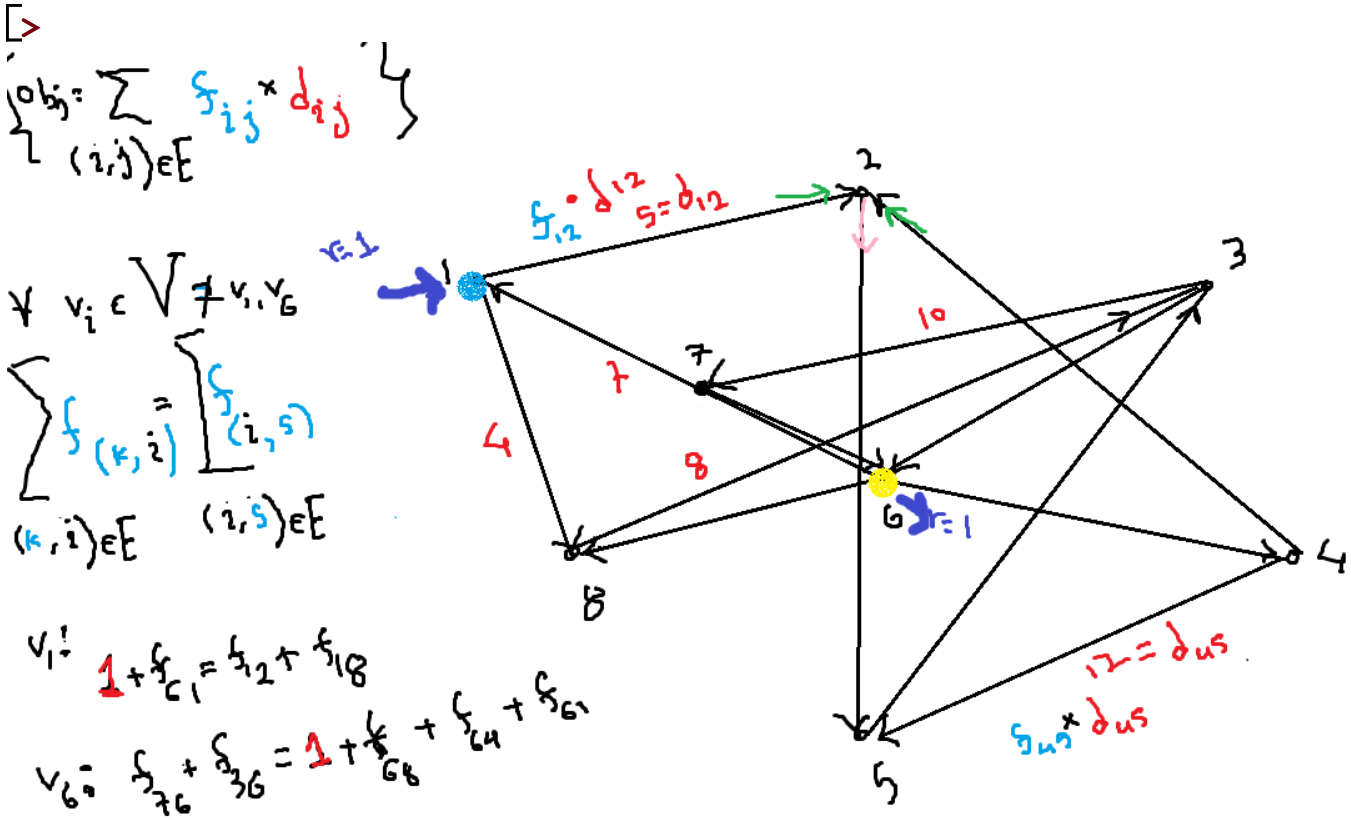
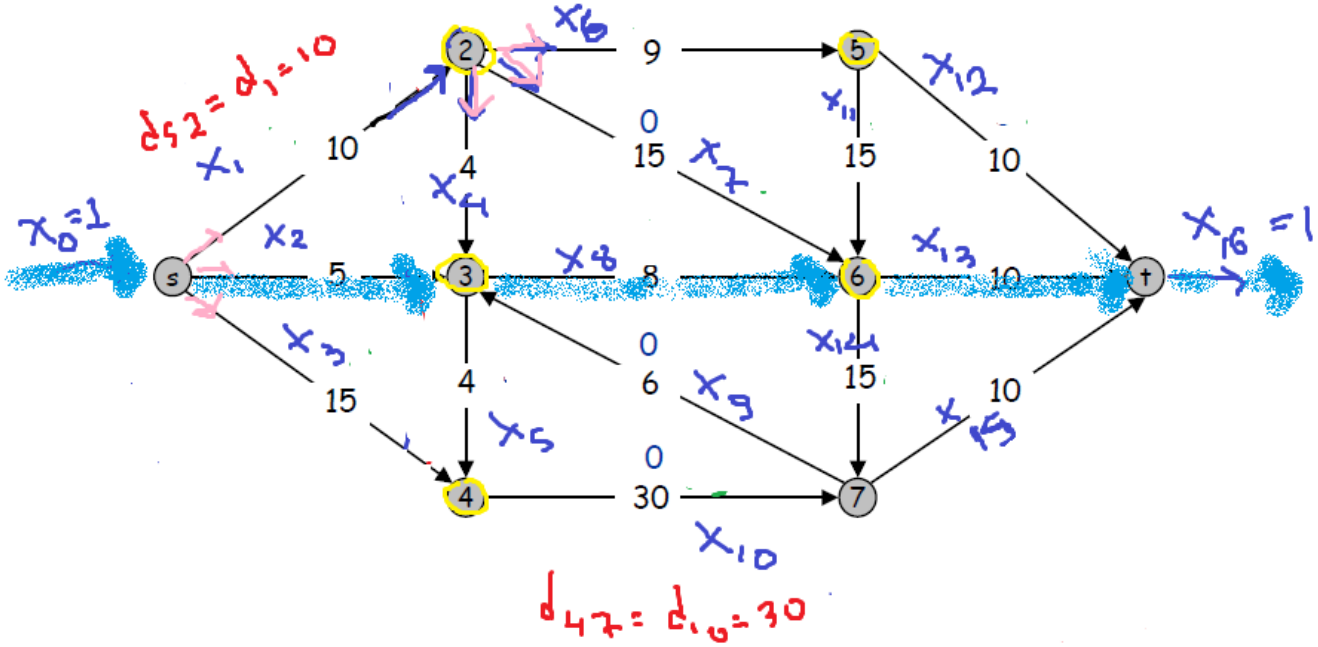



```
> restart:
  with(LinearAlgebra):
  with(linalg):
> with(simplex):
>
```



```
> constraints := { x0 = 1, x16 = 1, x1 ≤ 1, x2 ≤ 1, x3 ≤ 1, x4 ≤ 1, x5 ≤ 1, x6 ≤ 1, x7 ≤ 1, x8
      ≤ 1, x9 ≤ 1, x10 ≤ 1, x11 ≤ 1, x12 ≤ 1, x13 ≤ 1, x14 ≤ 1, x15 ≤ 1, x0 = x1 + x2 + x3 ,
       x1 = x4 + x6 + x7, x2 + x4 + x9 = x8 + x5, x3 + x5 = x10, x6 = x11 + x12, x11 + x7 + x8
      = x14 + x13, x14 + x10 = x9 + x15, x16 = x12 + x13 + x15} ;
```

