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Assignment-8

a1) Explain warnock's painters hidden face removal Algorithm.

→ i) It is a divide and conquer approach. It is also called area subdivision method.

ii) At each stage, in the recursive-subdivision process, the relationship between projection of each polygon & area of interest is checked for 4 possible relations

1. surrounding Polygon:- on that completely encloses the (shaded) area of interest.
2. Overlapping & intersecting polygon: one that is partly inside & partly outside.
3. Inside or contained - One that is completely inside the area.
4. Outside or disjoint - one that is completely outside.

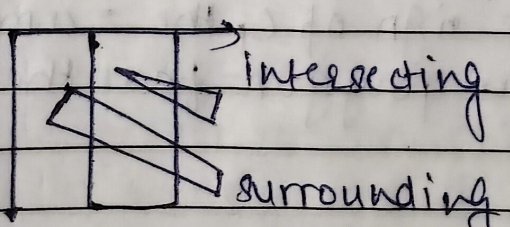
After checking them,

a) If all polygons are disjoint, background colour is displayed in the area.

b) If there is only 1 contained polygon, area is 1st filled with background colour & part of polygon contained is filled with colour of the polygon.

c) If there is single surrounding polygon, & no contained ones, area is filled with colour of surrounding polygon.

d) If more than 1 intersecting polygons are there, then we need to do more processing.



iii) Here, surrounding p. is not in front of intersecting p. so warnock's algorithm subdivides the area to

more

Q1) What is a fractal? explain characteristi...

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solve the problem.

iv) The algorithm stops subdivision of area only when the problem is simplified or area is only one single pixel.

Q2) Explain back face removal Algorithm.

→ i) When we look at light surface, polygon will appear to be drawn with counter clockwise motions & when it is dark, it appears to be drawn with clockwise motions.

ii) If a polygon is visible, light surface should face towards us & dark surface must face away. Hence, if the direction of light face is pointing towards the viewer, face is visible, else the face is hidden & must be removed.

iii) Direction of light face is identified by testing $N \cdot V > 0$

iv) If cosine is +ve that is 2 vectors are in the same direction $(0 \le \theta \le \pi/2)$ the overall dot product is +ve

v) However if $(\pi/2 < \theta \le \pi)$ then, cosine & the dot product is negative.

vi) If dot product is +ve, we say that the polygon faces towards us, otherwise it faces away & must be removed.

vii) If object description is converted to projection co-ordinates & our viewing direction is parallel to viewing z_v axis, then $V = (0, 0, V_z)$ & $V \cdot N = V_z C$

viii) Here we consider only the sign of C, the z component of normal vector N. If z is +ve polygon faces the viewer, if -ve it faces away.

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Q3) Explain BSP tree for hidden surface removal & explain its advantages.

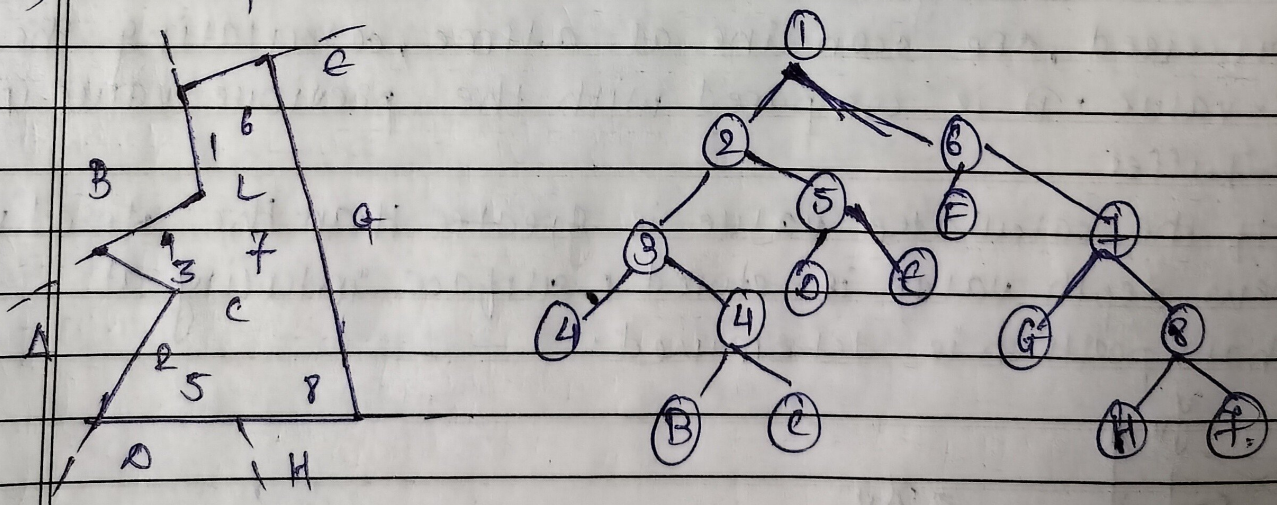
→ (1) Binary space positioning is a project which deals with the complexity of space division.

