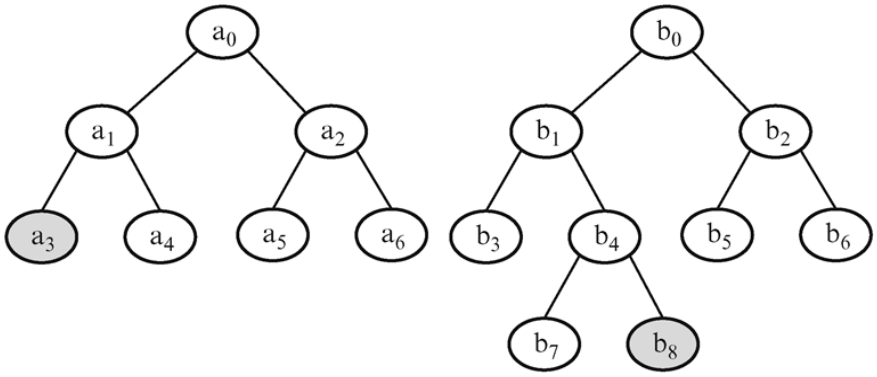
CS 418: Interactive Computer Graphics
In-class Worksheet

Simulating Physics

1. Using a BVH for Collision Detection

We have two objects **a** and **b**, each with their own BVH as shown below. Each node a bounding volume associated with it. Only the geometry in nodes a3 and b8 are in collision. What is the minimal number of bounding volume intersections that might be needed to determine this? What would be the maximal number?



2. Physics Engine

A particle begins at

$$\begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$$

and is moving with velocity

$$\begin{bmatrix} 1 \\ -1 \\ 2 \end{bmatrix} \text{ per second,}$$

and acceleration

$$\begin{bmatrix} 0 \\ 1 \\ -1 \end{bmatrix} \text{ per second per second.}$$

a. Use the second integral of the acceleration to compute the position after 5 seconds. The update equation you should use is:

$$p' = p + \dot{p}t + \ddot{p}\frac{t^2}{2}$$

b. Calculate the position using 5 time steps of 1 second each using the update equations below.

$$p' = p + \dot{p}t \qquad \dot{p}' = \dot{p} + \ddot{p}t$$

c. What is the error? Explain why it happens.