
Chap 5. Trees (5)

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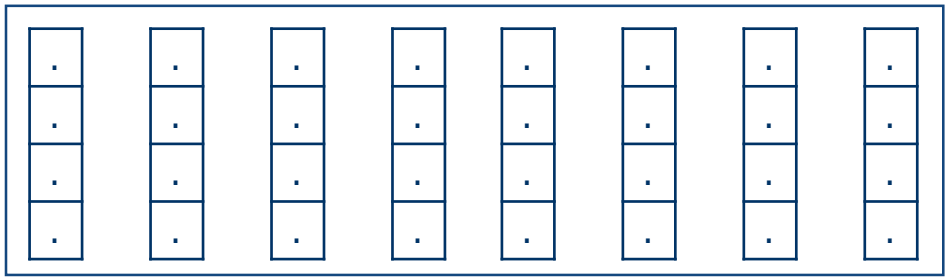
5.8 Selection Trees



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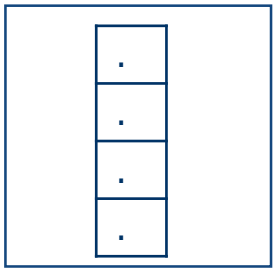

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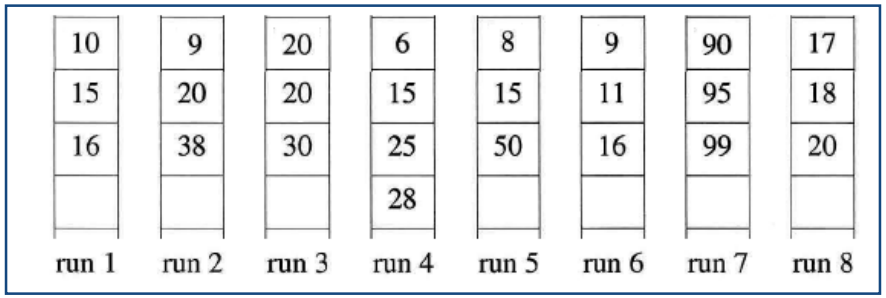

External storage

ordered sequences

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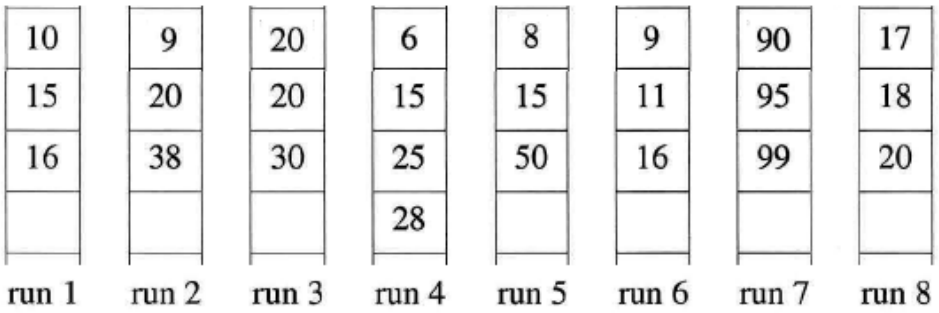
5.8 Selection Trees

5.8.1 Introduction

- ***k* ordered sequences**, called ***runs***,
  to be merged into **a single ordered sequence**.



- **The merging task can be accomplished by repeatedly outputting the record with the smallest key.**
- **For *k*>2, we can *reduce the number of comparisons* by using the selection tree; winner trees and loser trees.**

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5.8.2 Winner Trees

- **A *winner tree* is a complete binary tree in which each node represents the smaller of its two children.**

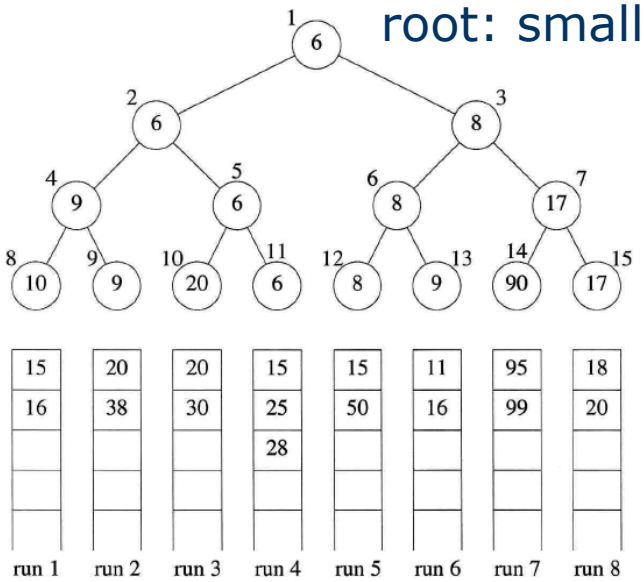

Figure 5.32: Winner tree for $k = 8$, showing the first three keys in each of the eight runs

sequential allocation (complete binary tree)

