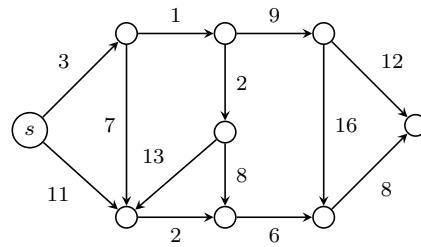


## Exercise 5

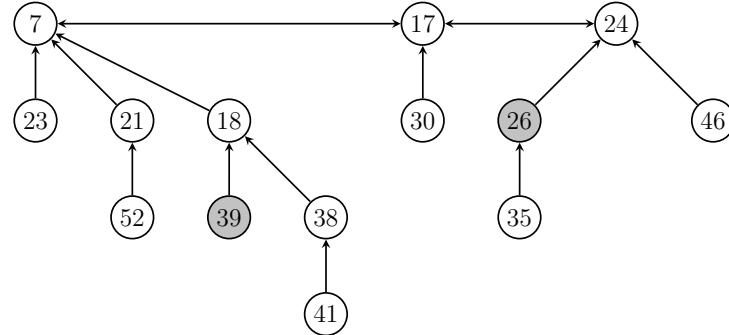
### Task 1

Use Dijkstras algorithm to compute all shortest paths starting at node  $s$ .



### Task 2

Given the following Fibonacci heap:



Perform the following operations:

**delete-min**, **decrease-key**("52", 9), **decrease-key**("46", 3), **insert**(42), **delete-min**, **decrease-key**("35", 7)

### Task 3

Show Theorem 18 from the lecture: For all  $k \geq 0$  we have

$$F_k = \frac{1}{\sqrt{5}} \left( \frac{1 + \sqrt{5}}{2} \right)^{k+1} - \frac{1}{\sqrt{5}} \left( \frac{1 - \sqrt{5}}{2} \right)^{k+1}$$

### Task 4

Prove or disprove: The height of a Fibonacci heap of size  $n$  is at most  $O(\log n)$ .