Roll Number: _____

## *Thapar Institute of Engineering & Technology, Patiala*

Computer Science & Engineering Department

**MID SEMESTER EXAMINATION**

B. E. (3rd Year)

Course Code: UCS505

Course Name: Computer Graphics

Date: 19th March 2023

Time: 2 Hours, M. Marks: 25

Faculty: Anupam Garg, Amrita Kaur, Kuntal Choudhary, Harpreet Singh, Yadwinder Singh

**Note: All questions are compulsory. Attempt the subparts of the question at one place.**

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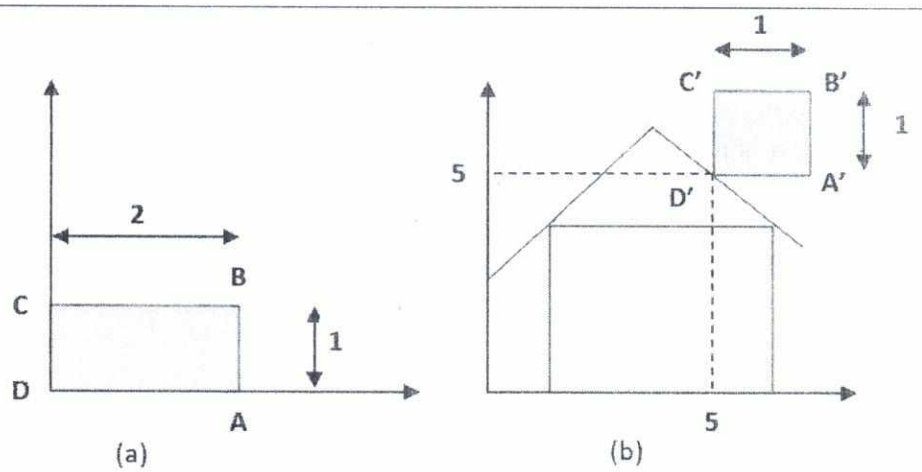
| **1.** | Derive the formulas for Midpoint ellipse drawing algorithm for region 2. Also, find the pixel points to be drawn using the derived formulas for an ellipse having major axis radius as 9 and minor axis radius as 5. (2+3) |
| **2.** | Explain the rules used in Cohen-Sutherland line clipping algorithm during line clipping. There is a rectangular window with xmin=2, xmax=10, ymin=3 and ymax=9. There are lines AB having coordinates (5,7) and (5,10), CD having coordinates (12,7) and (12,11) and EF having coordinates (4,4) and (7,3). Use the Liang-Barsky algorithm to clip the specified lines. (2+3) |
| **3(a)** |  Figure (a) shows an object (the rectangle ABCD with length 2 units and height 1 unit) in its local coordinate. This object is used to define the chimney of the house in Figure (b) (in world coordinate scene). Calculate new coordinates of the vertices (**A', B', C', D'**) of the object. (3) |
| **(b)** | Write the differences between boundary fill and flood fill algorithm. (Mention at least 4 differences). (2) |
| **4(a)** | Derive the reflection matrix about line $Y = mX - c$. Show all the required transformation matrices to derive the final reflection matrix. (2) |

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| (b) | Consider a window **ABCD** whose lower left corner is **A** $(XW_L, YW_L)$ and the upper right corner **C is** $(XW_M, YW_M)$. A viewport **PQRS** has been defined with the lower left corner **is P** $(XV_L, YV_L)$, and the upper right corner is **R**$(XV_M, YV_M)$. The window **ABCD** has to be mapped into the viewport **PQRS**. For this mapping two approaches have been defined below.<br><br>**Approach 1:** Translate **A** point of Window to coordinate origin by performing **T**$(t_a, t_b)$. Apply scaling transformation **S**$(s_a, s_b)$ and translate **A** point to **P** point of viewport by performing translation **T**$(t_m, t_n)$.<br>**Approach 2:** Scale the window by applying scaling transformation **S**$(s_a, s_b, x_f, y_f)$ with reference to point **A** and then translate **A** point to point **P** of viewport by applying translation **T**$(t_g, t_h)$.<br><br>(a) Are the approaches valid for this mapping? Are the approaches equivalent? Justify with proper explanation. Write all the parameters $t_a, t_b, s_a, s_b, t_m, t_n, t_g, t_h, x_f, y_f$.<br>(b) Write down the window to viewport transformation matrix if the viewport **PQRS** is normalize in the range of **[-1,1]**. **(2+1)** |
| 5 (a) | If we use 2-byte pixel values in a 24 bit lookup table representation, how many bytes does the lookup table occupy? What will be the storage requirement of 1024 × 1024 image? **(1.5)** |
| (b) | In a 512× 256 raster on a monochromatic display with an average access rate of 200 ns per pixel, what is refresh rate? **(2)** |
| (c) | What are the advantages of random scan system over raster scan system? How display processor is different from display controller? **(1.5)** |