$$constraints := \{x0 = 1, x0 = x1 + x2 + x3, x1 = x4 + x6 + x7, x16 = 1, x16 = x12 + x13 + x15, x6 = x11 + x12, x14 + x10 = x9 + x15, x3 + x5 = x10, x11 + x7 + x8 = x14 + x13, x2 + x4 + x9 = x8 + x5, x1 \le 1, x10 \le 1, x11 \le 1, x12 \le 1, x13 \le 1, x14 \le 1, x15 \le 1, x2 \le 1, x3 \le 1, x4 \le 1, x5 \le 1, x6 \le 1, x7 \le 1, x8 \le 1, x9 \le 1\} \quad (1)$$

```
> d1 := 10; d2 := 5; d3 := 15; d4 := 4; d5 := 4; d6 := 9; d7 := 15; d8 := 8 ; d9 := 6; d10
      := 30; d11 := 15; d12 := 10; d13 := 10; d14 := 15; d15 := 10;
```

$$d1 := 10$$
$$d2 := 5$$
$$d3 := 15$$
$$d4 := 4$$
$$d5 := 4$$
$$d6 := 9$$
$$d7 := 15$$
$$d8 := 8$$
$$d9 := 6$$
$$d10 := 30$$
$$d11 := 15$$
$$d12 := 10$$
$$d13 := 10$$
$$d14 := 15$$
$$d15 := 10 \quad (2)$$

```
> objective2 := d1·x1 + d2·x2 + d3·x3 + d4·x4 + d5·x5 + d6·x6 + d7·x7 + d8·x8 + d9·x9
      + d10·x10 + d11·x11 + d12·x12 + d13·x13 + d14·x14 + d15·x15;
```

$$objective2 := 10\,x1 + 30\,x10 + 15\,x11 + 10\,x12 + 10\,x13 + 15\,x14 + 10\,x15 + 5\,x2 + 15\,x3 + 4\,x4 + 4\,x5 + 9\,x6 + 15\,x7 + 8\,x8 + 6\,x9 \quad (3)$$

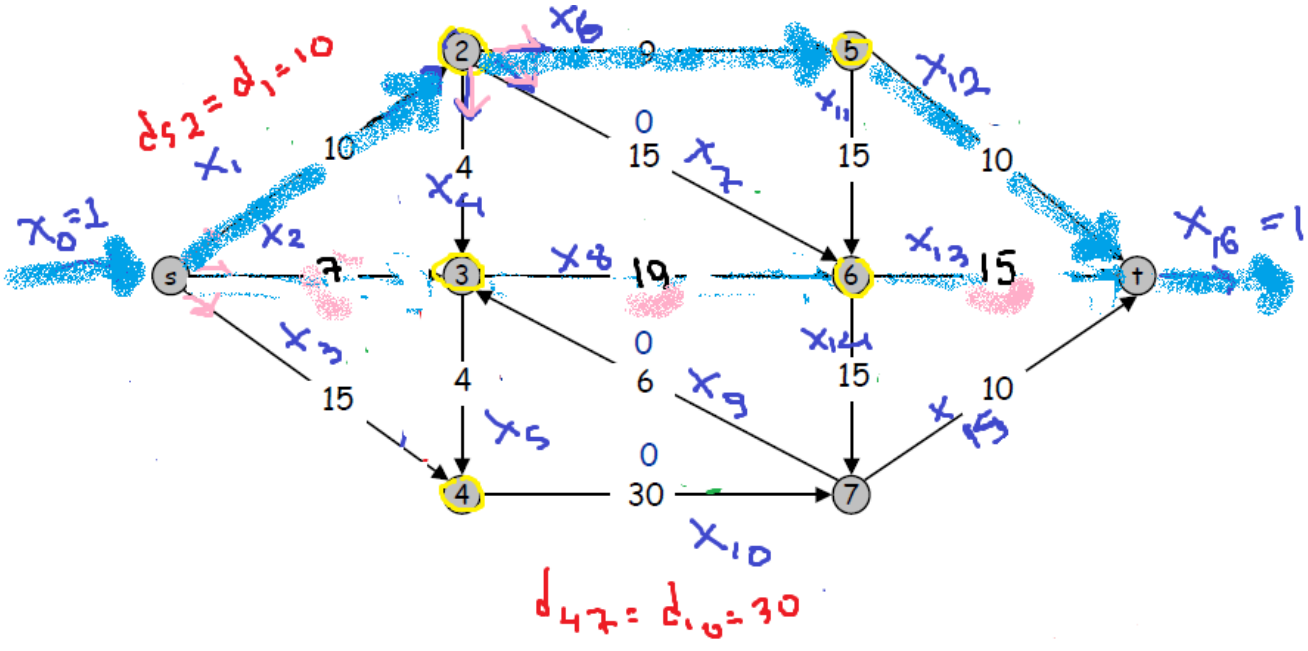
```
> z2 := minimize(objective2, constraints, NONNEGATIVE);
   assign(z2);
```

