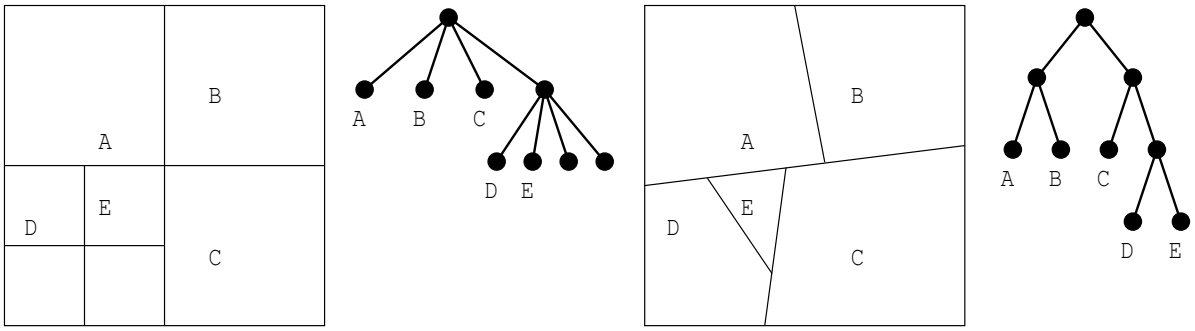
Assignment in Computer Graphics II
– Assignment 10 –

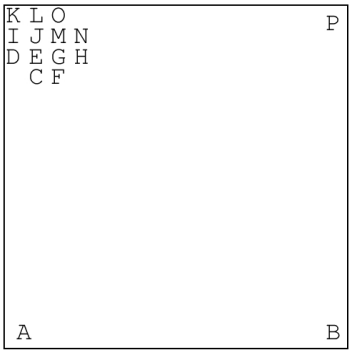
Computer Graphics and Multimedia Systems Group
Markus Kluge, Dmitri Presnov

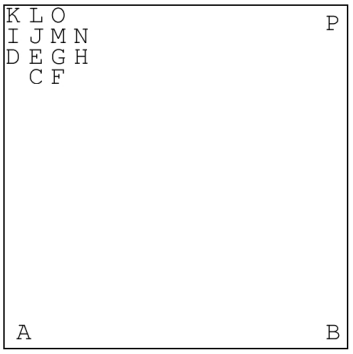
Assignment 1 [2 Points] Quadtree vs. BSP Tree

Create schematically both, a quadtree and a BSP tree on the basis of a given space with positioned objects (**A** - **P**). When creating the BSP-Trees, the subdivisions should be made in the way that the divided space divides objects into two subspaces of equal numbers. The subdivision has to be repeated until only one object per segment is present. Example:



Draw the quadtree and the BSP partitioning, and specify the corresponding trees for the following objects:





Assignment 2 [3 Points] Complex numbers

1. Given two complex numbers $p = 2+3i$ und $q = 4-i$, determine $p+q$ and $p \cdot q$.
2. Let be $c = a+ib \in \mathbb{C}$ a complex number.
   Proof the following equations:
$$Re(c) = \frac{1}{2}(c+\bar{c})$$

$$Im(c) = \frac{1}{2i}(c - \overline{c})$$

Note: For a given complex number $c = a + ib \in \mathbb{C}$ the conjugate complex number $\overline{c}$ is defined as $\overline{c} = a - ib \in \mathbb{C}$.

3. Determine the real and imaginary part of the following term:

$$\frac{1}{1+i}$$

4. Simplify the term i^{33} as far as possible.
5. Show that the product of two complex numbers $c_1,\ c_2 \in \mathbb{C}$ with $|c_1| = |c_2| = 1$ holds: $|c_1 \cdot c_2| = 1$.

Assignment 3 [2 Points] Quaternions

Given the following quaternions

$$\mathbf{q_1} = \tfrac{5}{13} - \tfrac{12}{13}k \qquad \mathbf{q_2} = \tfrac{4}{5} + \tfrac{4}{5}j \qquad \mathbf{q_3} = \tfrac{1}{17} - \tfrac{12}{17}i + \tfrac{12}{17}j$$

and let be $s_{ij} := q_i + q_j$ and $p_{ij} := q_i q_j$ the sum and the product of quaternions.

1. **Addition:** Calculate s_{12} and s_{13}.
2. **Multiplication:** Calculate p_{12} and p_{13}.
3. Determine if $q_1, q_2, q_3, s_{12}, s_{13}, p_{12}$ and p_{13} correspond to rotations in 3D.

Total points after sheet 10: 49 of 70.

Hand in: Until 28.06.2018 12:00 o'clock in mailbox of our chair (next to room 7115).