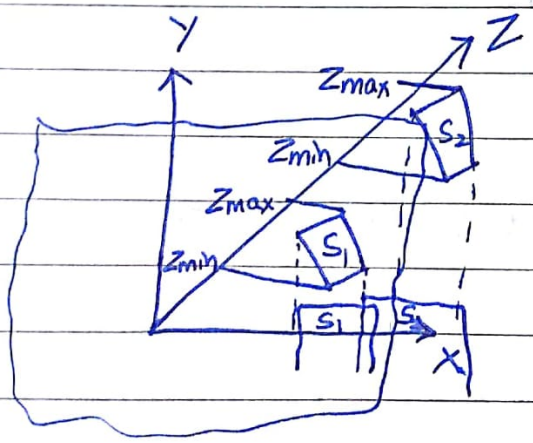
Hidden Surface

Painter Algorithm / Depth Sorting / Priority
(Newell & Sancha)

Standard practice of a painter

→ Distant object are painted first
→ Nearer object, in the order.



Surfaces they dont overlap on z-axis

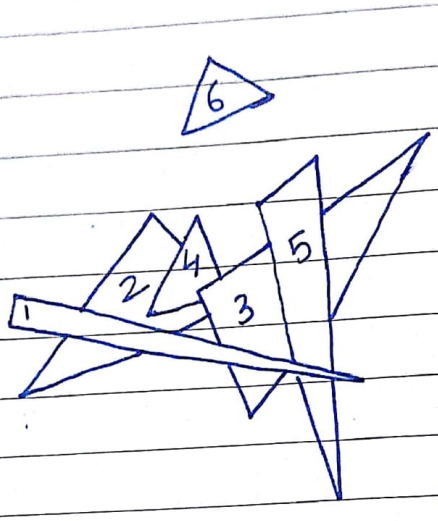
$S: \{S_1, \ldots S_n\}$

Sort (Depth)

↓

Cases	I	II	
z-extent overlap	X	X	X
y-extent overlap	X	X	✓
x-extent overlap	X	✓	X

Ex (1)



Set of surfaces which don't have z-extent overlap

$S: \{S_1, S_2, \ldots S_6\}$

(x, y, z)

Coordinates of all surfaces

Given: x, y, z of all surfaces

Solution: Construct of Table → No. of surfaces behind this triangle

To find behind counter.

