Assignment 3

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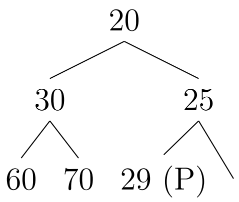
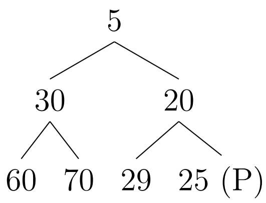
1. Heap Operations

1.1. deleteMin()



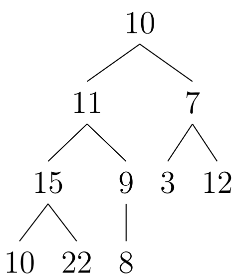
1.2. insert(5)



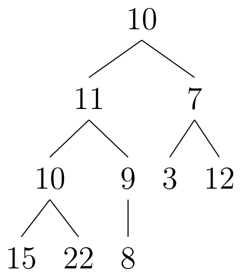
2. Binary Tree

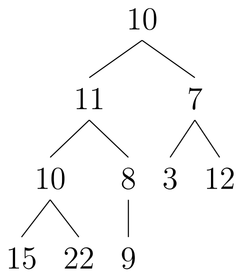
2.1. Essential complete binary tree

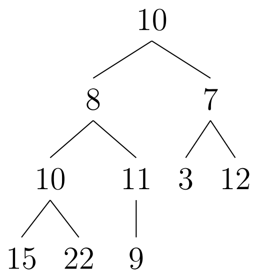
[10 11 7 15 9 3 12 10 22 8]

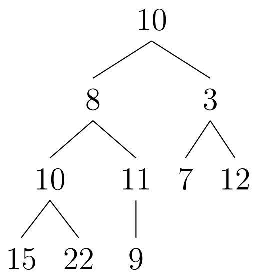


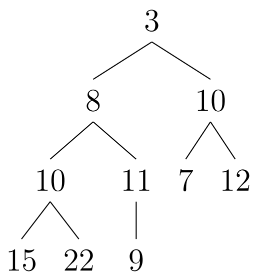
2.2. Min heap



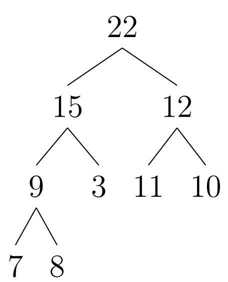








2.3. Max Heap



Sorted: [22 15 12 11 10 9 8 7 3]

3. LCS

X= CACMYCCA Y: YMCMAMYYCMA

Y	M	C	M	A	M	Y	Y	C	M	A
0	0	0	0	0	0	0	0	0	0	0
0	0	1	1	1	1	1	1	1	1	1
0	0	1	1	2	2	2	2	2	2	2
0	0	1	1	2	2	2	2	3	3	3
0	1	1	2	2	3	3	3	3	4	4
1	1	1	2	2	3	4	4	4	4	4
1	1	2	2	2	3	4	4	5	5	5
1	1	2	2	2	3	4	4	5	5	5
1	1	2	2	3	3	4	4	5	5	6

4. Floyd's Algorithm

6 iterations.

D^0, P^0

0	2	-	1	8
6	0	3	2	-
-	-	0	4	-
-	-	2	0	3
3	-	-	-	0

-	2	-	4	5
1	-	3	4	-
-	-	-	4	-
-	-	3	-	5
1	-	-	-	-

D^1, P^1

0	2	-	1	8
6	0	3	2	14
-	-	0	4	-
-	-	2	0	3
3	5	-	4	0

-	2	-	4	5
1	-	3	4	1
-	-	-	4	-
-	-	3	-	5
1	1	-	1	-

D^2, P^2

0	2	5	1	8
6	0	3	2	14
-	-	0	4	-
-	-	2	0	3
3	5	-	4	0

-	2	2	4	5
1	-	3	4	1
-	-	-	4	-
-	-	3	-	5
1	1	-	1	-

D^3, P^3

0	2	5	1	8
6	0	3	2	14
-	-	0	4	-
-	-	2	0	3
3	5	-	4	0

-	2	2	4	5
1	-	3	4	1
-	-	-	4	-
-	-	3	-	5
1	1	-	1	-

D^4, P^4

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

-	2	4	4	4
1	-	3	4	5
-	-	-	4	4
-	-	3	-	5
1	1	-	1	-

D^5, P^5

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

-	2	4	4	4
1	-	3	4	5
-	-	-	4	4
5	-	3	-	5
1	1	-	1	-

5. Merge Heap

The proposed algorithm is incorrect, sift down must be called on every node before n/2, where n is the size of the entire heap. Since $n_2 \geq n_1$, the algorithm will only be correct when $n_1 == n_2$.

```
for (i = 1; i <= n2, i++):
    bt1[n1 + i] = bt2[i]
last = n1 + n2
for (i = last / 2; i > 0, i--):
    siftDown(bt1, i)
```

This algorithm will run in $\Theta(n_2) + \Theta(n_1 + n_2)$

6. Binomial Coefficient

$\binom{8}{6} = 28$

	0	1	2	3	4	5	6	7	8
0	1								
1	1	1							
2	1	2	1						
3	1	3	3	1					
4	1	4	6	4	1				
5	1	5	10	10	5	1			
6	1	6	15	20	15	6	1		
7	1	7	21	35	35	21	7	1	
8	1	8	28	56	70	56	28	8	1

Compute $\binom{8}{8-6}$ instead

	0	1	2
0	1		
1	1	1	
2	1	2	1
3	1	3	3
4	1	4	6
5	1	5	10
6	1	6	15
7	1	7	21
8	1	8	28

7. Sum of Subsets

7.1. Recurrence

$$A_{i,s} = A_{i,s-1} \mid\mid A_{i-p[s],s-1}$$

7.2. Pseudo Code

```
for i in B:
  for j in B[i]:
    if p[i] >= y:
      B[i][j] = B[i-1][j]
    else:
      B[i][j] = B[i-1][j-p[i]]
```

7.3. Example

	0	1	2	3	4	5	6
1	$\uparrow T$	T	F	F	F	F	F
2	$\uparrow T$	$\uparrow T$	T	T	F	F	F
4	$\uparrow T$	$\uparrow T$	$\uparrow T$	$\uparrow T$	T	T	T