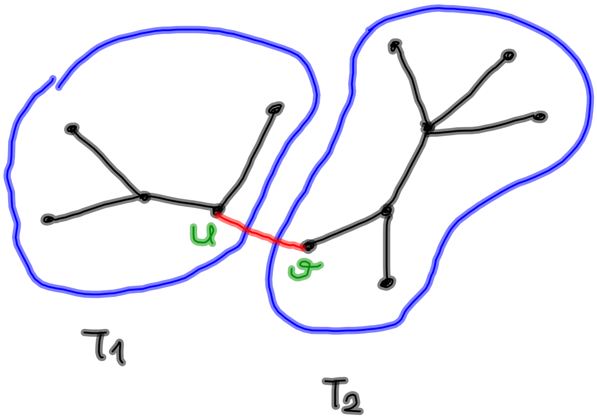
Optimal Yapı

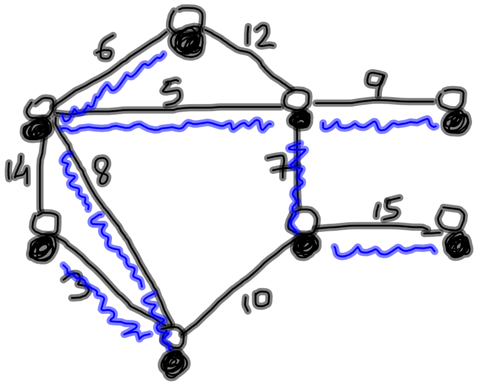


Açgözlü Algoritma seçim özelliği

Yerel olarak en uygun seçim genel olarak en uygundur.

Teorem: T bir $G=(V,E)$ grafının MKA'sı olsun ve $A \subseteq V$ olsun. (u,v) ayrıtı A yı $V-A$ ya bağlayan min ağırlıklı ayrıt olsun. O zaman $(u,v) \in T$ dir.

Prim Algoritması



● ∈ A

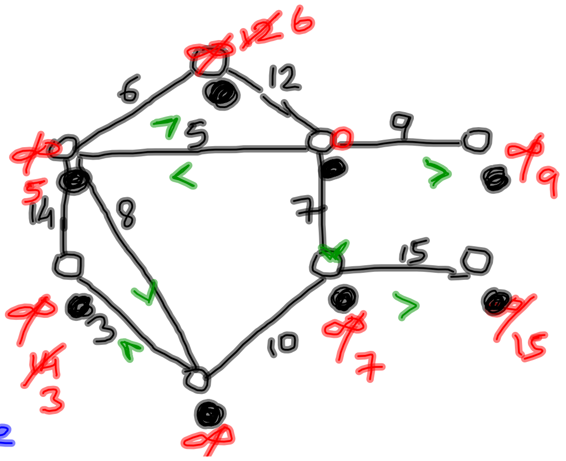
○ ∈ $V-A$

$w(T) = 6+5+9+7+15+8+3$
$= 53$

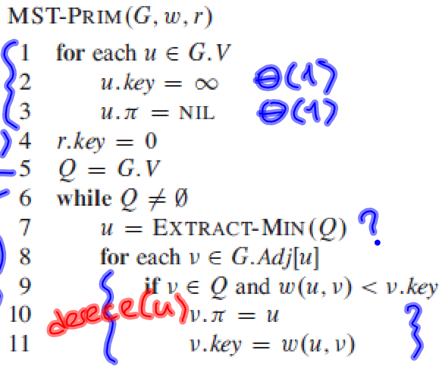
```
MST-PRIM(G, w, r)
    for each $u \in G.V$
        $u.key = \infty$
        $u.\pi = \text{NIL}$
    $r.key = 0$
    $Q = G.V$
    while $Q \neq \emptyset$
        $u = \text{EXTRACT-MIN}(Q)$
        for each $v \in G.Adj[u]$
            if $v \in Q$ and $w(u,v) < v.key$
                $v.\pi = u$
                $v.key = w(u,v)$
```

min(key) olanı çıkar

} gevşetme



Prim Algoritmasının Analizi



```
MST-PRIM(G, w, r)
for each $u \in G.V$
    $u.key = \infty$
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$r.key = 0$
$Q = G.V$
while $Q \neq \emptyset$
    $u = \text{EXTRACT-MIN}(Q)$
    for each $v \in G.Adj[u]$
        if $v \in Q$ and $w(u, v) < v.key$
            $v.\pi = u$
            $v.key = w(u, v)$
```

$\Theta(V)$ |V| defa

$\Theta(1)$

$\Theta(1)$

$\Theta(1)$

|V|

?