Each node contains only a pointer to the record

Leaf node: the first record in the corresponding run

Runs : ordered sequences

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5.8.2 Winner Trees

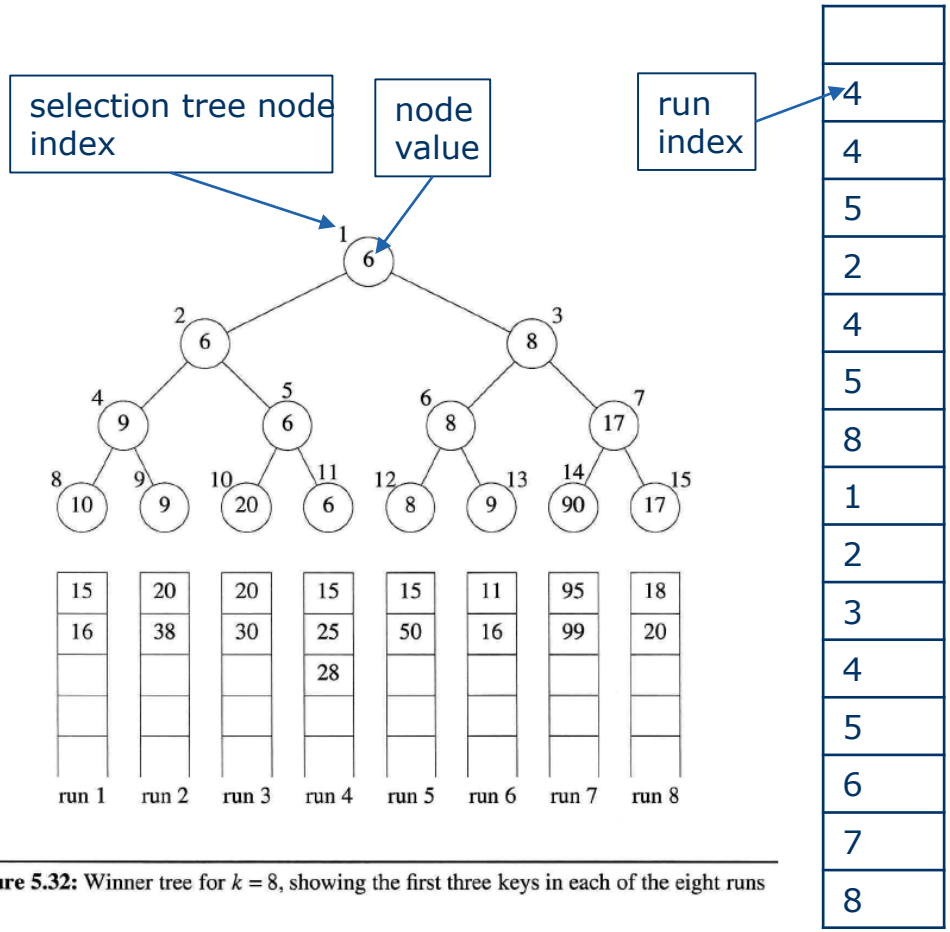
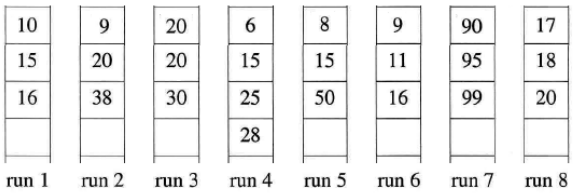


Figure 5.32: Winner tree for $k = 8$, showing the first three keys in each of the eight runs

implemetation of winner tree

- section tree node arry

Each node contains only a pointer to the record



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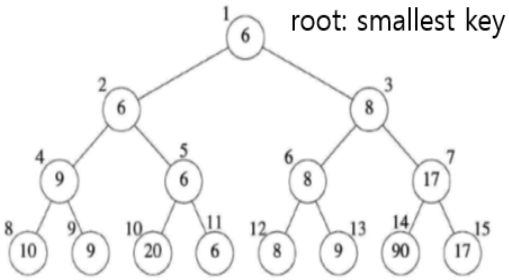
5.8.2 Winner Trees