Step 1 → Draw bounding rectangles & see whose bounding rect are overlapping

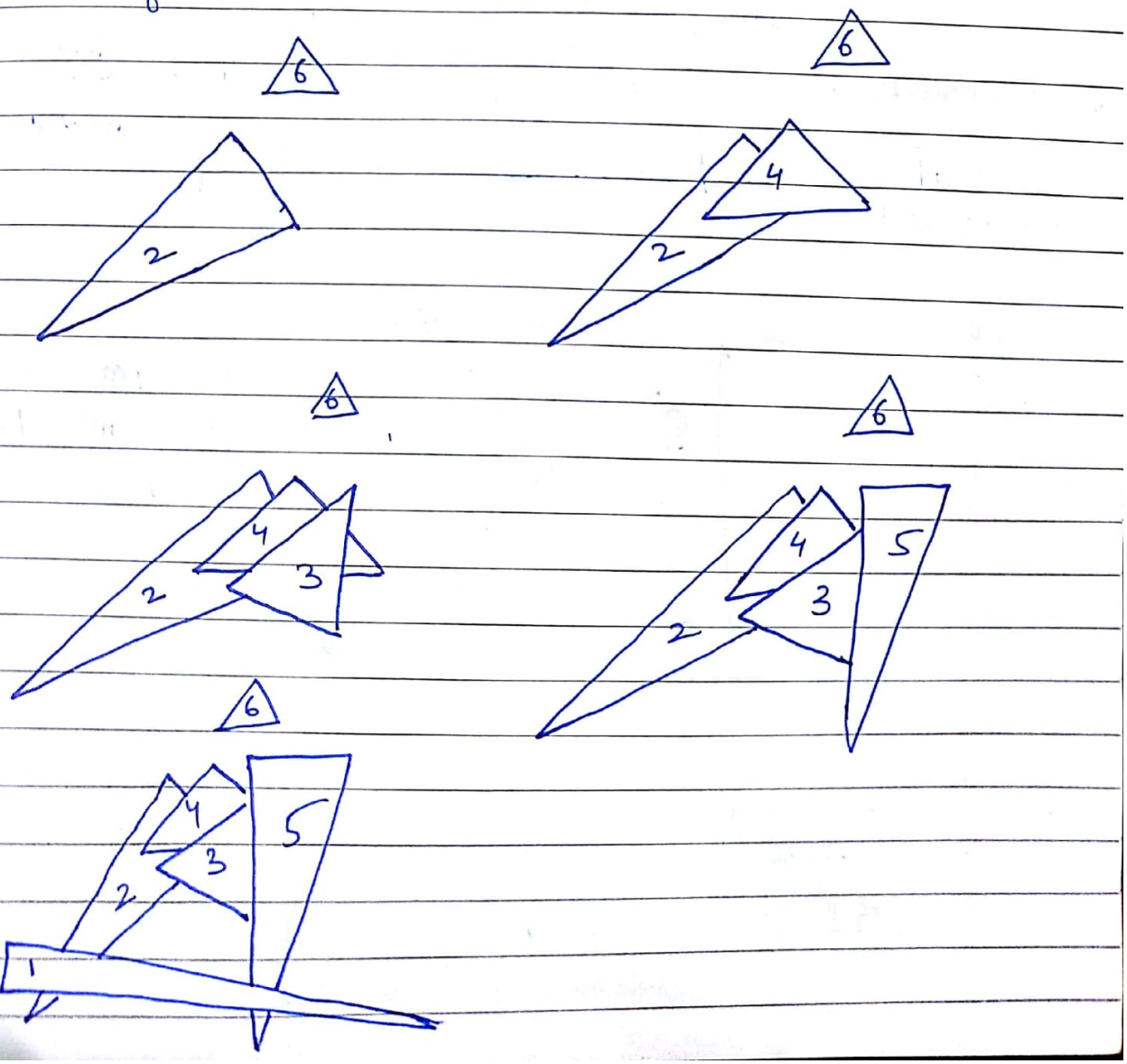
Triangle	Behind Counter	List of Triangle in front
1	3	—
2	0	1,3,4
3	2	1,5
4	1	3
5	1	1
6	0	—

Take a bounding rect & check other bounding rectangles for no of overlappings.

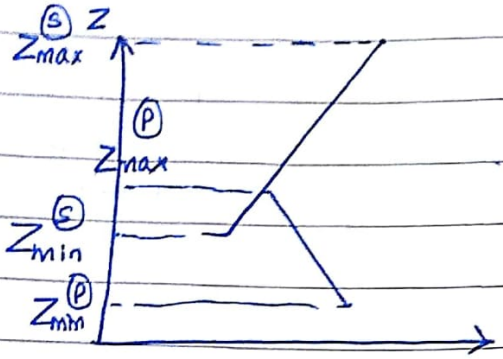
Contents of Table (Processed)

Triangle	Front List	Behind counter (Pass ①)	Pass ②	③	④	⑤
1	—	3	2	2	1 → 0	
2	1,3,4	0 ✓				
3	1,5	2	1 → 0 ✓			
4	3	1	0 ✓			
5	1	1	1	1 → 0 ✓		
6	—	0 ✓				

Take all with Behind counter=0 & draw. Then decrement Behind counter of all in their Front List



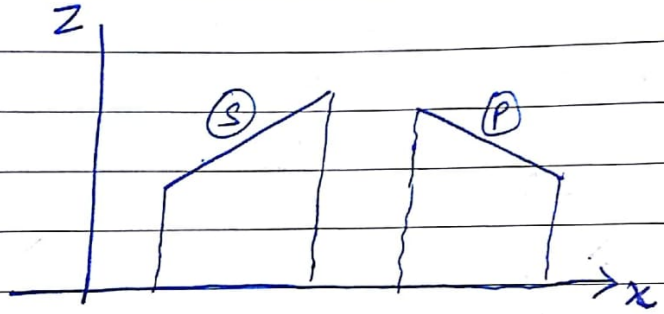
Z-extent overlap



Projection in xy

$S_{z_{min}} < P_{z_{max}}$

Test

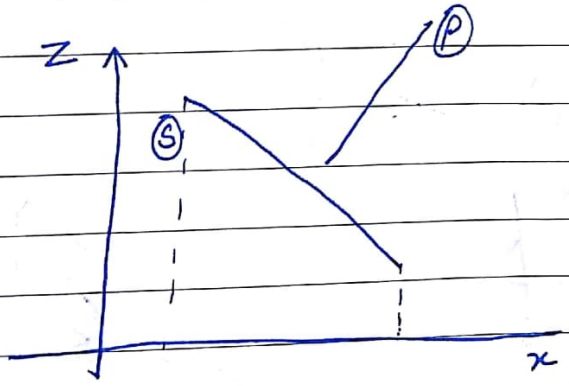


Zextent ✓

Yextent ✗

xextent ✗

If no x, y overlap, Z overlap doesn't matters. Paint acc. to z values.

