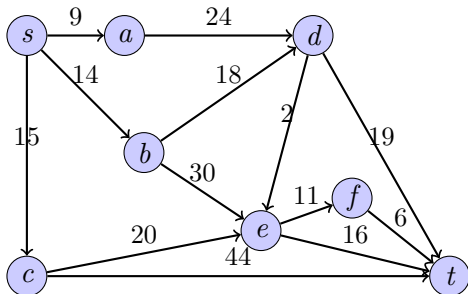
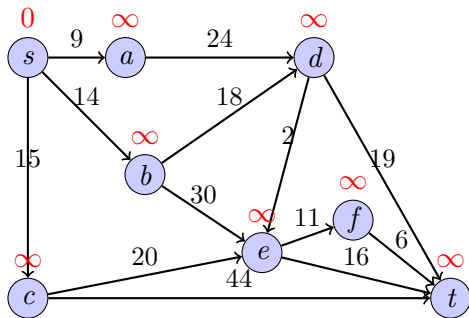


# Dijkstra's algorithm: an example



# Initialization

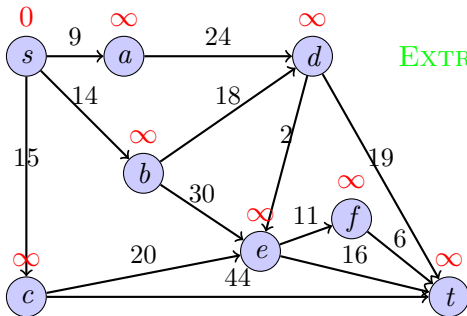
$$S = \{\}$$
$$PQ = \{s(0), a(\infty), b(\infty), c(\infty), d(\infty), e(\infty), f(\infty), t(\infty)\}$$



# Step 1: EXTRACTMIN

$$S = \{\}$$

$$PQ = \{s(0), a(\infty), b(\infty), c(\infty), d(\infty), e(\infty), f(\infty), t(\infty)\}$$

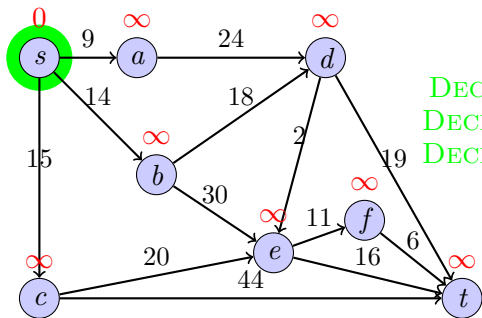


EXTRACTMIN returns  $s$

# Step 1: DECREASEKEY

$$S = \{s\}$$

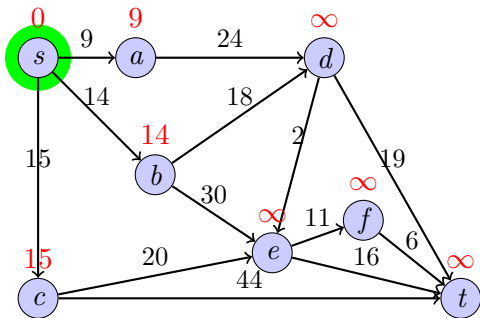
$$PQ = \{a(\infty), b(\infty), c(\infty), d(\infty), e(\infty), f(\infty), t(\infty)\}$$



DECREASEKEY(a, 9)  
DECREASEKEY(b, 14)  
DECREASEKEY(c, 15)

## Step 2: EXTRACTMIN

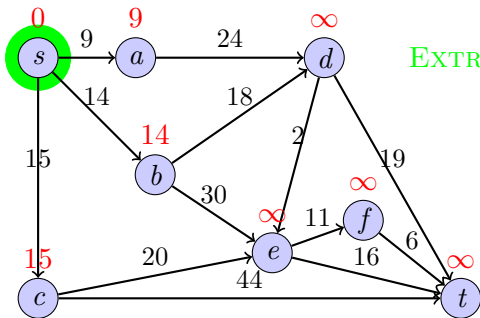
$S = \{s\}$   
 $PQ = \{a(9), b(14), c(15), d(\infty), e(\infty), f(\infty), t(\infty)\}$



