CS128 Assignment 1: Rigid Body Motion - Answers

Part 1: Matrix and Vector Operations

1. Matrix Addition:

A + B =

[[11, 22, 33],

  [44, 55, 66],

  [77, 88, 99]]

2. Matrix Multiplication:

A (3x2) * B (2x4) =

[[110, 140, 170, 200],

  [230, 300, 370, 440],

  [350, 460, 570, 680]]

3. Matrix Transpose:

Transpose of A (3x2):

[[1, 3, 5],

  [2, 4, 6]]

Transpose of B (2x4):

[[10, 50],

  [20, 60],

  [30, 70],

  [40, 80]]

4. Matrix-Vector Multiplication:

A * X =

[[22],

  [49],

  [76]]

Part 2: 2D and 3D Rigid Body Transformations

a) 2D Rotation (theta = 30°):

Aw = (0.73, 2.73)

Bw = (4.20, 4.73)

Cw = (2.20, 7.20)

Dw = (-1.27, 5.20)

b) 2D Translation (tx = 2, ty = 1):

Aw = (4.0, 3.0)

Bw = (8.0, 3.0)

Cw = (8.0, 7.0)

Dw = (4.0, 7.0)

c) 3D Rotation (around X-axis by 30°):

Aw = (0, 0, 0)

Bw = (1, 0, 0)

Cw = (0, 0.866, 0.5)

Dw = (1, 0.866, 0.5)

Ew = (0, -0.5, 0.866)

Fw = (1, -0.5, 0.866)

Gw = (0, 0.366, 1.366)

Hw = (1, 0.366, 1.366)

d) 3D Translation (tx = 2, ty = 2, tz = 2):

Aw = (2, 2, 2)

Bw = (3, 2, 2)

Cw = (2, 3, 2)

Dw = (3, 3, 2)

Ew = (2, 2, 3)

Fw = (3, 2, 3)

Gw = (2, 3, 3)

Hw = (3, 3, 3)