Step a) intersect w/ top edge: point C

line: \((-2, -3) + t(6, 5)\)

\[ C = [?, 1] \]

\[ 1 = -3 + 5t_c \quad t_c = \frac{4}{5} \]

\[ C_x = -2 + \frac{4}{5} \cdot 6 \]

\[ = -2 + \frac{24}{5} \]

\[ = 2.8 \]

\[ C = [2.8, 1] \quad OC(C) = 0001 \]

Discard AC, keep BC

\(\text{over} \rightarrow\)
b) \[ \begin{align*}
B &= \left[ -2, -3 \right] \\
C &= \left[ 2.8, 1 \right] \\
OC(B) &= 0110 \\
OC(C) &= 0001
\end{align*} \] cannot trivially accept or reject.

bottom edge: \( y = -1 \)

line: \((-2, -3) + t(4.8, 4)\)

point \( D \) \( \left[ ?, -1 \right] \)

\[-2 + 4t = -1\]
\[ t = \frac{3}{4} = \frac{1}{2} \]

\[ D_x = -2 + 4.8 \left( \frac{1}{2} \right) = 0.4 \]

\[ D = \left[ 0.4, -1 \right] \quad OC(D) = 0000 \]

Discard \( BD \), keep \( DC \)

c) \[ \begin{align*}
C &= \left[ 2.8, 1 \right] \\
D &= \left[ 0.4, -1 \right] \\
OC(C) &= 0001 \quad \text{cannot trivially accept or reject} \\
OC(D) &= 0000
\end{align*} \]

right edge: \( x = 1 \)

line \((0.4, -1) + t(2.8, 1)\)

point \( E \) \( \left[ 1, ? \right] \)

\[ 0.4 + 2.8t = 1 \]
\[ t = 0.2143 \]

\[ E_x = -1 + t \]
\[ = -0.7857 \]

\[ E = \left[ 1, -0.7857 \right] \quad OC(E) = 0000 \]

Discard \( EC \), keep \( DE \)

\((OC(D) = 0000) \& (OC(E) = 0000)\) ACCEPT

d) The line was accepted in step 3, no further steps necessary.
Q2) Sutherland Hodgeman Algorithm:
- Inside around vertices of polygon:
  4 cases:
  (1) prev vertex inside clip box 
  current vertex inside clip box \[ \Rightarrow \text{add current vertex to output} \]
  (2) prev vertex outside 
  curr vertex inside \[ \Rightarrow \text{add intersection on prev-current line to output} \]
  \[ \Rightarrow \text{add current vertex to output} \]
  (3) prev vertex inside 
  curr vertex outside \[ \Rightarrow \text{add intersection on prev-current line to output} \]
  (4) prev vertex outside 
  curr vertex inside

Initially

\[ A(2, 2) \]
\[ B(-2, -2) \]
\[ C(2, -2) \]

a) after clipping w/ top edge:

\[ D \]
\[ E \]
\[ A_{\text{top}} \]
b) clipping w/ bottom edge

c) clipping w/ right edge

d) clipping w/ left edge (no effect)
Q3)

a) Plane A

b) Plane B

D subdivided by B

c) Plane C

d) Plane D1

Plane D2
start with node A: \([A]\)

V1 is on the labelled side of node A, so do left child first, then A, then right child:

\([B]\) A [C]

expand node B:

V1 is on the labelled side of B so do left child of B first

\([D2]\) B [D1] A [C]

expand node D2:

D2 has no children

D2 B D1 A [C]

expand node D1:

D1 has no children

D2 B D1 A [C]

expand node C:

C has no children

D2 B D1 A C

result first: D2, B, D1, A, C

f) same method as e), but with V2

\([C]\) A [B]

C A [D1] B [D2]

C, A, D1, B, D2

v2
Q4) One or more of the polygons will be subdivided along the plane of another, resulting in two halves, resolving the conflict.

Q5) Assumption: positive normal on opposite side to label
Algorithm: cull if view point is on negative side of plane

* backface culling may be disabled for non-closed objects -> depends on implementation.

Q6) 3 bits $\rightarrow 2^3 = 8$ bins

$$Z_{NDCS} = \frac{f+n}{f-n} + \frac{1}{Z_{VCS}} \left( \frac{2\cdot f \cdot n}{f-n} \right)$$

$$Z_{DCS} = \frac{1}{2} + \frac{1}{2} Z_{NDCS}$$

$$Z_{DCS} = \frac{1}{2} + \frac{1}{2} \left( \frac{f+n}{f-n} + \frac{1}{Z_{VCS}} \left( \frac{2\cdot f \cdot n}{f-n} \right) \right)$$
\[ Z_{\text{rel}} = \frac{-fn}{(f-n)z_{\text{rel}} - f} \]

\[ f = -50, \quad n = -0.1 \]

\[ Z_{\text{rel}} = \frac{-5}{(-49.9)z_{\text{rel}} + 50} \]

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**Q7)**

Wall:

a) 

16 Bricks
4x texture
500 pixels

P1

\[ \begin{array}{c}
\uparrow \\
\text{4 repeats} = 4 \times 128 \text{ texels}
\end{array} \]

\[ \Rightarrow \frac{4 \times 128}{500 \text{ pixels}} = 1.024 \frac{\text{texels}}{\text{pixel}} \]

b) 

4 \times 128 = 256
4 \times 64 = 256
4 \times 32 = 128

The next MIP-map image is used when the effective scale drops by \(\frac{1}{2}\). Eg, level 2 is used when the wall is 4x64 = 256 pixels high.

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**Note:** Original texture is 128x128 px.