	0	1	2	3	4	5	6	7	8
sortedIdx	-	1	1	1	1	1	1	1	1

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
winTree	-	4	4	5	2	4	5	8	1	2	3	4	5	6	7	8

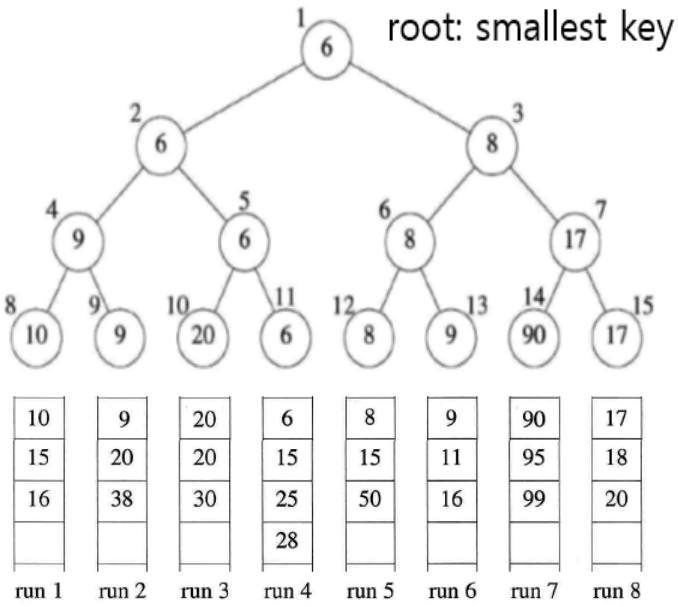
nums

각 레코드의 **1**번째 원소들을 정렬해야 함

10	9	20	6	8	9	90	17
11	10	21	7	9	10	91	18
12	11	22	8	10	11	92	19
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
19	18	29	15	17	18	99	26

5.8.2 Winner Trees

4(5)
4(2)
5
2
4
5
8
1
2
3
4
5
6
7
8



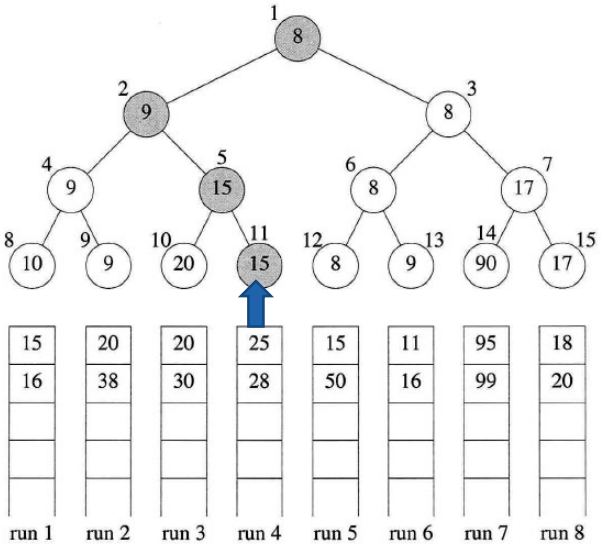


Figure 5.33: Winner tree of Figure 5.32 after one record has been output and the tree restructured (nodes that were changed are shaded)

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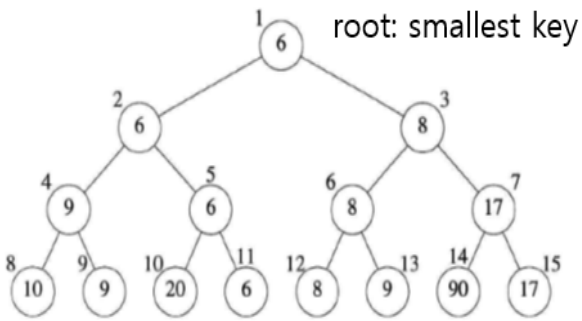
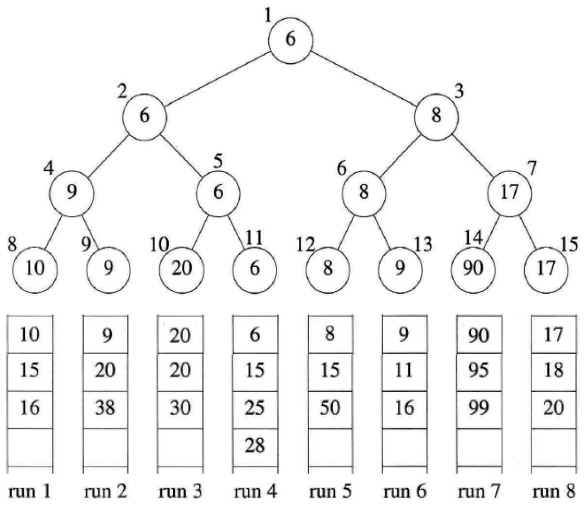
5.8.2 Winner Trees

