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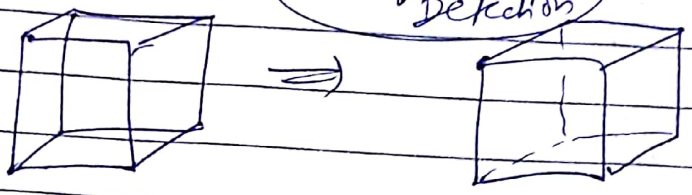
CG - Lab

Hidden Surface → Backface Detection

(for cube → at max 3 faces are visible)

eg: 

Edges behind should be dotted.

A solid tetrahedron is given by pos. vectors, A(1, 1, 1), B(3, 1, 1), C(2, 1, 3), D(2, 2, 2).

Torch, P = (2, 3, 4). (ie Viewing Position)
Tell which faces are lighted, & which are not.

Sol: → Step1 → Surfaces → ACD, CBD, BAD, ACB.

(Write like this (ie steps) in exams)

Step2 Normals :- N_{ACD} ⇒ $\vec{AC} = 1, 0, 2$

$\vec{CD} = 0, 1, -1$

(Normal should be outside)

$\vec{N} = \vec{AC} \times \vec{CD} = \begin{vmatrix} i & j & k \\ 1 & 0 & 2 \\ 0 & 1 & -1 \end{vmatrix}$

$= -2, 1, 1$

Now, $\vec{AB} = 2, 0, 0$

So, $\vec{N} \cdot \vec{AB} = -4$ ⇒ -ve ⇒ $\vec{N}$ & $\vec{AB}$ are opposite

ie Normal outside

Explain

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$\vec{N}_{CBD}$, $\vec{N}_{BAD}$, $\vec{N}_{ACB}$.

$\vec{CB}$ =

$\vec{BD}$ =

$\vec{N}$ = $-2, -1, -1$

So, $\vec{CA} \cdot \vec{N}$

$= (-1, 0, -2)(-2, -1, -1)$

$= 2 + 0 + 2 = 4$ — +ve

Reverse $\vec{N}$

$\vec{N} = 2, 1, 1$

$\vec{N}_{BAD}$ =

$\vec{BA} = -2, 0, 0$

$\vec{AD} = 1, 1, 1$

$$\begin{vmatrix} i & j & k \\ -2 & 0 & 0 \\ 1 & 1 & 1 \end{vmatrix} = 0, 2, -2$$

Now, $\vec{BC} = -1, 0, 2$

$\vec{N} \cdot \vec{BC} = 0 + 0 + (-4) = -4$

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$\vec{N}_{ACB}$ =

$\vec{AC}$ 1, 0, 2

$\vec{CB} = 1, 0, -2$

$$\begin{vmatrix} 1 & 0 & 2 \\ 1 & 0 & -2 \end{vmatrix}$$

$0, 4, 0$

$\vec{AD} = 1, 1, 1$

4 — Reverse

$\Rightarrow -1$

Step 3 → Centroid of $ACD = \left(\frac{5}{3}, \frac{4}{3}, 2\right)$

Centroid of $CBD = \left(\frac{7}{3}, \frac{4}{3}, 2\right)$

Centroid of $BAD = \left(2, \frac{4}{3}, \frac{4}{3}\right)$

Centroid of $ACB = \left(2, 1, \frac{5}{3}\right)$.

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Step 4 → Vectors from centroid

Now, take dot product with Normal → if +ve ⇒ Hidden
else ⇒ Visible.

So $L_{ACD} = C - P_{ACD}$

$= (2,3,4) -$

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