Chapter 23

SOLUTIONS TO EXERCISES 11

1. (a) Ordinary binary search tree insertion of 15 produces

which is not an AVL-tree. The search path followed before this insertion was 55(1), 35(1), 20(0), 10(0), where the figures in parentheses are the Balance fields of the corresponding nodes. The pivot node $A$ is the node containing 35. The insertion was made in the left subtree of $A$, with root the node $B$ containing 20. Since the insertion was made to the left of $B$ we are in the
situation $LL$; following the $LL$ instructions we restore the AVL property, obtaining


\[ \begin{array}{c}
55 \\
B \quad 20 \quad 75 \\
10 \quad A \quad 35 \quad 90 \\
15 \quad 25 \quad 40
\end{array} \]

(b) When we insert 22 the ordinary insertion procedure produces


\[ \begin{array}{c}
A \quad 55 \\
B \quad 20 \quad 75 \\
10 \quad C \quad 35 \quad 90 \\
15 \quad 25 \quad 40 \\
22
\end{array} \]

which is not an AVL-tree. The search path followed before the insertion of 22 was 55(1), 20(0), 35(0), 25(0); the pivot node $A$ is the node containing 55. The insertion had to be made in the left subtree of $A$, with root $B$, the node containing 20. This time the insertion had to be made to the right of $B$, so we are in the situation $LR$, with the node containing 35 playing the rôle of $C$. Following the $LR$ instructions we produce the AVL-tree