$$z2 := \{x0 = 1, x1 = 0, x10 = 0, x11 = 0, x12 = 0, x13 = 1, x14 = 0, x15 = 0, x16 = 1, x2 = 1, x3 = 0, x4 = 0, x5 = 0, x6 = 0, x7 = 0, x8 = 1, x9 = 0\} \quad (4)$$

```
> #παρατηρούμε ότι πάλι έχουμε το ίδιο αποτέλεσμα
> objective2;
```

$$23 \quad (5)$$

```
>
> restart:
  with(LinearAlgebra):
  with(linalg):
> with(simplex):
```



> $constraints := \{\ x0=1, x16=1,\ x1 \le 1, x2 \le 1, x3 \le 1, x4 \le 1, x5 \le 1, x6 \le 1, x7 \le 1, x8 \le 1, x9 \le 1, x10 \le 1, x11 \le 1, x12 \le 1, x13 \le 1, x14 \le 1, x15 \le 1, x0=x1+x2+x3,\ x1=x4+x6+x7,\ x2+x4+x9=x8+x5,\ x3+x5=x10,\ x6=x11+x12,\ x11+x7+x8=x14+x13,\ x14+x10=x9+x15, x16=x12+x13+x15\}$;

$$constraints := \{x0=1, x0=x1+x2+x3, x1=x4+x6+x7, x16=1, x16=x12+x13+x15, x6=x11+x12, x14+x10=x9+x15, x3+x5=x10, x11+x7+x8=x14+x13, x2+x4+x9=x8+x5, x1 \le 1, x10 \le 1, x11 \le 1, x12 \le 1, x13 \le 1, x14 \le 1, x15 \le 1, x2 \le 1, x3 \le 1, x4 \le 1, x5 \le 1, x6 \le 1, x7 \le 1, x8 \le 1, x9 \le 1\} \quad (6)$$

> $d1 := 10; d2 := 7; d3 := 15; d4 := 4; d5 := 4; d6 := 9; d7 := 15; d8 := 12; d9 := 6; d10 := 30; d11 := 15; d12 := 10; d13 := 15; d14 := 15; d15 := 10;$

$$d1 := 10$$
$$d2 := 7$$
$$d3 := 15$$
$$d4 := 4$$
$$d5 := 4$$
$$d6 := 9$$
$$d7 := 15$$
$$d8 := 12$$
$$d9 := 6$$
$$d10 := 30$$
$$d11 := 15$$
$$d12 := 10$$
$$d13 := 15$$
$$d14 := 15$$
$$d15 := 10 \quad (7)$$

> $objective2 := d1 \cdot x1 + d2 \cdot x2 + d3 \cdot x3 + d4 \cdot x4 + d5 \cdot x5 + d6 \cdot x6 + d7 \cdot x7 + d8 \cdot x8 + d9 \cdot x9 + d10 \cdot x10 + d11 \cdot x11 + d12 \cdot x12 + d13 \cdot x13 + d14 \cdot x14 + d15 \cdot x15;$

$$objective2 := 10\,x1 + 30\,x10 + 15\,x11 + 10\,x12 + 15\,x13 + 15\,x14 + 10\,x15 + 7\,x2 + 15\,x3 + 4\,x4 + 4\,x5 + 9\,x6 + 15\,x7 + 12\,x8 + 6\,x9 \quad (8)$$