## Step 2: EXTRACTMIN

$$S = \{s\}$$

$$PQ = \{a(9), b(14), c(15), d(\infty), e(\infty), f(\infty), t(\infty)\}$$

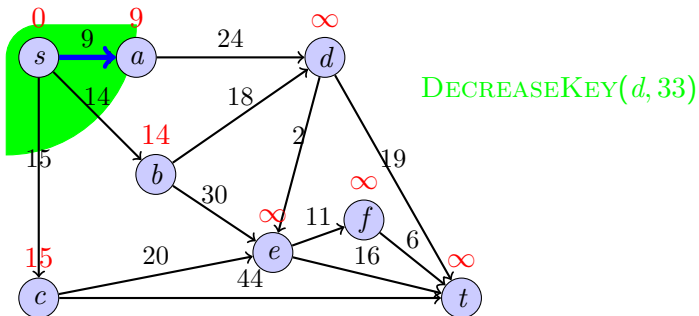


EXTRACTMIN returns  $a$

## Step 2: DECREASEKEY

$$S = \{s, a\}$$

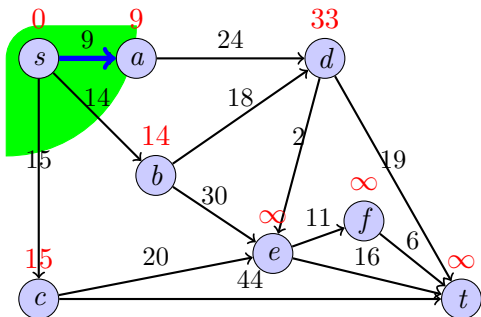
$$PQ = \{b(14), c(15), d(\infty), e(\infty), f(\infty), t(\infty)\}$$



