

Sample solution for COP 5536/ AD 711R
Make-up Exam, Spring 2004

1. (10) See attached sheet.

2. (10)

Note that we need 2 dummy runs (run length is zero) for optimal 4-way merge which must merged first to be optimal.

- 4-way merge :

step 1: $(0,0,100,200) = 300$

step 2: $(300,300,400,500) = 1500$

step 3: $(1500, 600, 700, 800) = 3600$

- 8-way merge :

$$(100, 200, 300, 400, 500, 600, 700, 800) = 3600$$

- (a) Number of comparisons

In 4-way scheme: For each step, loser tree initialization needs 3 comparisons (one record produced) and then each record needs 2 comparisons to output.

So, the total number of comparisons in the 4-way scheme is $3+(300-1)*2 + 3+(1500-1)*2 + 3+(3600-1)*2 = 10803$

In 8-way scheme: $7 + (3600-1)*3 = 10804$.

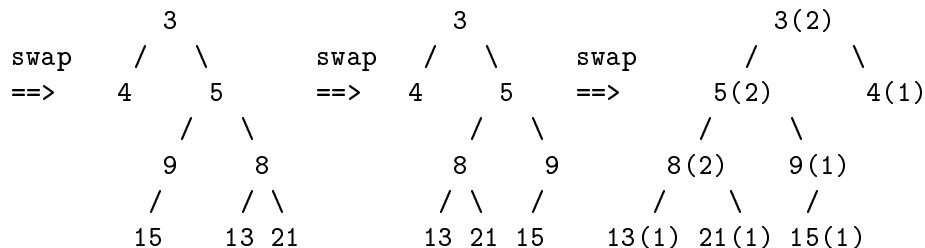
- (b) Number of disk IOs

Each merge step need 2 disk IOs: one for input and one for output. 4-way scheme needs $3*2 + 15*2 + 36*2 = 108$ and 8-way scheme $36*2 = 72$.

- (c) 8-way merge is better scheme than 4-way merge scheme due to the number of disk IOs.

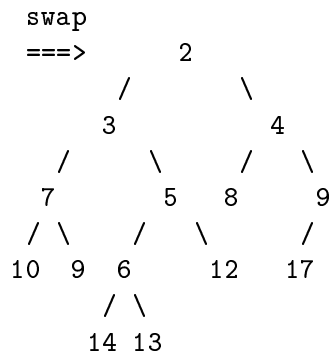
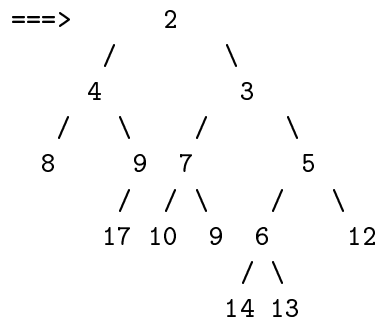
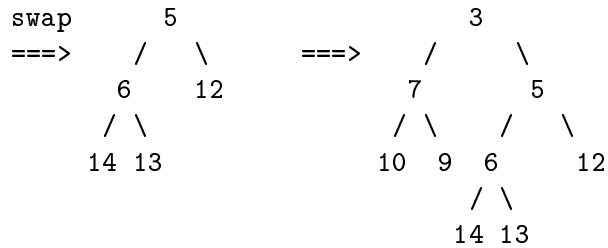
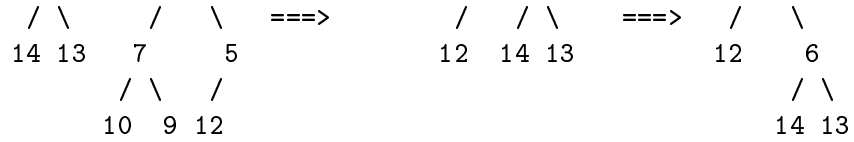
3. (10)

- (a) (4)



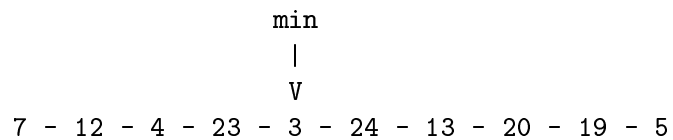
- (b) (6) Meld right subtree with smaller root and all of the other tree.

```
meld[ 6 ,      3 ]      meld[ 5,  6 ]      5
```



4. (10)

(a) (4) *Insert* does not need pairwise combine.



(b) (6)

meld(7,12) 7 ==> meld(4,23) 7 4

```

      |
      12
meld(7, 4)
==>  | | ==>  / | ==>  |
      12 23      7 23      24
              |
              12

```

```

meld(19,5) 5      meld(13, 5)      5
==>  | ==>  | | ==>  / |
      19      24 19      13 19
                      |
                      24

```

```

meld(4,5)      4
==>  / / |
      5 7 23
    / | |
    13 19 12
    |
    24

```

```

      min
      |
      V
meld(4,20)      4-----20
==>  / / |
      5 7 23
    / | |
    13 19 12
    |
    24

```