- **Analysis of merging runs using winner trees**
  - *Let n be the number of records in all k* runs.
  - The number of levels in the tree is $[\log_2 k+1]$
  - The time to restructure the tree is $O(\log_2 k)$.
  - The time required to merge all n records is $O(n\log_2 k)$.
  - The time required to set up the selection tree the first time is $O(k)$.
  - The total time needed to merge the k runs is $O(n\log_2 k)$.



5.8.3 Loser Trees

- **A selection tree in which each nonleaf node retains a pointer to the loser is called a *loser tree*.**



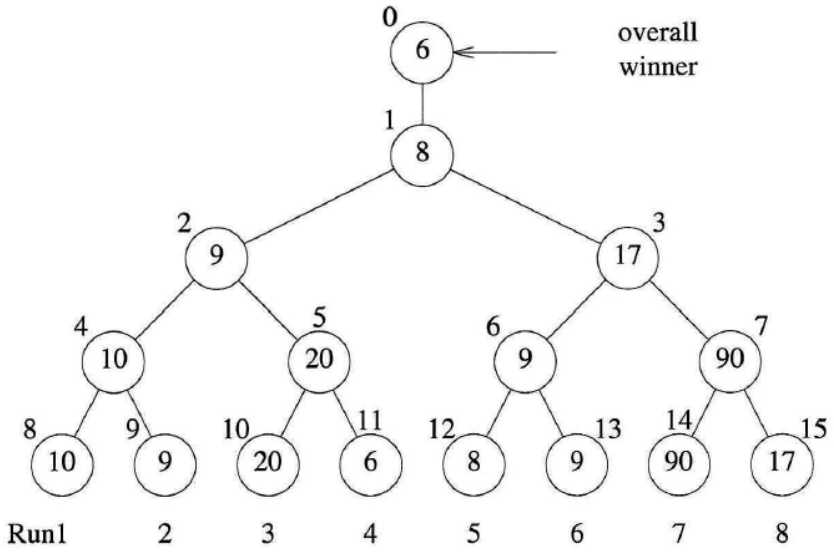


Figure 5.34: Loser tree corresponding to winner tree of Figure 5.32

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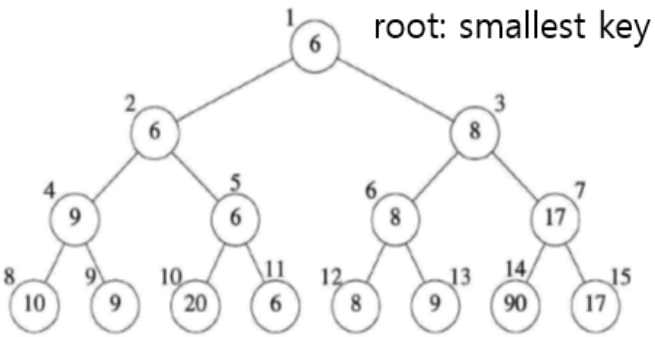
5.8.3 Loser Trees

- **In winner tree, following the output of the overall winner, the tree is restructured by playing tournaments along the path from node 11 to node 1.**
- ***In loser, the records with which the tournaments are to be played* are readily available *from the parent nodes*.**
  - As a result, *sibling nodes along the path from 11 to l are not accessed*.



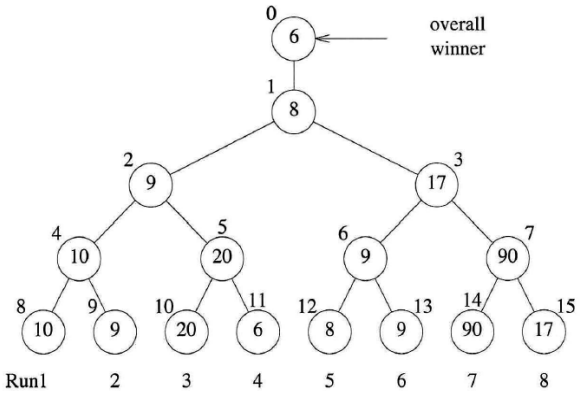


Figure 5.34: Loser tree corresponding to winner tree of Figure 5.32