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B.Sc. Engg. / HD CSE 5th Semester — 15 March 2018 (Afternoon)

# ISLAMIC UNIVERSITY OF TECHNOLOGY (IUT)
## ORGANISATION OF ISLAMIC COOPERATION (OIC)
## Department of Computer Science and Engineering (CSE)

**MID SEMESTER EXAMINATION** — **WINTER SEMESTER, 2017-2018**

**DURATION: 1 Hour 30 Minutes** — **FULL MARKS: 75**

## CSE 4551: Computer Graphics and Multimedia

**Programmable calculators are not allowed. Do not write anything on the question paper.**

There are **4 (four)** questions. Answer any **3 (three)** of them.

Figures in the right margin indicate marks.

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1. a) Compute the access time per pixel for a display system with resolution 1280X1024 assuming that the refresh rate is 60fps. Also consider that for each scan line 20% time is wasted on performing horizontal retrace and it takes about 20 scan lines worth of time for vertical retrace. 7

   b) Prove that two successive 2D rotations are additive; that is $R(\theta_1) \cdot R(\theta_2) = R(\theta_1 + \theta_2)$. 8

   c) Draw the basic architecture of a Refresh and Raster Scan display device. Considering *Full Color Frame Buffer*, discuss how a color image can be displayed on the CRT monitor. 10

2. a) Write the sequence of steps required to reflect an object about an arbitrary axis (e.g. $y=mx+c$) in three dimensional space. Find out the transformed coordinates of a line AB, where A = (2, 1, 2) and B = (0, 1, 1) is rotated by $30^0$ around Y-Axis. 8

   b) In modern technology, different manufacturer companies try their best to produce display devices such that they can commit the naturalistic visionary impression to the viewer. Now comparatively discuss about the functional mechanism between LED display devices and plasma display devices to touch this goal. 7

   c) Derive the Rotation matrix required to perform an anti-clockwise rotation in 3D space. Mention any useful properties that this rotation matrix possess. 10

3. a) Suppose T1, T2 and T3 are three different matrices which represent different kinds of transformation in three dimensional space. Now if these matrices are applied in the following sequences on Figure 1, will the final transformed image be the same for both cases? Justify your answer mathematically. 5

   Sequence 1: T1, T3, T2
   Sequence 2: T2, T1, T3

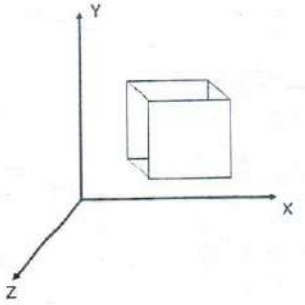


Figure 1: A 3D object. (2D).

b) Derive the sequence of transformation matrix required to transform the object in Figure 2(a) into the object in Figure 2(b). 12

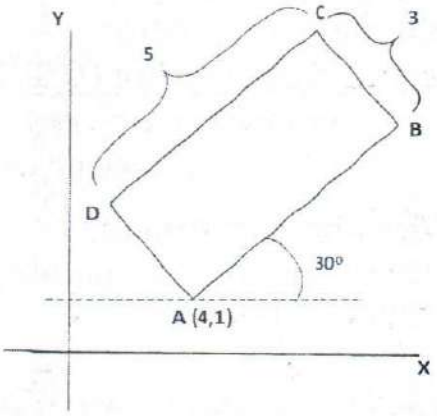


Figure 2(a): Original object (2D).

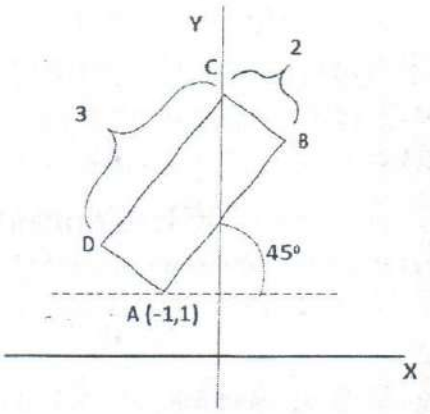


Figure 2(b): Transformed object

c) Write short notes on: 8
   i. Resolution
   ii. Bandwidth of a display
   iii. Phosphorescence
   iv. Shadow mask

4. a) Write down the pseudo code of Cohen-Southerland algorithm to clip a line which is partially inside viewing window. Also mention the weakness with this algorithm if there any. 8

b) Let W be the rectangular window in Figure 3 whose lower-left corner is at A(-3,-2) and upper-right corner is at B(6,7). 10

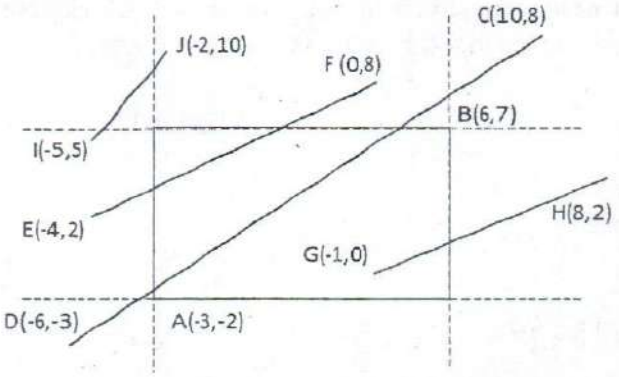


Figure 3: Rectangular window with arbitrary lines.

Answer the following questions:
   i. Calculate the TBRL codes for the endpoints of all the lines. Find out which of these points will be trivially accepted and rejected.
   ii. Use the Cohen-Southerland algorithm to clip the line segments in Figure 3 (Show all the steps).

c) Define **affine transformation**. What is **homogenèous co-ordinate system**? Why do we need this co-ordinate system in computer graphics? 7