(2) Binary space partitioning is a method that recursively subdivides the space into convex sets using hyper planes.

ii) It uses the tree data structure to store information about the set of objects in each convex set. The whole BSP tree is constructed as a pre processing step & at the time the program runs, the tree gets processed at each run. It calculates the division space at the runtime.

iv) It uses a recursive approach. A single surface is divided into 2 subspaces by the hyper plane & next 2 by super spaces are further divided into 2 subspaces. It continues till each object is in a seperate subspace.

v) A complex BSP :-



vi) Advantages :- the program on BSP is easy to understand.

b) It improves the scalability and boosts the performance

c) It is widely used in the gaming industry.

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Q4) Describe z-buffer hidden surface algorithm.

→ i) This algorithm compares the surface depths at each pixel position on the projection plane.

ii) surface depth is measured from the view plane along the z-axis of a viewing system.

iii) When object description is converted to projection co-ordinates, each pixel position on the view point is specified by x, y co-ordinates & z gives the depth value.

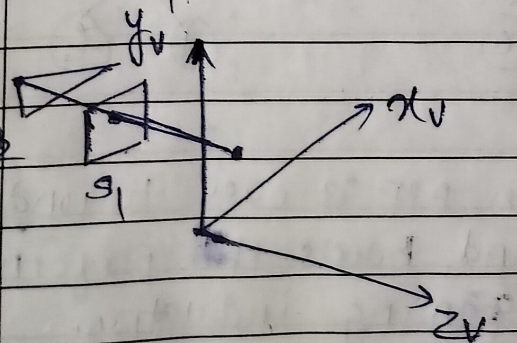
iv) This is usually implemented using normalized co-ordinates & hence z varies from 0 at back clipping to 1 at front clipping.

v) The memory requires another buffer called the z-buffer along with frame buffer memory in raster displays.

vi) z-buffer is used to store the depth values for each (x,y) position & frame buffer stores the intensity values.

vii) At the beginning z-buffer is initialized to 0 & frame buffer to background colour. Each surface is then processed, one scan line at a time, calculating the z-value. It is compared with the previous value in the z-buffer

viii) If the calculated value is greater than the stored value, new depth value is stored & surface intensity at that position is determined.



Here S has smallest depth & highest z value.

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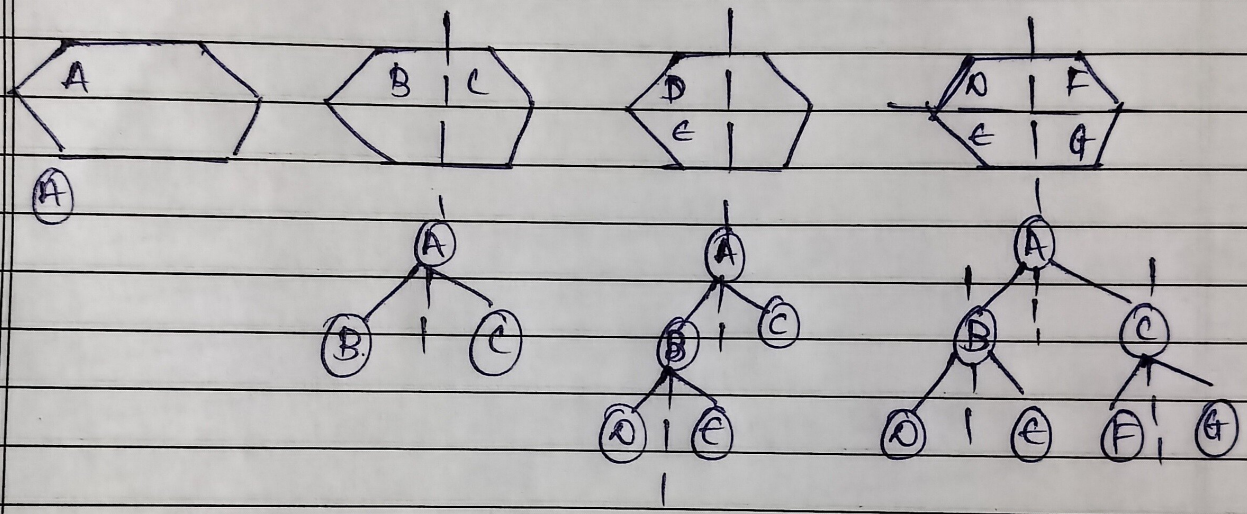
Q5) Explain BSP Algorithm with example.

→ It is a 2 step procedure.

① creation of BSP tree
② Display of tree

① creation



Step 1: We will apply algorithm to node A.
Step 2: Then we apply BSP to B & C to left & right node respectively where A is the parent node.
Step 3: Now start leftmost partioning with the leftmost B node.
Step 4: Add simply D & E to the left & right respectively.
Step 5: similary do for right node.
Step 6: end

② for display

For back view point, traverse tree in the order
left → current → right
A B C D E

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(b) For front viewpoint traverse reversely.
Right → current → left
E D C B A