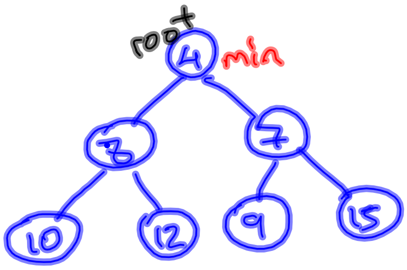
|V| defa

decrease(u)

decrease_key

$$T = \Theta(V) \cdot T_{extract\_min} + \Theta(E) \cdot T_{decrease\_key}$$

Q	$T_{extract\_min}$	$T_{decrease\_key}$	T
Array	$\Theta(V)$	$\Theta(1)$	$\Theta(V^2) + \Theta(E) = \Theta(V^2$
Binary Heap	$\Theta(\lg V)$	$O(\lg V)$	$\Theta(V \lg V) + \Theta(E \lg V) =$ $\Theta(E \lg V$

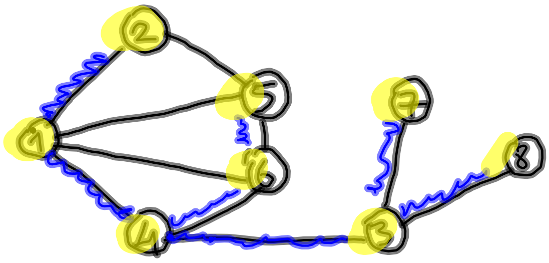


DFS (Depth First Search)
Derinlik Öncelikli Arama

```
DFS(G,s)
    mark(s);
    $L = \{s\}$;
    while $L \neq \emptyset$
        $u$ = last(L);        there exists
        if $\exists (u,v)$ such that $v$ is unmarked
            choose $(u,v)$ with $v$ of smallest index;
            mark(v);
            $L = L \cup \{v\}$;   // push(L,v)
        else
            $L = L \setminus \{u\}$;   // pop(L)
```

DFS de L için stack (Last in First out) kullanılır.

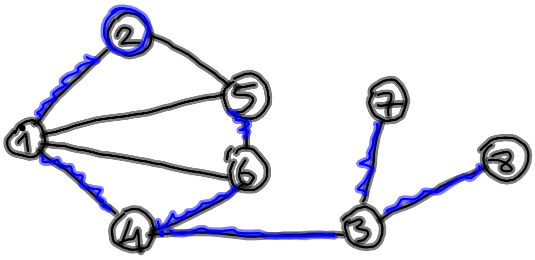
L (stack)	Marked
2	2
2,1	1
2,1,4	4
2,1,4,3	3
2,1,4,3,7	7
2,1,4,3	—
2,1,4,3,8	8
2,1,4,3	—
2,1,4	—
2,1,4,6	6
2,1,4,6,5	5
2,1,4,6	—
2,1,4	—
2,1	—
2	—
$\emptyset$	—



```
while  $L \neq \emptyset$
    u= last(L);
    if  $\exists$ (u,v) such that v is unmarked
        choose (u,v) with v of smallest index
        mark(v);
        $L = L \cup \{v\}$;   //  push(L,v)
    else
        $L = L \setminus \{u\}$;   //  pop(L)
```

Çalışma Zamanı:

$T(|V|,|E|) = \Theta(E+V)$



DFS

BFS (Breadth First Search)

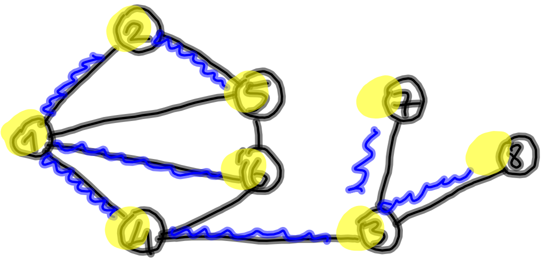
Genişlik Öncelikli Arama

```
BFS (G, s)
    mark(s);
    L = {s};      // L kuyruktur.
    while  L ≠ ∅
        u = first(L);
        if ∃ (u,v) such that v is unmarked
            choose (u,v) with v of smallest index;
            mark(v);
            L = L ∪ {v};      //  enqueue(L, v)
        else
            L = L \ {u};      //  dequeue(L)
```

L için kuyruk veri yapısı (First in first out) kullanılır.

L (kuyruk)	Marked
2	2
2,1	1
2,1,5	5
1,5	—
1,5,4	4
1,5,4,6	6
5,4,6	—
4,6	—
4,6,3	3
6,3	3
3	—
3,7	7
3,7,8	8
7,8	—
8	—
∅	—

BFS

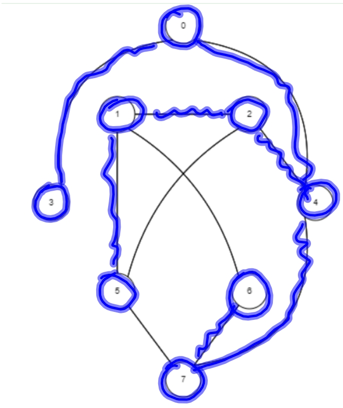


```
while  $L \neq \emptyset$
    u= first(L);
    if  $\exists (u,v)$ such that v is unmarked
        choose  (u,v) with v of smallest index;
        mark(v);
        $L = L \cup \{v\}$;  //  enqueue(L,v)
    else
        $L = L \setminus \{u\}$;  //  dequeue(L)
```

Çalışma Zamanı:

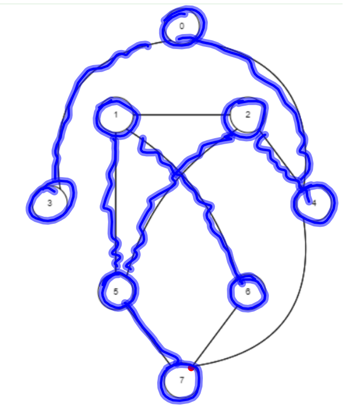
$$T(|V|,|E|) = \Theta(E+V)$$

DFS



s=5

BFS



s=5