

# 21720 Programació Concurrent

Curs 2018 - 2019

Primer exercici avaluable: El problema de Santa

Claus amb semàfors

## Descripció de la simulació

Aquest problema és una adaptació del problema original enunciat per John Trono al 1994. Santa Claus dorm a la seva tenda al pol nord i només pot ser despertat per dos motius: per que els 9 rens han arribat de les seves vacances o bé per que els algun dels 9 elfs tenen problemes amb la fabricació de joguines; per que Santa pugui dormir un poc els elfs només el desperten quan hi ha 3 elfs amb problemes. Quan els 3 elfs han rebut ajuda, 3 més podran ser atesos. A la nostra simulació els elfs aniran a demanar ajut dues vegades i llavors acabaran. Quan els rens arriben s'esperen a que arribi el darrer, en aquest moment el darrer desperta a Santa Claus que carrega les joguetes i els rens se'n van i acaben. Santa acaba la seva simulació quan ha enganxat a tots els rens (1 vegada) i ha respost 6 torns de dubtes.

## Indicacions

La simulació s'ha de programar usant els llenguatges Java o Python emprant com a eines de sincronia els semàfors (comptadors i binàris).

Tant els rens, com els elfs o Santa són processos concurrents.

```
run:
-----> Santa says: I'm tired
-----> Santa says: I'm going to sleep
Hi I am the elf Taleasin
Hi I am the elf Halafarin
Elf Taleasin says: I have a question, I'm the 1 waiting...
Elf Halafarin says: I have a question, I'm the 2 waiting...
Hi I am the elf Ailduin
Hi I am the elf Adamar
Elf Ailduin says: I have a question, I'm the 3 SANTAAAAA!
Hi I am the elf Galather
-----> Santa says: I'm awake ho ho ho!
Hi I am the elf Estelar
Hi I am the elf Lyari
-----> Santa says: What is the problem?
Hi I am the elf Andrathath
-----> Santa helps the elf 1 of 3
Hi I am the elf Wyn
The elf Ailduin is getting help
The elf Taleasin is getting help
-----> Santa helps the elf 2 of 3
Elf Adamar says: I have a question, I'm the 1 waiting...
The elf Halafarin is getting help
-----> Santa helps the elf 3 of 3
Elf Galather says: I have a question, I'm the 2 waiting...
-----> Santa Ends turn 1
-----> Santa says: I'm going to sleep
Elf Estelar says: I have a question, I'm the 3 SANTAAAAA!
-----> Santa says: I'm awake ho ho ho!
-----> Santa says: What is the problem?
-----> Santa helps the elf 1 of 3
-----> Santa helps the elf 2 of 3
-----> Santa helps the elf 3 of 3
The elf Estelar is getting help
The elf Adamar is getting help
The elf Galather is getting help
-----> Santa Ends turn 2
Elf Lyari says: I have a question, I'm the 1 waiting...
-----> Santa says: I'm going to sleep
Elf Andrathath says: I have a question, I'm the 2 waiting...
Elf Wyn says: I have a question, I'm the 3 SANTAAAAA!
-----> Santa says: I'm awake ho ho ho!
-----> Santa says: What is the problem?
-----> Santa helps the elf 1 of 3
The elf Lyari is getting help
The elf Andrathath is getting help
-----> Santa helps the elf 2 of 3
The elf Wyn is getting help
-----> Santa helps the elf 3 of 3
-----> Santa Ends turn 3
-----> Santa says: I'm going to sleep
Elf Andrathath says: I have a question, I'm the 1 waiting...
Elf Halafarin says: I have a question, I'm the 2 waiting...
Elf Taleasin says: I have a question, I'm the 3 SANTAAAAA!
-----> Santa says: I'm awake ho ho ho!
-----> Santa says: What is the problem?
-----> Santa helps the elf 1 of 3
-----> Santa helps the elf 2 of 3
The elf Andrathath is getting help
The elf Halafarin is getting help
-----> Santa helps the elf 3 of 3
Elf Wyn says: I have a question, I'm the 1 waiting...
The elf Taleasin is getting help
-----> Santa helps the elf 3 of 3
-----> Santa Ends turn 4
-----> Santa says: I'm going to sleep
Elf Taleasin Ends
Elf Estelar says: I have a question, I'm the 2 waiting...
Elf Andrathath Ends
Elf Galather says: I have a question, I'm the 3 SANTAAAAA!
-----> Santa says: I'm awake ho ho ho!
-----> Santa says: What is the problem?
-----> Santa helps the elf 1 of 3
The elf Wyn is getting help
The elf Estelar is getting help
-----> Santa helps the elf 2 of 3
-----> Santa helps the elf 3 of 3
The elf Galather is getting help
-----> Santa Ends turn 5
-----> Santa says: I'm going to sleep
Elf Ailduin says: I have a question, I'm the 1 waiting...
Elf Lyari says: I have a question, I'm the 2 waiting...
Elf Halafarin Ends
Elf Adamar says: I have a question, I'm the 3 SANTAAAAA!
-----> Santa says: I'm awake ho ho ho!
-----> Santa says: What is the problem?
-----> Santa helps the elf 1 of 3
The elf Ailduin is getting help
The elf Lyari is getting help
-----> Santa helps the elf 2 of 3
-----> Santa helps the elf 3 of 3
-----> Santa Ends turn 6
-----> Santa says: I'm going to sleep
The elf Adamar is getting help
Elf Estelar Ends
Elf Lyari Ends
Elf Wyn Ends
Elf Galather Ends
Elf Adamar Ends
Elf Ailduin Ends
```

