International Institute of Information Technology, Hyderabad

(Deemed to be University)

Computer Graphics (CS7.302) Spring-2022

Question Paper

Quiz 1

Max. Time: 45 Minutes Max. Marks: 34

Special Instructions about the exam

1. This is an Open book exam and all questions are compulsory. Calculators are allowed.
2. Please mention your name and Roll number and put your signature on top of the first page.
3. Please mention question number while answering on each page of the answersheets.
4. Draw clear figures for depticting geometry, as and when necessary.

Each Multiple Choice Question (MCQ), with multi-select option, carry 1 marks with no partial marking or negative marking.

"Please provide brief justification along with the answer for MCQs."

1. Consider a 3D point. The following sequence of operations is applied to it: (1) Scaling, (2) Translation, (3) Rotation. Can the overall transformation of the point can ever be represented by the following sequence: (1) Rotation, (2) Translation, (3) Scaling ?
   (a) Yes.
   (b) No.
2. i) There are multiple model matrices and ii) multiple view matrices for a typical OpenGL program.
   (a) First is true, second is true.
   (b) First is false, second is true.
   (c) First is true, second is false.
   (d) First is false, second is false.
3. Select which is true from the following:
   (a) All rotation operations (Yaw, Pitch, Roll) are applied w.r.t., global co-ordinate frame.
   (b) Yaw followed by Pitch is the same as Pitch followed by Yaw.
   (c) None of these.
4. Select which is true from the following:
   (a) Orthographic projections are strictly length preserving.
   (b) Canonical view volume is not useful for oblique projection.
   (c) None of these.

Each question below carry 10 marks.

5. Give the final rotated 3D point and corresponding rotation matrix to rotate a given 3D point [x,y,z] (use last three digits of your roll number) by an angle of 45 degrees around the axis α= [1, $\sqrt{2}$, 1]. You can use any method convenient. Please also provide the intermediate matrices, e.g., $R_{\alpha x}$ and R_x.

6. The 3D vertex of a triangle ABC are defined as a function of your roll number given below: point A = (2nd , 5th , 8th) digits of your roll number point B = (3rd , 6th , 9th) digits of your roll number point C = (4th , 7th , 10th) digits of your roll number

   Example roll number = 2021123456 point 1 = (0,1,4) point 2 = (2,2,5) point 3 = (1,3,6)

   Triangle is translated by (1,2,3) in world coordinates with no rotation and scale. Camera location = (-1,-1,-1) and camera is looking at point (1,2,4) with upward direction be (0,1,0), where all these points are in the world coordinates. The symmetric perspective FOV of the camera is 60 degree in both horizontal and vertical direction, near and far planes are 0.1 and 100 respectively. The veiw port specification are W=256 and H=256.

   Given the above information, get the view port coordinates of the triangle vertices and show the intermediate steps of the rasterization pipeline. State if the points are inside or outside the viewport and give the coordinates even if the points lie outside the viewport. Please feel free to use publicly available resources including slides, calculators, glm functions and relevant documents, if needed.

7. Derive Mid-point line drawing algorithm for lines with negative slopes (e.g., $-1 \leq$m< 0). Provide details of dry run scenario by drawing a line (as per the slope assumption) over at least 4 pixels inside the view window (assumed accordingly).

Good Luck