

Data Structures: Solution of Final Exam

Fall, 2004

1.

F, F, F, T, F,
 T, F, F, F, T,
 F, T, T, F, F
 T, F, T.

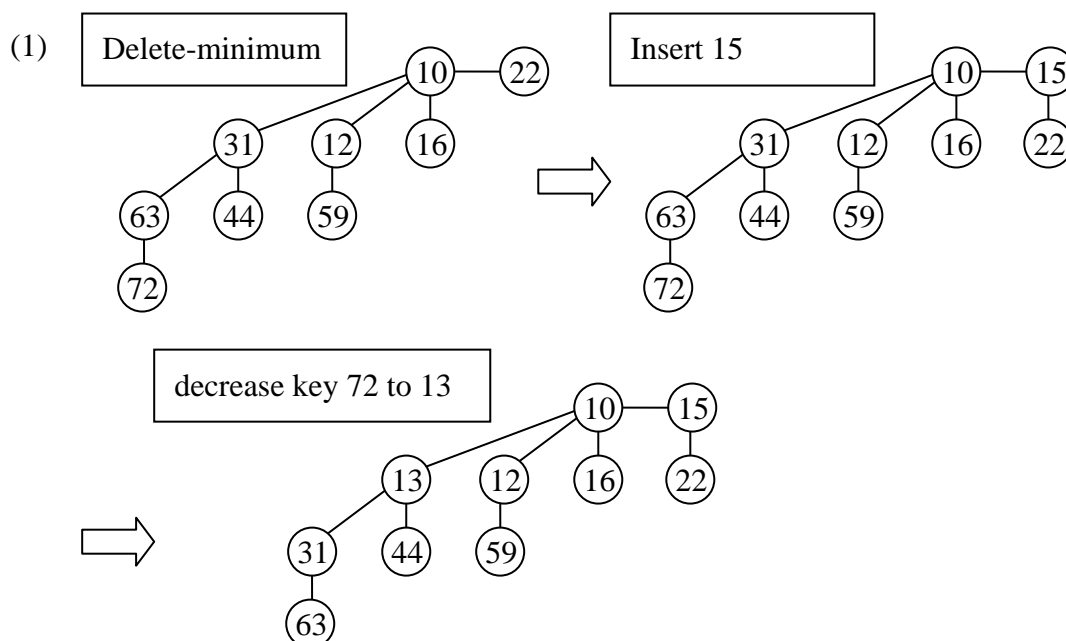
2.

1. **True**, because each *find* always takes $O(1)$, and then, unaffectedly, each *union* always takes $O(1)$.
2. **True**. Since we start with singletons, a *find* that takes k steps must proceed with k *unions*. The bottom line is that each upward move must correspond to a union in the beginning.

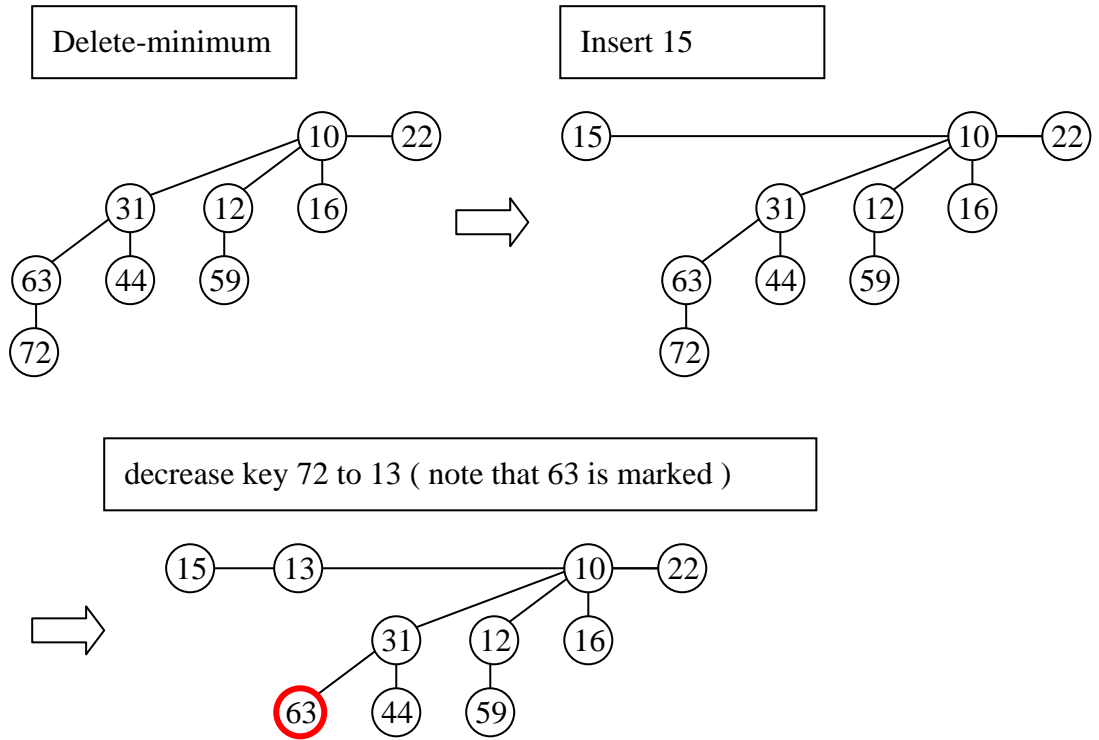
3.

	Find minimum	Delete minimum	Union	Decrease Key
Min-Binomial	$O(\log n)$	$O(\log n)$	$O(\log n)$	$O(\log n)$
Min-Fibonacci heap	$O(1)$	$O(n)$	$O(1)$	$O(n)$
Min-max heap	$O(1)$	$O(\log n)$	$O(n)$	$O(\log n)$

4.



(2)



5. The details are as follows.

pass	S	b	c	d	e	f	g	h
1	a	5, a	∞	2, a	∞	8, a	∞	∞
2	ad	5, a	∞	2, a	10, d	8, a	7, d	∞
3	adb	5, a	6, b	2, a	10, d	8, a	7, d	∞
4	adbc	5, a	6, b	2, a	9, c	8, a	7, d	10, c
5	adbcg	5, a	6, b	2, a	9, c	8, a	7, d	10, c
6	adbcgf	5, a	6, b	2, a	9, c	8, a	7, d	10, c
7	adbcgfe	5, a	6, b	2, a	9, c	8, a	7, d	10, c
8	adbcgfeh	5, a	6, b	2, a	9, c	8, a	7, d	10, c

The final answer is as follows:

	The path	cost
Shortest path form a to b	$a \rightarrow b$	5
Shortest path form a to c	$a \rightarrow b \rightarrow c$	6
Shortest path form a to d	$a \rightarrow d$	2
Shortest path form a to e	$a \rightarrow b \rightarrow c \rightarrow e$	9
Shortest path form a to f	$a \rightarrow f$	8
Shortest path form a to g	$a \rightarrow d \rightarrow g$	7
Shortest path form a to h	$a \rightarrow b \rightarrow c \rightarrow h$	10

6.

- (1) No. The leftmost data of the diagram obviously violates the requirement.
- (2) No. The leftmost data of the diagram obviously violates the requirement.
- (3) Yes. There exists some partition which tends to be sorted.
- (4) No. It should resemble

- (5) Yes, the 9th bar seems to be pivot.

7.

- (a) $2 \rightarrow 3 \rightarrow 4$
- (b) $2 \rightarrow 3 \rightarrow 6 \rightarrow 1$
- (c) $2 \rightarrow 9 \rightarrow 6 \rightarrow 3 \rightarrow 0$