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Selected Problem Set 3

1. Suppose we have a square window with lower-left corner $(0,0)$ and upper-left corner $(10,10)$. Clip the segment defined by endpoints $(-1,0)$ and $(15,13)$ using Cohen-Sutherland's algorithm. Show your calculations.

   We encode both segment endpoints as per the algorithm. The code for $P_1=(-1.0,0)$ is 0001, and 1010 for $P_2=(15,13)$. Point P_1 is thus outside and to the left. We compute the intersection of the segment with $x=X_{min}$, as per the notes, and the clipped point is obtained as $(0,13/16)$. Re-encoding the point shows that it is clipped correctly. Point P_2 is outside and to the right. Hence, we compute the intersection of the segment with $y=Y_{max}$. Re-encoding this point shows it is still outside the window. We then compute the segment intersection with $x=X_{max}$ as per the notes, to obtain $\left(10,8+\frac{15}{16}\right)$. Re-encoding shows this point is clipped correctly.

2. Clip the same segment against the same window this time using Liang-Barsky's algorithm. Show your calculations.

   $(p_1,p_2,p_3,p_4) = (-16,16,-13,13)$ $(q_1,q_2,q_3,q_4) = (-1,11,0,10)$. *For* $p_k<0$ *:* $max\{0,1/16,0\}=1/16$ *and* $u_1=1/16$. *For* $p_k>0$ *:* $min\{1,11/16,10/13\}=11/16$ *and* $u_2=11/16$. *Using* u_1 *and* u_2 *into the equation of the clipped segment, we obtain* $(0,13/16)$ *and* $\left(10,8+\frac{15}{16}\right)$.

3. Clip the same segment against the same window this time using the Midpoint Division method. Show your calculations.

   This question is not part of the examination material.

4. Write an algorithm that performs Raster-Scan polygon filling for any type of 2D polygon.

   Two such algorithms are found in the notes.

5. Write the Midpoint Division method algorithm in a recursive manner.

   This question is not part of the examination material.