# Step 3: EXTRACTMIN

$$S = \{s, a\}$$

$$PQ = \{b(14), c(15), d(33), e(\infty), f(\infty), t(\infty)\}$$

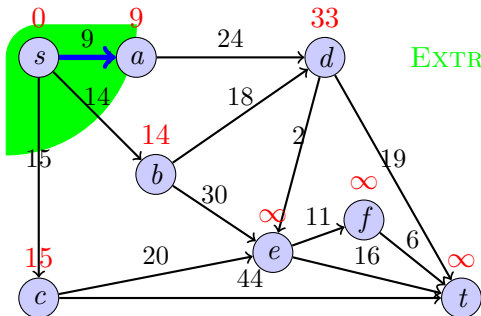




# Step 3: EXTRACTMIN

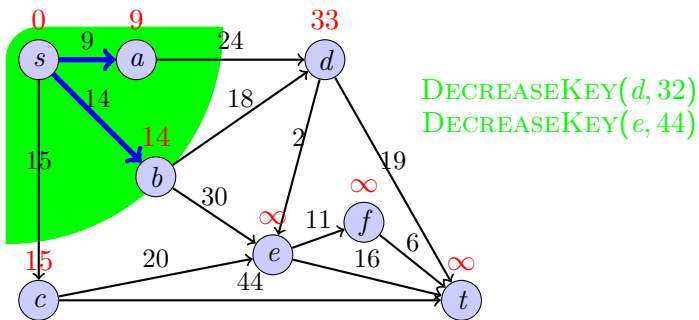
$$S = \{s, a\}$$

$$PQ = \{b(14), c(15), d(33), e(\infty), f(\infty), t(\infty)\}$$



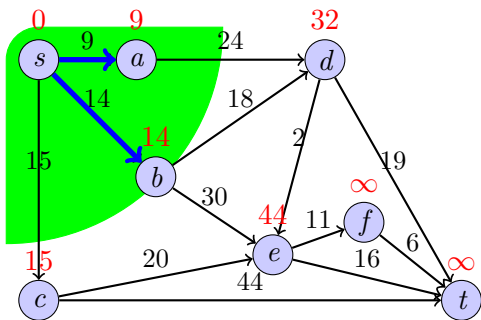
# Step 3: DECREASEKEY

$S = \{s, a, b\}$   
 $PQ = \{c(15), d(33), e(\infty), f(\infty), t(\infty)\}$



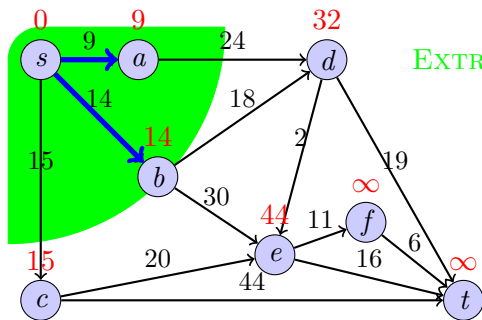
# Step 4: EXTRACTMIN

$S = \{s, a, b\}$   
 $PQ = \{c(15), d(32), e(44), f(\infty), t(\infty)\}$



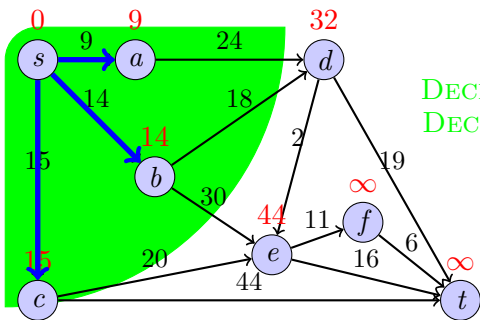
# Step 4: EXTRACTMIN

$$S = \{s, a, b\}$$
$$PQ = \{c(15), d(32), e(44), f(\infty), t(\infty)\}$$



# Step 4: DECREASEKEY

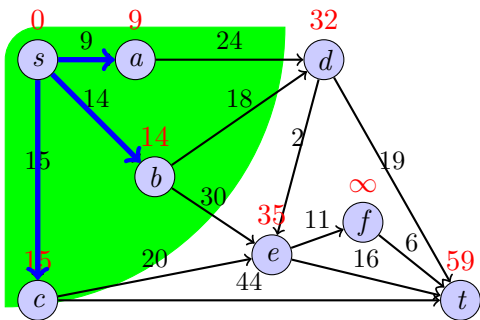
$S = \{s, a, b, c\}$   
 $PQ = \{d(32), e(44), f(\infty), t(\infty)\}$



DECREASEKEY( $e, 35$ )  
DECREASEKEY( $t, 59$ )

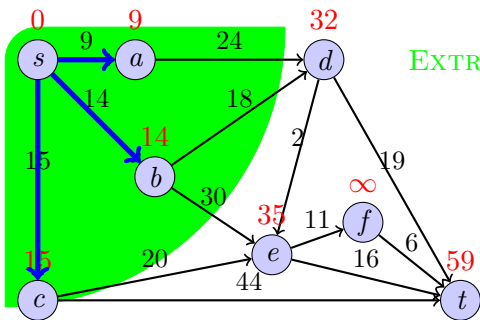
# Step 5: EXTRACTMIN

$S = \{s, a, b, c\}$   
 $PQ = \{d(32), e(35), t(59), f(\infty)\}$



# Step 5: EXTRACTMIN

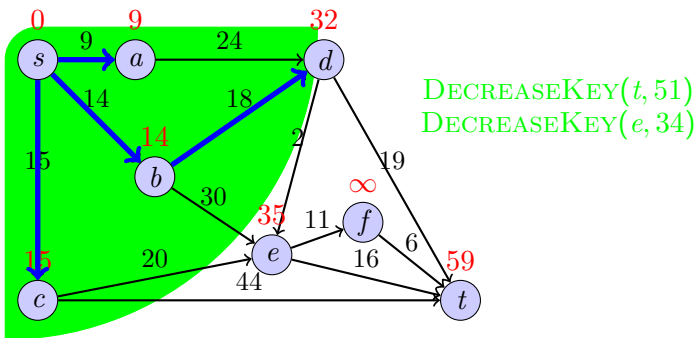
$$S = \{s, a, b, c\}$$
$$PQ = \{d(32), e(35), t(59), f(\infty)\}$$



EXTRACTMIN returns  $d$

# Step 5: DECREASEKEY

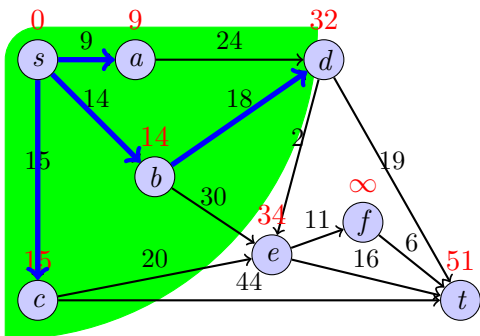
$$S = \{s, a, b, c, d\}$$
$$PQ = \{e(35), t(59), f(\infty)\}$$





