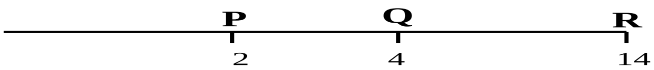
(A)



(B)



(C)



(c) Suppose we allow translation on the plane in addition to rotation. Is it still possible to recognize the unknown view of a triangle using only two stored views? Why or why not?

Answer: