1) 1 2 3 4 5 6 7 → $\boxed{6}$

i j

$-\infty$ 7 6 5 4 3 2 1

6 7

1, ..., n

$1+2+\dots n-1 = \frac{n(n-1)}{2}$

6 7 5 4 ...

2

1 · 2 · 3

$1+2+3+\dots+n = \frac{n+1}{2} \cdot n$

5 6 7 4

$1+2+3+4+5+6 = \boxed{21} \Leftrightarrow \boxed{\frac{n}{2} \cdot (n-1)}$

3 2 1

7 6 5 4

~~1~~ 2 3 4 5 6 7 1

2)

1 2 3 4 5 6 7 7 6 5

6 7

$\boxed{2n-1}$

8 7 6 5 4 3 2 1

i

5 6 7 8

1 2 3 4

j j j j j

→ 1 2 3 4 5 6 7 8

3)

$$\boxed{O(n \cdot \log n)}$$

$$T(n) = O(n) + 2 \cdot T\left(\frac{n}{2}\right) =$$

$$= O(n) + 2 \cdot O\left(\frac{n}{2}\right) + 4 \cdot T\left(\frac{n}{4}\right) =$$

$$= \sum_{i=0}^{\log n} 2^i \cdot O\left(\frac{n}{2^i}\right) = O(n \cdot \log n)$$

$$T(n) = 2 \cdot T\left(\frac{n}{2}\right) + O(n)$$

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$$T(n) = O(n \log n).$$

5)

4 7 8 1 3 2 3

p i j

$\boxed{n=1}$

4 3 2 1 3 8 7

3 3 2 1 $\underline{\underline{4}}$ 8 7

Sa & 17

$\boxed{1}$ 2 3 4 5 $n-1$

$n-2$ 4

$n-3$ 3

$\vdots$ 2

1 1

$$\boxed{\frac{n(n-1)}{2}} = O(n^2)$$

$$\frac{(n-1+1)(n-1)}{2}$$

$$\frac{n^2-n}{2} \rightarrow O(n^2)$$

$$\frac{n^2}{2} - \frac{n}{2}$$

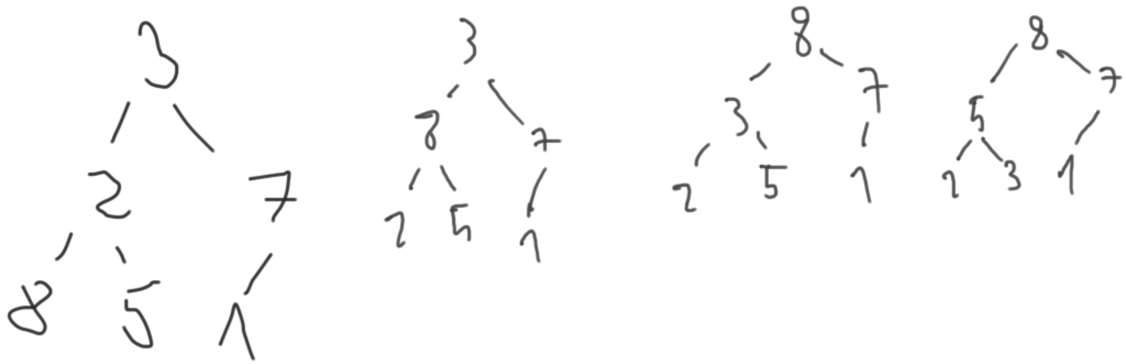
6)

3 2 1 8 5 7 MAX

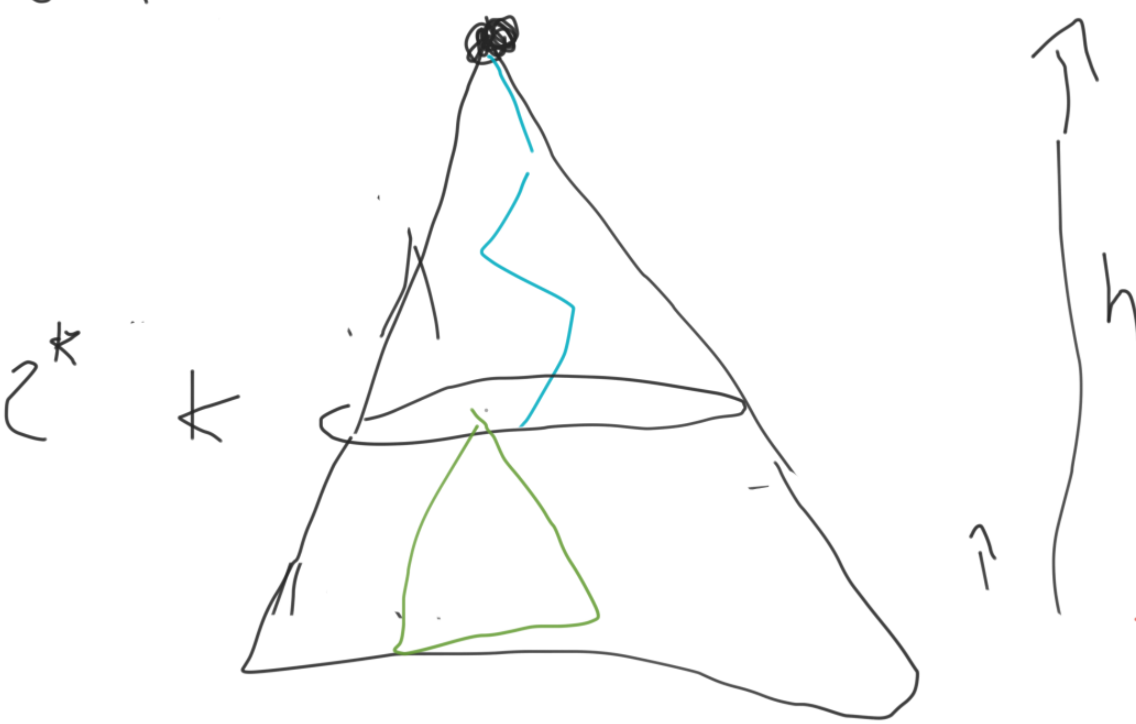
for($i = \frac{n}{2}$; $i \geq 0$; i--)

heap_down(i)

[8, 5, 7, 2, 3, 1]



6 call



$$T(n) = O(n) = O(\log n)$$

$$i = \frac{n}{2}$$

$$\cancel{\frac{n}{2} \cdot O(\log n) = O(n \log)}$$

$$2^0 \cdot O(h) + 2^1 \cdot O(h-1) + \dots + 2^{h-1} O(1)$$

$$h = \log(n)$$

$$2^k \cdot O(h-k)$$

$$\sum_{k=0}^{h-1} 2^k \cdot O(h-k) = \sum_{k=1}^{h-1} 2^{h-k} O(k)$$

$$\sum_{k=1}^{n} \frac{2^n}{2^k} \cdot O(k) = 2^n \sum_{k=1}^{n} O\left(\frac{k}{2^k}\right) = O(2^n) =$$

$$= O(n)$$

$$\sum_{k=1}^{\infty} \frac{k}{2^k} < 2$$

$n =$ 177 [illegible]

