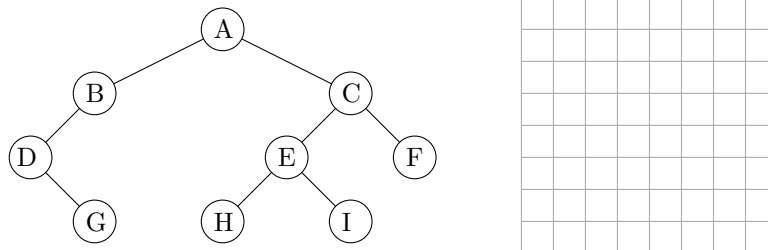


## Exercise sheet 1

### Exercise 1 – Binary trees with pre- and postorder coordinates

Let  $T = (V, E)$  be a binary tree with root  $r$ . For each  $v \in V$ , let  $x(v) := \text{preorder}(v)$  and  $y(v) := \text{postorder}(v)$ . Recall that  $T(v)$  denotes the subtree rooted at  $v$ .

You may use the graph and grid below to try an example.

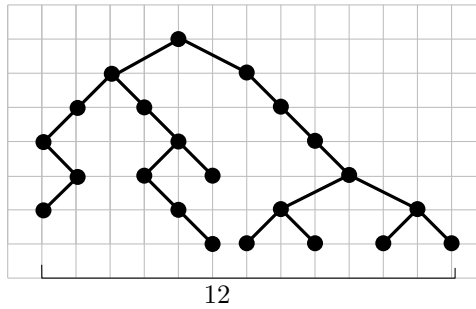


- Prove that this coordinate assignment yields a planar drawing of  $T$ .  
**4 Points**
- What is the area requirement of the generated drawing? Give tight bounds.  
**2 Points**

### Exercise 2 – Reingold - Tilford algorithm

- Prove that there are cases in which the Reingold-Tilford algorithm generates drawings with area requirements  $\Omega(n^2)$ .  
**2 Points**

- b) The given layout is based on the Reingold-Tilford algorithm and has width equal to 12. Find a drawing of smaller width and with the same drawing conventions (i.e. level grid-drawing, planar, straight-line, with parent placed (i) to the left of its right child (if it exists), (ii) to the right of its left child (if it exists) and (iii) at the middle of the span of its two children (if they exist)). **4 Points**



### Exercise 3 – Right-heavy hv-layout

Prove that there are cases in which the right-heavy hv-layout algorithm generates drawings with area requirement  $\Omega(n \log n)$ . **4 Points**

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**Due by:** Monday, October 24 before the lecture.

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