Computer Graphics Assignment 3

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Code will be uploaded to
`https://github.com/Riften/SJTU-Computer-Graphics-2020-Assignments`
after deadline.

1 Question 1

In Lecture 6, we introduced some regularized boolean set operations, such as $\cap*$ and $\cup*$. Please explain why the operation result is limited to the regular set. Furthermore, explain how to determine the normal vector on each face.

Solution. The definition of $\cap*$ and $\cup*$ is

$$A\ op*\ B = closure(interior(A\ op\ B))$$

The result of $\cap*$ and $\cup*$ is closure. As the regulation of a closure is itself, a closure is a regular set. So the operation result is limited to the regular set.

Consider a face ABC where $\{A, B, C\}$ are three vertices. The normal vector of it is $\frac{\vec{AB}\times\vec{BC}}{||\vec{AB}\times\vec{BC}||}$. As for the direction of normal vector, many 3D mesh model formats, *.obj* file for example, use the order of vertices to determine the direction of face. □

2 Question 2

When using quadtrees or octrees to implement boolean set operations, why do we not need to distinguish between ordinary boolean set operations and regularized boolean set operations such as $\cap*$?

Solution. Because each node of quadtrees or octrees represents a partition of the object. It simply identifies whether a rectangular or a cubic belongs to the model. In that case, quadtrees or octrees can not represent the boundary points. The closure or interior of a quadtree or octree model makes no sence. The results of ordinary boolean set operations and regularized boolean set operations are just the same.

So we do not need to distinguish between ordinary boolean set operations and regularized boolean set operations when using quadtrees or octrees to implament boolean set operations. □