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots = 1$$

7) a) $O(n)$

b) $O(1)$

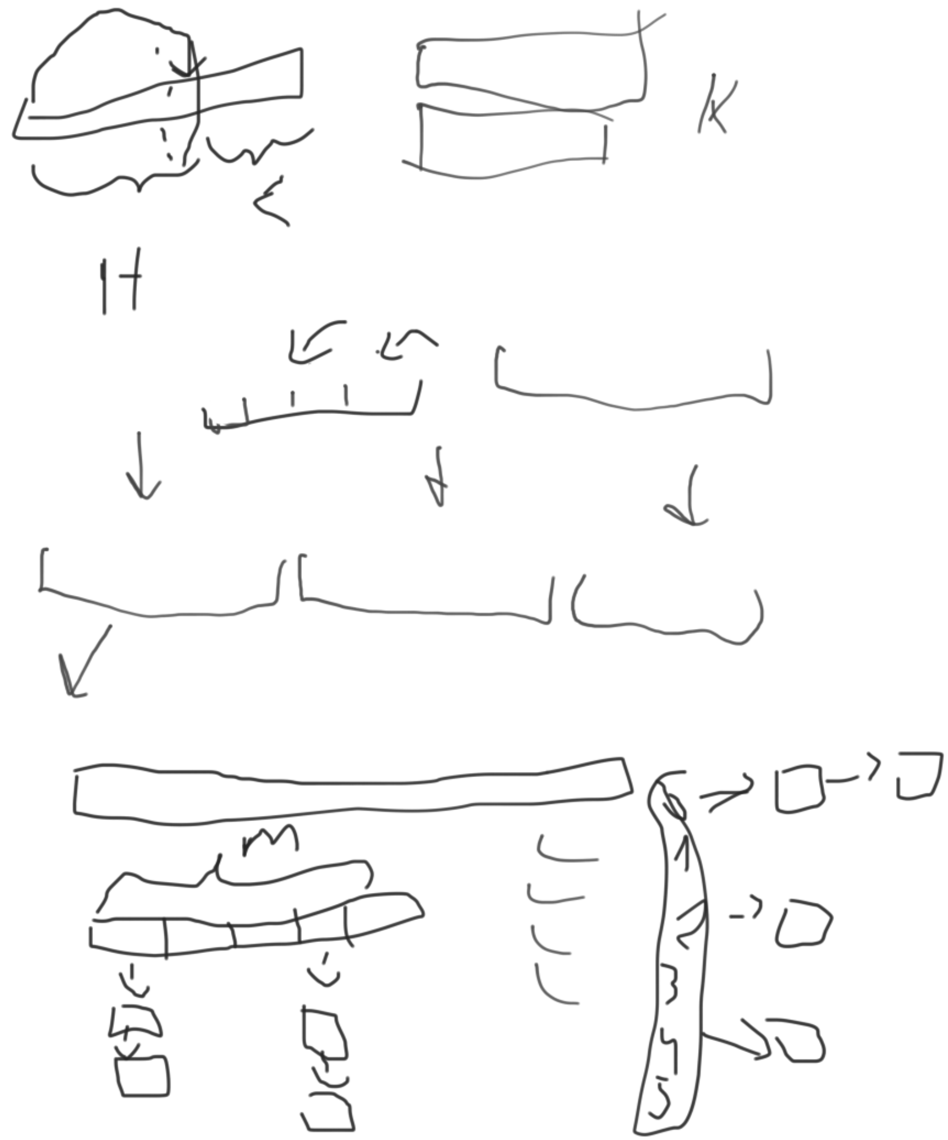
c) $O(1)$

d) $O(1)$

e) $O(m)$

f) $O(m+n)$

g) $10 + n$



8)

[illegible]	B	A	W
a)	$n \log n$		
b)	$n \log n$		n^2
c	$n \log n$		
d	n	n^2	n^2
e	$n + m$		
f	n	$n + \frac{n^2}{k} + k$	n^2
g	$n \cdot k$		

10)

$s \to 1$

$R \to \left\lfloor \frac{i}{2} \right\rfloor$

$L \to 2i$

$P \to 2i+1$

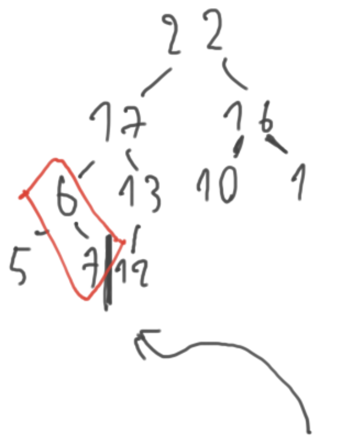
$s \to 0$

$R \quad \left\lfloor \frac{i+1}{2} \right\rfloor - 1$

$L \to 2(i+1) - 1$

$P \to 2(i+1)$

11)



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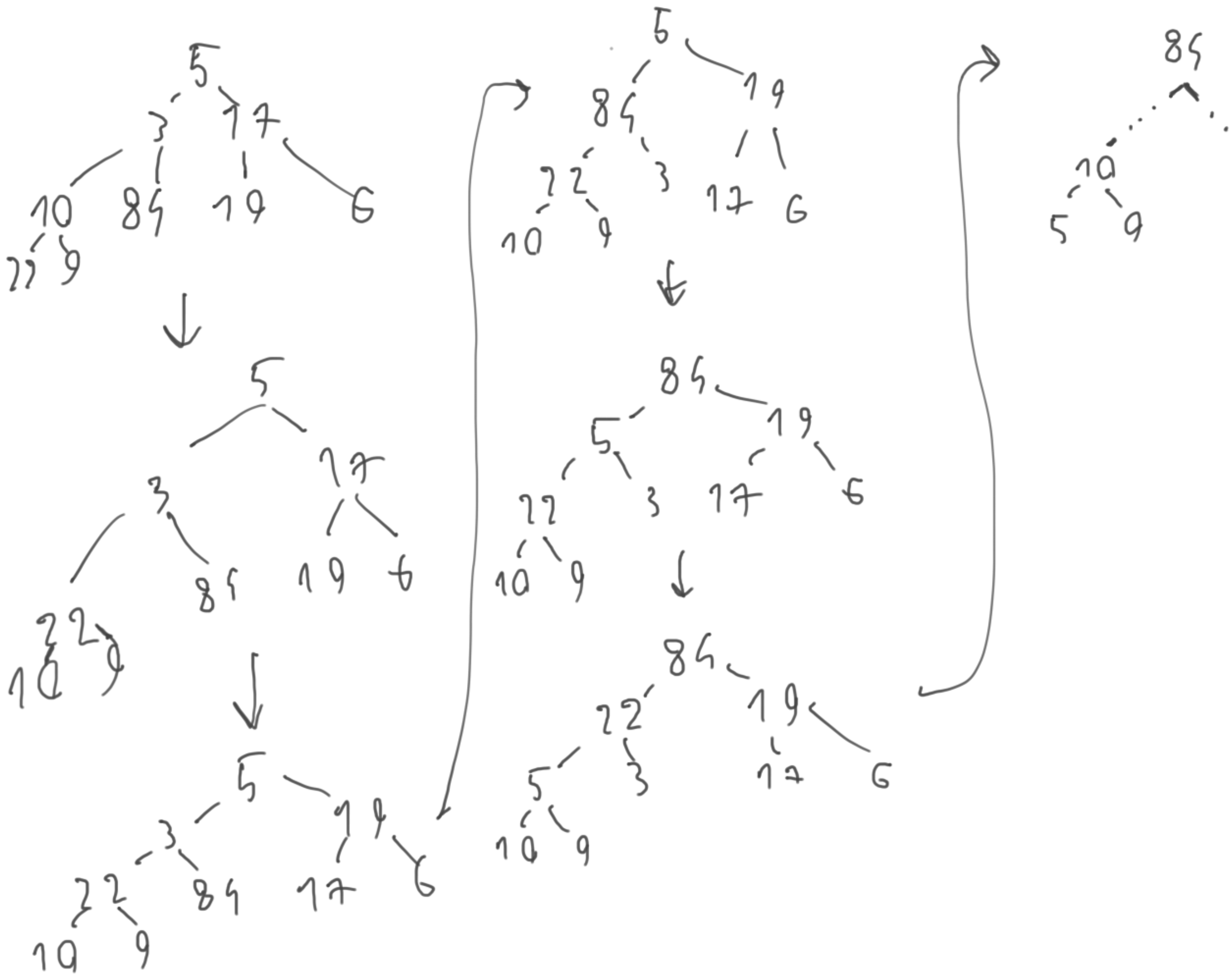
11)