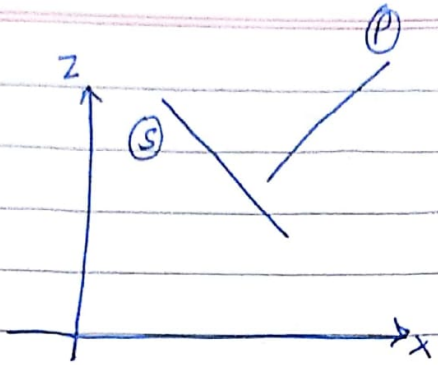


Bounding Rectangle are Completely inside

Revert order

Scan S

Ignore P → No need to draw P.



Partially obscured

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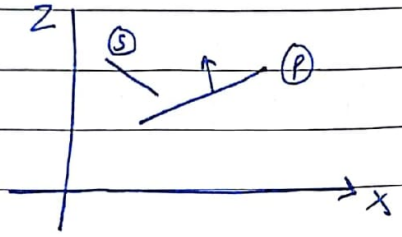
There are no. of cases.

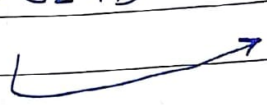
Cases



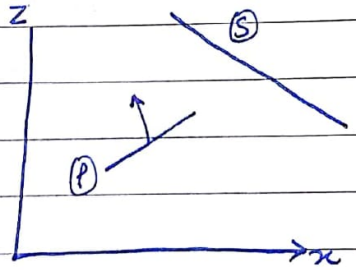
Polygon S is "outside" of polygon P

If Polygon S is outside of Polygon P relative to view Plane

$f(x,y): Ax + By + Cz + D$

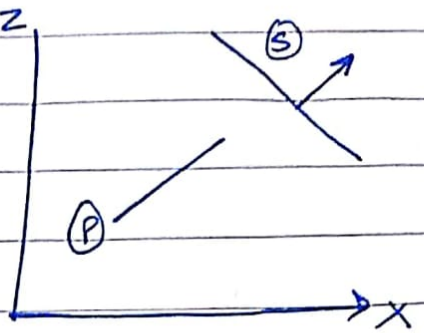


1) If putting point P in plane eq" gives >0, then S is outside the plane R
2) Take Normal of P. If both vertices of S on same side on normal than S is outside of P.



If Case 2 "outside" of P fails then test to see if P is inside of S (again with respect to view plane)

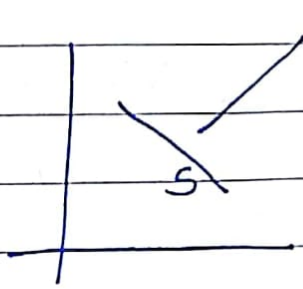
P is inside of S



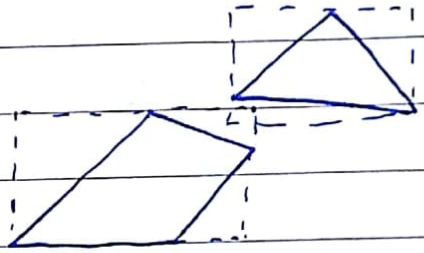
So, Scan Convert S first and then paint P.

1) Bounding rect overlap but not figure

Case

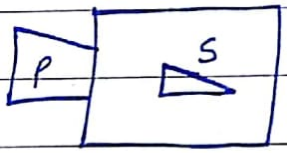


S is not inside of P and P not inside of S.



if there is overlapping with actual surface S & P

Apply Polygon clipping of P & reapply whole procedure again



Q Triangle ① $T_{11}(0,7,5)$ $T_{12}(6,7,5)$ $T_{13}(0,1,5)$

Triangle ② $T_{21}(0,6,7)$ $T_{22}(0,1,2)$ $T_{23}(5,1,7)$