**Assignment 04 | Theory**

# **Name: Usama Mahmood**

# **Student ID: 0710399**

## **Question:**

We’ve skipped over the possible complexities of scene graphs, but what graph structures could be used for scenes and why would they be beneficial? The two prominent families of scene graphs are *bounding volumes* and *spatial partitioning*. 500 words (yes, that’s relatively a lot, but the theory is essential, though the implementation is mainly impractical in the time we have).

## **Answer:**

Scene graphs are an exciting part of graphics and game development, the creation is a character in the games is only possible by considering the scene graphs. Basically, it is more like structures or patterns that help in creating the whole body or character by inheritance. A most common and simple implementation of scene graph structures is in the body movements of the game characters by defining arms, legs and head, etc. Like if we move the character’s arm then its shoulders and head also have to move. In modern games, the application of scene graph structure is quite high, because of the vector-based graphics. The arrangement of basic moves in graphics becomes easier with the nodes in the graph.

For the scene graphs, the best-suited structure is the tree-like structure, because in the tree structure the formation of nodes will be like parent and child nodes. If we pass property or functionality to the parent node in the tree then that property will also be associated with all the child nodes of the same parent in the tree, so this structure is very convenient in the game development. In modern game development where each object has many properties and all are in 3D graphics, tree structure offers 3D objects where you can create as many subgraphs representing different scenes associated with the object with the help of 3D nodes which can have a relationship with the parent node.

**Bounding volumes:**

Bounding volumes is a structure for the scene graphs that basically just fastens up the process of determining the collisions in the nodes and boost up the algorithms used for view. The main advantage of using bounding volumes is that they can be implemented from any part of the moving object or character in the graphics, and can be performed collectively in the form of a hierarchy to show the results. All the geometry implementation could be stored in any node present in the structure of the object and can be implemented immediately whenever there is a need to change the transformation of the object.

**Spatial partitioning:**

Spatial partitioning as it is defined in its name that it partitions the space repeatedly, this technique is also for scene graphs and there are many ways to partition the space. It is mainly used for the inside graphic representation of the object and it does the spatial division of the object. Mostly we deal with 3D games or graphics so using spatial partitioning is different in 3D objects using ray tracing we will get to know what type of object is present in the space and where it is. By doing ray tracing then we could say about the object and where it is then we divide the whole scene into partitions and the object will come in one of the partitions. But to find the object in which the partition intersected we need to do many tests, it seems that a lot of effort just for a single object in the space then it would be a lot more difficult with so many objects on the scene.

It seems that spatial partitioning is not a good choice for the scene graphs as it requires a lot of computational cost and difficulty. We could use bounding volumes instead of spacial partitioning as bounding volumes is a tree-based structure which makes the process faster and easy.