Lab2 - Ex2

Variabile de decizie:

- $x_{11}, x_{12}, x_{21}, x_{22}, x_{31}, x_{32}$ — unde x_{ij} denota faptul ca jobul i este asignat masinii j

Constrangeri:

1. Variabilele de decizie au ca valori 0 | 1
   - $x_{ij} \in \{0,1\}, \forall i \in \{1,2,3\},\ j \in \{1,2\}$
2. Un job trebuie executat de o singura masina
   - $x_{i1} + x_{i2} = 1, \forall i \in \{1,2,3\}$
3. Makespanul maximal este 8 TU
   - $2 * x_{11} + 1 * x_{12} + 3 * x_{21} + 1 * x_{22} + 2 * x_{31} + 3 * x_{32} <= 8$

Functia obiectiv:

Minimizarea costului final:

- $2x_{11} + 1x_{12} + 3x_{21} + 1x_{22} + 2x_{31} + 3x_{32}$

```
; Variabile
(declare-fun x11 () Int)
(declare-fun x12 () Int)
(declare-fun x21 () Int)
(declare-fun x22 () Int)
(declare-fun x31 () Int)
(declare-fun x32 () Int)

; Constrangeri
;  Valori de 0 | 1
(assert (or (= x11 0) (= x11 1)))
(assert (or (= x12 0) (= x12 1)))
(assert (or (= x21 0) (= x21 1)))
(assert (or (= x22 0) (= x22 1)))
(assert (or (= x31 0) (= x31 1)))
(assert (or (= x32 0) (= x32 1)))

;  Un job poate fi executat de o singura masina
(assert (= (+ x11 x12) 1))
(assert (= (+ x21 x22) 1))
(assert (= (+ x31 x32) 1))

;  Makespanul maximal este 8 TU
(assert (>= 8 (+ (* 2 x11) (* 1 x12) (* 3 x21) (* 1 x22) (* 2 x31) (* 3 x32))))

; Functie obiectiv
(minimize (+ (* 2 x11) (* 1 x12) (* 3 x21) (* 1 x22) (* 2 x31) (* 3 x32)))

(check-sat)
(get-model)
(get-objectives)
```

Folosing z3 solver obtinem solutia:

```
amalia@DESKTOP-QJMM7BC:~$ z3 ex2.txt
sat
(
  (define-fun x22 () Int
    1)
  (define-fun x12 () Int
    1)
  (define-fun x32 () Int
    0)
  (define-fun x31 () Int
    1)
  (define-fun x21 () Int
    0)
  (define-fun x11 () Int
    0)
)
(objectives
 ((+ (* 2 x11) (* 1 x12) (* 3 x21) (* 1 x22) (* 2 x31) (* 3 x32)) 4)
)
```

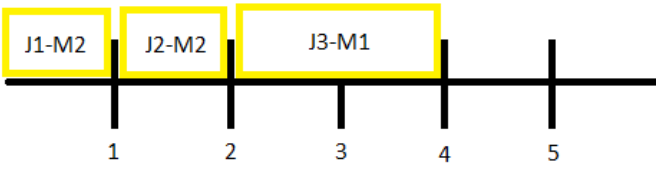
Care se traduce prin:

x12 = 1 ⇒ Jobul 1 este situat pe masina 2

x22 = 1 ⇒ Jobul 2 este situat pe masina 2

x31 = 1 ⇒ Jobul 3 este situat pe masina 1

Datorita faptului ca avem doar 3 joburi si 2 masini putem observa si constata ca solutia obtina de z3 este una optima obtinand-use un total de 4 TU.



Fara functia de optimize:

```
amalia@DESKTOP-QJMM7BC:~$ z3 ex2.txt
sat
(
  (define-fun x32 () Int
    0)
  (define-fun x22 () Int
    0)
  (define-fun x12 () Int
    0)
  (define-fun x31 () Int
    1)
  (define-fun x21 () Int
    1)
  (define-fun x11 () Int
    1)
)
```

Care se traduce prin:

x11 = 1 ⇒ Jobul 1 este situat pe masina 1

x21 = 1 ⇒ Jobul 2 este situat pe masina 1

x31 = 1 ⇒ Jobul 3 este situat pe masina 1