Exercise 2 "Implementation of Databases"
Due until 5 Nov, 2008 (before exercises)  
WS 08/09

2.1 B*-Tree

1. Let's assume the branch factor (the number of children) of any internal node is fixed to \( k \), including the root node.

   (a) What is the time complexity of search in B*-tree, considering only reading of internal nodes?

   (b) Discuss the differences between B-tree and B*-tree. Show that B*-tree is more efficient.

2. Let \( k = 1 \) and \( k^* = 2 \). Given the following B*-tree:

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          ●  34  ●
         /   ----
        26 34 ---- ---- 46 50 61 ----
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Perform the listed operations on the B*-tree and redraw the resulting B*-tree after each step:

a) insert 11  f) insert 35  k) remove 29
b) insert 52  g) insert 56  l) remove 25
c) insert 31  h) insert 29  m) remove 18
d) insert 18  i) remove 26  n) remove 56
e) insert 25  j) remove 34  o) remove 61

2.2 CSR and VSR

Given the following schedules:

- \( s_1 = r_1(x) \ r_2(y) \ w_1(y) \ r_3(z) \ w_3(z) \ r_2(x) \ w_2(z) \ w_1(x) \ c_1 \ c_2 \ c_3 \)
- \( s_2 = r_3(z) \ w_3(z) \ r_2(y) \ r_2(x) \ w_2(z) \ r_1(x) \ w_1(y) \ w_1(x) \ c_3 \ c_2 \ c_1 \)
- \( s_3 = r_1(x) \ r_3(x) \ w_3(y) \ w_2(x) \ c_2 \ r_4(y) \ w_4(x) \ c_2 \ r_5(x) \ c_4 \ w_5(z) \ w_1(z) \ c_1 \ c_5 \)
- \( s_4 = r_1(x) \ r_3(x) \ w_3(y) \ w_2(x) \ r_4(y) \ c_2 \ w_4(x) \ c_4 \ r_5(x) \ c_3 \ w_5(z) \ c_5 \ w_1(z) \ c_1 \)

a) Compute the conflict graphs for each of the schedules.

b) For each of the schedules, determine whether it is in CSR / VSR.