Fig. 1 Simulació amb el procés Santa i els Elfs, el procés Santa no acaba pendent dels Rens

## Exemple

La sortida que ha de generar la simulació ha de ser de l'estil que es veu a les figures 1, 2 i 3.

```
run:
-----> Santa says: I'm tired
-----> Santa says: I'm going to sleep
        RUDOLPH here!
        BLITZEN here!
        DONDER here!
        CUPID here!
        COMET here!
        VIXEN here!
        PRANCER here!
        DANCER here!
        DASHER here!
        Reindeer DONDER arrives
        Reindeer VIXEN arrives
        Reindeer CUPID arrives
        Reindeer DASHER arrives
        Reindeer COMET arrives
        Reindeer PRANCER arrives
        Reindeer DANCER arrives
        Reindeer RUDOLPH arrives
        Reindeer BLITZEN I'm the 9
-----> Santa says: I'm awake ho ho ho!
-----> Santa says: Toys are ready!
-----> Santa loads the toys
-----> Santa says: Until next Christmas!
-----> Santa says: I'm going to sleep
        DONDER ready and hitched
        CUPID ready and hitched
        DASHER ready and hitched
        VIXEN ready and hitched
        Reindeer DASHER Ends
        BLITZEN ready and hitched
        Reindeer BLITZEN Ends
        Reindeer CUPID Ends
        RUDOLPH ready and hitched
        Reindeer RUDOLPH Ends
        DANCER ready and hitched
        Reindeer DANCER Ends
        PRANCER ready and hitched
        COMET ready and hitched
        Reindeer COMET Ends
        Reindeer DONDER Ends
        Reindeer PRANCER Ends
        Reindeer VIXEN Ends
```