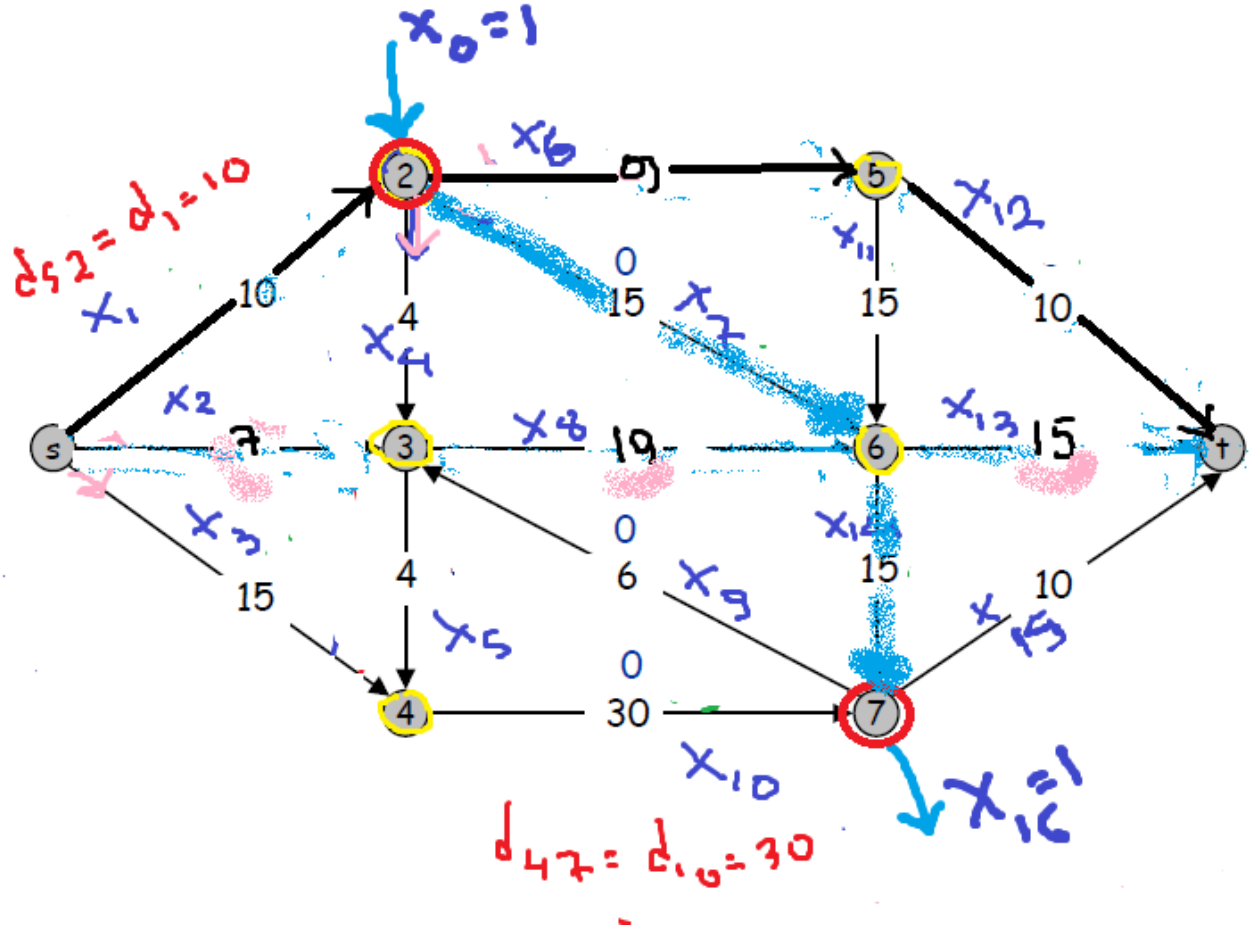
```
> z2 := minimize(objective2, constraints, NONNEGATIVE);
  assign(z2);
```

