```
    <<< Exam #2 sample solution >>>
              -- Fall, 1999



1. min BH.

  (a)

      min
      -1--2--7--4--3--5--6--8-


  (b) delete_min

       min
        2        5      8
        | \      |
        7  3     6
           |
           4



2. 2P min PH

  (a) insert (meld)
                              3
                             / \
              +-----------+     4
              |  |  |  |  |    / \
             11 10  9  8  7   5   6


  (b) delete_min (meld in 2 pass)

             4
          /  / | \  \
        10  8  7  5  6
        / |
      11  9



  (c) decrease_key : 8 --> 2 (meld subtree & main tree)


             2
            /   \
```
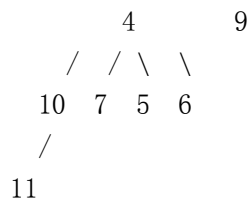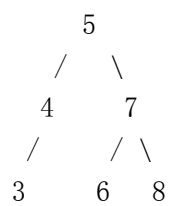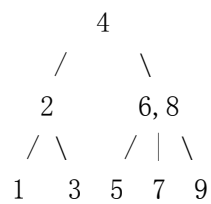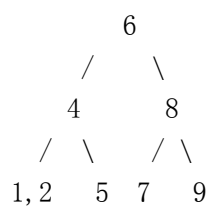
```
              4          9
           /  / \  \
        10  7  5   6
          /
       11


3. AVL insert
   : rotation types used : RR, RL, LR


                5
             /     \
            4       7
           /       / \
          3       6   8


4. 2-3 tree

  (a)
                4
             /       \
            2        6,8
           / \      / | \
          1   3    5  7  9


     delete 3:
                6
             /       \
            4         8
           / \       / \
        1,2   5    7    9


  (b)
              2,4
            /  |  \
          1    3   5,6


     insert 7:
                4
              /   \
```
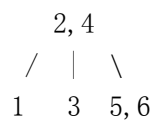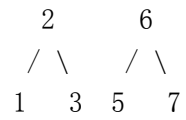
```
       2         6
      / \       / \
     1   3     5   7
```

5. RB
   rotation types / color flips used : RRr,RLb,LLr, LLb

```
         2
        /  \\
       1     6
            /  \
           4    7
          // \\
          3    5
```
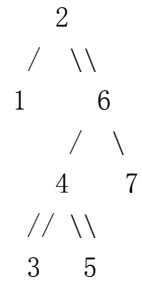
6. merits of RB

   o efficient join and split of small & big trees.
   o no waste of memory space
   o no data movement within node