Fig. 2. Simulació del procés Santa amb els processos dels Rens, el procés Santa no acaba pendent dels Elfs

```

run:
----> Santa says: I'm tired
----> Santa says: I'm going to sleep
      RUDOLPH here!
      BLITZEN here!
      CUPID here!
      DONDER here!
      COMET here!
      VIXEN here!
      DANCER here!
      DASHER here!
      PRANCER here!
Hi I am the elf Taleasin
Hi I am the elf Halafarin
Elf Taleasin says: I have a question, I'm the 1 waiting...
Hi I am the elf Adamar
Elf Adamar says: I have a question, I'm the 2 waiting...
Hi I am the elf Galather
Hi I am the elf Ailduin
Hi I am the elf Estelar
Hi I am the elf Lyari
Elf Halafarin says: I have a question, I'm the 3 SANTAAAAA!
Hi I am the elf Andrathath
Hi I am the elf Wyn
----> Santa says: I'm awake ho ho ho!
----> Santa says: What is the problem?
----> Santa helps the elf 1 of 3
----> Santa helps the elf 2 of 3
----> Santa helps the elf 3 of 3
----> Santa Ends turn 1
----> Santa says: I'm going to sleep
The elf Taleasin is getting help
The elf Adamar is getting help
The elf Halafarin is getting help
Elf Galather says: I have a question, I'm the 1 waiting...
Elf Estelar says: I have a question, I'm the 2 waiting...
Elf Ailduin says: I have a question, I'm the 3 SANTAAAAA!
----> Santa says: I'm awake ho ho ho!
----> Santa says: What is the problem?
----> Santa helps the elf 1 of 3
----> Santa helps the elf 2 of 3
----> Santa helps the elf 3 of 3
----> Santa Ends turn 2
----> Santa says: I'm going to sleep
The elf Estelar is getting help
The elf Galather is getting help
The elf Ailduin is getting help
Elf Lyari says: I have a question, I'm the 1 waiting...
Elf Andrathath says: I have a question, I'm the 2 waiting...
Elf Wyn says: I have a question, I'm the 3 SANTAAAAA!
----> Santa says: I'm awake ho ho ho!
----> Santa says: What is the problem?
----> Santa helps the elf 1 of 3
----> Santa helps the elf 2 of 3
The elf Lyari is getting help
The elf Wyn is getting help
----> Santa helps the elf 3 of 3
The elf Andrathath is getting help
----> Santa Ends turn 3
----> Santa says: I'm going to sleep
Elf Taleasin says: I have a question, I'm the 1 waiting...
      Reindeer DANCER arrives
      Reindeer PRANCER arrives
Elf Galather says: I have a question, I'm the 2 waiting...
      Reindeer DONDER arrives
Elf Adamar says: I have a question, I'm the 3 SANTAAAAA!
----> Santa says: I'm awake ho ho ho!
----> Santa says: What is the problem?
----> Santa helps the elf 1 of 3
----> Santa helps the elf 2 of 3
----> Santa helps the elf 3 of 3

The elf Galather is getting help
The elf Taleasin is getting help
The elf Adamar is getting help
----> Santa Ends turn 4
----> Santa says: I'm going to sleep
Elf Andrathath says: I have a question, I'm the 1 waiting...
Elf Lyari says: I have a question, I'm the 2 waiting...
Elf Taleasin Ends
Elf Wyn says: I have a question, I'm the 3 SANTAAAAA!
----> Santa says: I'm awake ho ho ho!
----> Santa says: What is the problem?
----> Santa helps the elf 1 of 3
The elf Andrathath is getting help
The elf Lyari is getting help
----> Santa helps the elf 2 of 3
----> Santa helps the elf 3 of 3
The elf Wyn is getting help
----> Santa Ends turn 5
----> Santa says: I'm going to sleep
Elf Ailduin says: I have a question, I'm the 1 waiting...
Elf Lyari Ends
      Reindeer DASHER arrives
Elf Adamar Ends
      Reindeer VIXEN arrives
      Reindeer BLITZEN arrives
Elf Andrathath Ends
      Reindeer CUPID arrives
      Reindeer RUDOLPH arrives
      Reindeer COMET I'm the 9
----> Santa says: I'm awake ho ho ho!
----> Santa says: Toys are ready!
----> Santa loads the toys
----> Santa says: Until next Christmas!
----> Santa says: I'm going to sleep
      DANCER ready and hitched
      PRANCER ready and hitched
      DONDER ready and hitched
      Reindeer DONDER Ends
      Reindeer DANCER Ends
      BLITZEN ready and hitched
      COMET ready and hitched
      Reindeer COMET Ends
      VIXEN ready and hitched
      Reindeer VIXEN Ends
      DASHER ready and hitched
      Reindeer PRANCER Ends
      Reindeer DASHER Ends
      Reindeer BLITZEN Ends
      RUDOLPH ready and hitched
      Reindeer RUDOLPH Ends
      CUPID ready and hitched
      Reindeer CUPID Ends
Elf Estelar says: I have a question, I'm the 2 waiting...
Elf Halafarin says: I have a question, I'm the 3 SANTAAAAA!
----> Santa says: I'm awake ho ho ho!
----> Santa says: What is the problem?
----> Santa helps the elf 1 of 3
The elf Ailduin is getting help
----> Santa helps the elf 2 of 3
The elf Estelar is getting help
The elf Halafarin is getting help
----> Santa helps the elf 3 of 3
----> Santa Ends turn 6
----> Santa Ends
Elf Galather Ends
Elf Ailduin Ends
Elf Estelar Ends
Elf Wyn Ends
Elf Halafarin Ends
BUILD SUCCESSFUL (total time: 3 seconds)

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Fig. 3. Simulació completa