$$z2 := \{x0 = 1, x1 = 1, x10 = 0, x11 = 0, x12 = 1, x13 = 0, x14 = 0, x15 = 0, x16 = 1, x2 = 0, x3 = 0, x4 = 0, x5 = 0, x6 = 1, x7 = 0, x8 = 0, x9 = 0\} \quad (9)$$

```
> objective2;
```

$$29 \quad (10)$$

```
> restart:
  with(LinearAlgebra):
  with(linalg):
> with(simplex):
>
```




```
> constraints := { x0 = 1, x16 = 1, x1 ≤ 1, x2 ≤ 1, x3 ≤ 1, x4 ≤ 1, x5 ≤ 1, x6 ≤ 1, x7 ≤ 1, x8
    ≤ 1, x9 ≤ 1, x10 ≤ 1, x11 ≤ 1, x12 ≤ 1, x13 ≤ 1, x14 ≤ 1, x15 ≤ 1, x0 + x1 = x4 + x6
    + x7, x2 + x4 + x9 = x8 + x5, x3 + x5 = x10, x6 = x11 + x12, x11 + x7 + x8 = x14 + x13,
    x16 + x9 + x15 = x10 + x14} ;
```

$$constraints := \{x0 = 1, x16 = 1, x6 = x11 + x12, x0 + x1 = x4 + x6 + x7, x3 + x5 = x10, x11 + x7 + x8 = x14 + x13, x16 + x9 + x15 = x10 + x14, x2 + x4 + x9 = x8 + x5, x1 \le 1, x10 \le 1, x11 \le 1, x12 \le 1, x13 \le 1, x14 \le 1, x15 \le 1, x2 \le 1, x3 \le 1, x4 \le 1, x5 \le 1, x6 \le 1, x7 \le 1, x8 \le 1, x9 \le 1\} \quad (11)$$

```
> d1 := 10; d2 := 7; d3 := 15; d4 := 4; d5 := 4; d6 := 9; d7 := 15; d8 := 12 ; d9 := 6; d10
```

$:= 30; d11 := 15; d12 := 10; d13 := 15; d14 := 15; d15 := 10;$

$$d1 := 10$$
$$d2 := 7$$
$$d3 := 15$$
$$d4 := 4$$
$$d5 := 4$$
$$d6 := 9$$
$$d7 := 15$$
$$d8 := 12$$
$$d9 := 6$$
$$d10 := 30$$
$$d11 := 15$$
$$d12 := 10$$
$$d13 := 15$$
$$d14 := 15$$
$$d15 := 10 \quad \textbf{(12)}$$

> $objective2 := d1 \cdot x1 + d2 \cdot x2 + d3 \cdot x3 + d4 \cdot x4 + d5 \cdot x5 + d6 \cdot x6 + d7 \cdot x7 + d8 \cdot x8 + d9 \cdot x9 + d10 \cdot x10 + d11 \cdot x11 + d12 \cdot x12 + d13 \cdot x13 + d14 \cdot x14 + d15 \cdot x15;$

$$objective2 := 10\,x1 + 30\,x10 + 15\,x11 + 10\,x12 + 15\,x13 + 15\,x14 + 10\,x15 + 7\,x2 + 15\,x3 + 4\,x4 + 4\,x5 + 9\,x6 + 15\,x7 + 12\,x8 + 6\,x9 \quad \textbf{(13)}$$

> $z2 := minimize(objective2, constraints, NONNEGATIVE);$
> $assign(z2);$

$$z2 := \{x0 = 1, x1 = 0, x10 = 0, x11 = 0, x12 = 0, x13 = 0, x14 = 1, x15 = 0, x16 = 1, x2 = 0, x3 = 0, x4 = 0, x5 = 0, x6 = 0, x7 = 1, x8 = 0, x9 = 0\} \quad \textbf{(14)}$$

> $objective2;$

$$30 \quad \textbf{(15)}$$

>