

Mid Term Examination

MAE 574, Virtual Reality Application and Research - Spring 2009

March 20th 2009

100 points

50 minutes

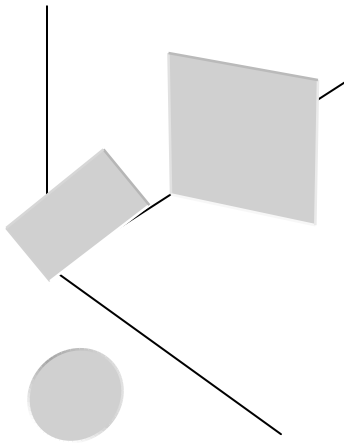
5 pages

(1 point)

Name:

Person #:

1. Given the following cross sections, describe (with necessary math) how you would perform a sweep operation to generate a smooth blended surface. Include atleast one example of how the numbers for an intermediary section would look like. The square has a side of length a , the rectangle has side a , breadth $a/2$, is rotated 45 degrees about X axis and the circle (radius a) lies at an offset of a units from the X axis and is rotated by 45 degrees about Y axis. (20 points)



2. Write an algorithm for testing whether a 3D polygon having n vertices and e edges (connected cyclically, CCW) is self intersecting. Then, given an algorithm to split this polygon into triangles or smaller convex polygons (non overlapping – non intersecting). (20 points)

3. A recently discovered ancient cup was scanned to get a 3D point cloud. Assuming that the points in the cloud are not in any specific order and only the outer surface of the cup was scanned (the insides and bottom ignored), come up with an algorithm that will allow you to reconstruct a polygon mesh (for the outer surface) from the point cloud data. (20 points)



4. Write the hierarchical transformation matrices (in OpenGL push and pop format – don't worry about syntax) required to animate this skeleton (head, body, legs-fingers and tail). (20 points)



5. Write the pseudo-code/algorithm/procedure (prototype functions, variable types etc. also needed) implementation required to simulate a Newton's Pendulum. Assume that the strings connecting the bobs are elastic (but have high stiffness) (19 points).

