

Question 1

a. Because it's the static world,

so there is no cost of refitting the bounding volumes. And compare the cost of collision of bounding volumes, the efficiency from low to high is:

- Oriented bounding boxes
- Axis-aligned bounding boxes.
- bounding spheres

b. Rigid bodies have no cost of refitting the bounding volumes. So still compare the cost of collision detection. the efficiency from low to high is:

- oriented bounding boxes
- Axis-aligned bounding boxes.
- spheres

C. deformable bodies have cost of refitting the bounding volumes, so the cost of detection is ignored and we only compare the cost of refitting the efficiency from low to high:

- Oriented bounding boxes
- Bounding spheres
- Axis-aligned bounding boxes

Question 2

a. Because at each step, one box is split into 2 sub-boxes, so it's each inner node has 2 children. And the last leaf layer has n leaves. so, the order should be

1, 2, 4, ..., $\frac{n}{4}$, $\frac{n}{2}$, n . the number of layers is k , assuming that $n = 2^k$

b. Assume $2^k = n$, so the tree has k layers.

For one triangle, there are $4k-3$ intersection tests. And thus the upper bound should be

$C \cdot (4k-4) + 1 = 4ck - 4c + 1$, because the root test only happens once.

Question 3

For undeformed points x_i ,

$$\|x_i - c\| \leq r.$$

After deformation, $y_i = Ax_i$, $d = Ac$,

$$R = \|A\| r$$

$$\|y_i - d\| = \|Ax_i - Ac\|$$

$$= \|A \cdot (x_i - c)\|$$

$$\leq \|A\| \cdot \|x_i - c\|$$

$$\leq \|A\| \cdot r$$

$$= R$$

So the condition still holds after deformation