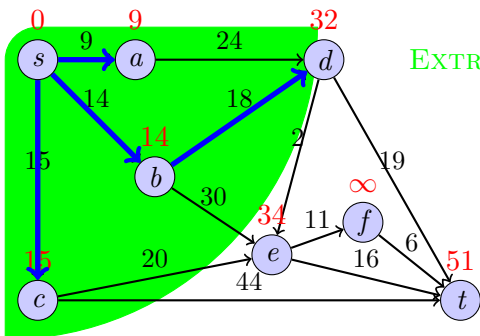
# Step 6: EXTRACTMIN

$$S = \{s, a, b, c, d\}$$
$$PQ = \{e(34), t(51), f(\infty)\}$$



# Step 6: EXTRACTMIN

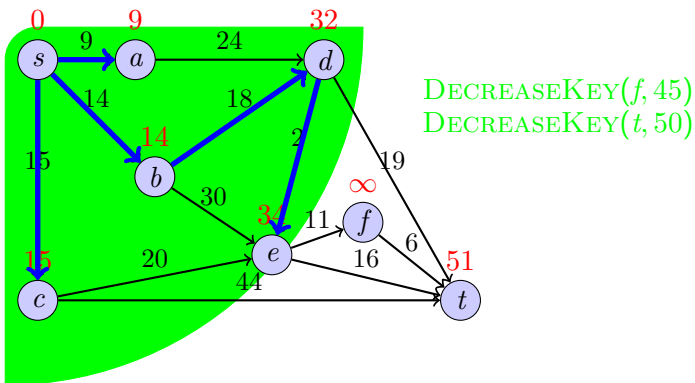
$$S = \{s, a, b, c, d\}$$
$$PQ = \{e(34), t(51), f(\infty)\}$$



EXTRACTMIN returns  $e$

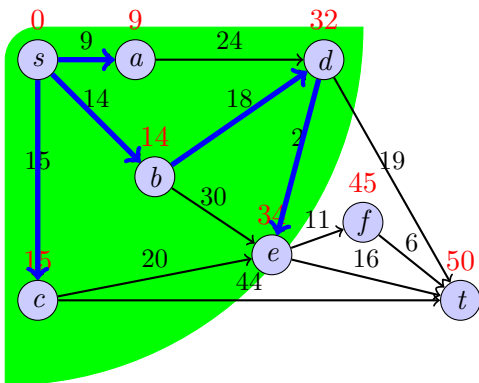
# Step 6: DECREASEKEY

$S = \{s, a, b, c, d, e\}$   
 $PQ = \{f(45), t(50)\}$



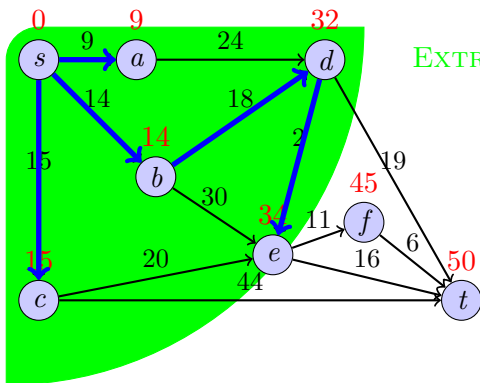
# Step 7: EXTRACTMIN

$$S = \{s, a, b, c, d, e\}$$
$$PQ = \{f(45), t(50)\}$$



# Step 7: EXTRACTMIN

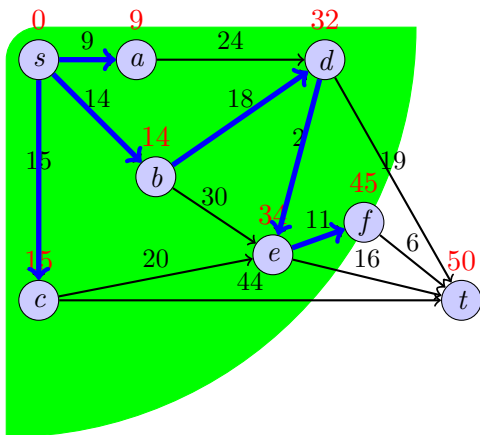
$$S = \{s, a, b, c, d, e\}$$
$$PQ = \{f(45), t(50)\}$$



EXTRACTMIN returns  $f$

# Step 7: DECREASEKEY

$$S = \{s, a, b, c, d, e, f\}$$
$$PQ = \{t(50)\}$$



# Step 8: EXTRACTMIN

$$S = \{s, a, b, c, d, e, f, t\}$$
$$PQ = \{\}$$