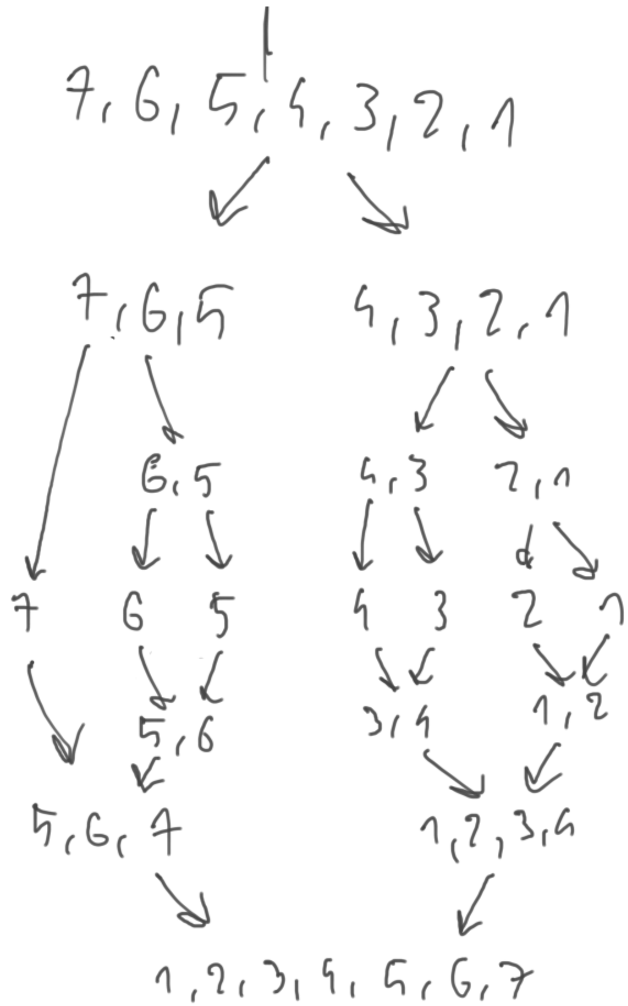
9, 22, 6, 19, 14, 10, 17, 3, 5

6, 9, 19, 22   10, 14, 17   3, 5

6, 9, 10, 14, 17, 19, 22   3, 5

3, 5, 6, 9 ..., 22

14



15)

7, 6, 5, 4, 3, 2, 1

4 6 5 7 3 2 1

i → ← j

4 1 5 7 3 2 6

i j

4 1 2 7 3 5 6

i j

4 1 2 3 7 5 6

3 1 2 4 7 5 6

16

7, 6, 5, 4, 3, 2, 1

i → → → → j

18 $\left\lfloor \frac{x-a}{b-a} \cdot n \right\rfloor$

19 $\boxed{\frac{x}{10^k} \bmod 10}$

10^1

$100 = 10^2$

99

$\log_{10} 10 = 1$

$\log_{10} 10^2 = 2$

$\lfloor \log_{10} 99 < 2 \rfloor$

$= 1$

$\boxed{\lfloor \log_{10} x \rfloor + 1}$