Tutorial_4_Python

March 17, 2021

1 Introduction to SimPy

Before doing this lab, you are required to study the notes **"Introduction to SimPy"** and the corresponding prerecored video (optional) which are available on Blackboard.

You also need to install package **SimPyClassic**. In the command line mode, you just need to type: **pip install SimPyClassic**

You also can excute the following code to install **SimPyClassic** from Jupyter Notebook:

[1]:
```
import sys
!{sys.executable} -m pip install SimPyClassic
```

```
Requirement already satisfied: SimPyClassic in c:\anaconda3\lib\site-packages
(2.3.4)
```

Now, let's do our lab questions.

1.1 Question 1

Art lover, Klaus, enters the art gallery and admires the **Npictures** hung on the walls. He examines each picture for **lookTime** minutes, and remarks **Very nice** before going on to the next one. When he finishes he leaves the art gallery saying **How Refreshing!**.

Write a SimPy simulation program to model this situation. The print statements should include the time and Klaus's name. Set **Npictures = 20** and **lookTime = 2.5**.

[2]:
```
from SimPy.Simulation import *

## Model components ---------------------
class ArtLover(Process):
    """An art lover"""
    def walk(self):
        print(now(), self.name, 'Here I am')
        for picture in range(Npictures):
            yield hold, self, lookTime
            print(now(), self.name, 'Very nice')
        print(now(), self.name, 'How Refreshing!')

## Experiment data ----------------------
Npictures = 20
```

```
lookTime = 2.5

## Experiment ---------------------------
initialize()
klaus = ArtLover('Klaus')
activate(klaus, klaus.walk(), now())
simulate(until=2000)
```

```
0 Klaus Here I am
2.5 Klaus Very nice
5.0 Klaus Very nice
7.5 Klaus Very nice
10.0 Klaus Very nice
12.5 Klaus Very nice
15.0 Klaus Very nice
17.5 Klaus Very nice
20.0 Klaus Very nice
22.5 Klaus Very nice
25.0 Klaus Very nice
27.5 Klaus Very nice
30.0 Klaus Very nice
32.5 Klaus Very nice
35.0 Klaus Very nice
37.5 Klaus Very nice
40.0 Klaus Very nice
42.5 Klaus Very nice
45.0 Klaus Very nice
47.5 Klaus Very nice
50.0 Klaus Very nice
50.0 Klaus How Refreshing!
```

[2]: `'SimPy: No more events at time 50.0'`

Comments: - This is just a modification of the first program of TheBank tutorial. The addition is a loop going through the pictures. - **self.name** is available here since name is one of the attributes of the **Process** class.

1.2 Question 2

Art lover, Klaus, enters the art gallery and admires the **Npictures** hung on the walls. He examines each picture for a random time. He remarks **Very nice** before going on to the next one. When he finishes he leaves the art gallery saying **How Refreshing!**.

Write a SimPy simulation program to model this situation. Use a trace method which prints only if **TRACING** is **True**. It should display the time and the art lover's name. Set **Npictures = 20** and **lookTime = 2.5**. The time in minutes spent looking at a picture has a **uniform(1,lookTime)** distribution. Use a random seed of 123.

[3]:
```
from SimPy.Simulation import *
import random

## Model components ------------------
class ArtLover(Process):
    """An art lover"""
    def walk(self):
        self.trace('Here I am')
        for picture in range(Npictures):
            t = random.uniform(1, lookTime)
            yield hold, self, t
            self.trace('Very nice')
        self.trace('How Refreshing!')

    def trace(self,msg):
        FMT='%8.4f %s %s'
        if TRACING:
            print(FMT%(now(), self.name, msg))

## Experiment data ---------------------
TRACING = True
Npictures = 20
lookTime = 2.5 # maximum time 1 picture

## Experiment --------------------------
random.seed(123)
initialize()
klaus = ArtLover('Klaus') # a new ArtLover
activate(klaus, klaus.walk(), now())
simulate(until=2000)
```

```
 0.0000 Klaus Here I am
 1.0785 Klaus Very nice
 2.2093 Klaus Very nice
 3.8202 Klaus Very nice
 4.9817 Klaus Very nice
 7.3335 Klaus Very nice
 8.3908 Klaus Very nice
10.1951 Klaus Very nice
11.6934 Klaus Very nice
13.9715 Klaus Very nice
15.2110 Klaus Very nice
16.7168 Klaus Very nice
18.2175 Klaus Very nice
19.5853 Klaus Very nice
20.5878 Klaus Very nice
22.2422 Klaus Very nice
```

```
 23.3736 Klaus Very nice
 25.2700 Klaus Very nice
 26.3748 Klaus Very nice
 27.8480 Klaus Very nice
 29.5205 Klaus Very nice
 29.5205 Klaus How Refreshing!
```

[3]: `'SimPy: No more events at time 29.52048039833309'`

1.3 Question 3

Art lovers, Klaus, Evelyn, Virginia, and Tony enter the art gallery at intervals of 1 minute. They independently walk round and admire the **Npictures** hung on the walls. They examine each picture for a random time. They remark **Very nice** before going on to the next one. When finished, each leaves the art gallery saying **How Refreshing!**.

Write a SimPy simulation program to model this situation. Use a trace method which prints only if **TRACING** is **True**. It should display the time and the art lover's name. Set **Npictures = 10** and **lookTime = 2.5**. The time in minutes spent looking at a picture has a **uniform(1,lookTime)** distribution. Use a random seed of 123.

[4]:
```
from SimPy.Simulation import *
import random

## Model components --------------------
class ArtLover(Process):
    """An art lover"""
    def walk(self):
        self.trace('Here I am')
        for picture in range(Npictures):
            t = random.uniform(1,lookTime)
            yield hold,self,t
            self.trace('Very nice')
        self.trace('How Refreshing!')

    def trace(self,msg):
        if TRACING:
            print('%8.4f %s %s' % (now(), self.name, msg))

## Experiment data ---------------------
TRACING = True
Npictures = 10
lookTime = 2.5

## Experiment --------------------------
random.seed(123)
initialize()
arrivetime=0.0
```

```
for person in [ 'Klaus', 'Evelyn', 'Virginia', 'Tony']:
    p = ArtLover(name=person)
    activate(p, p.walk(), arrivetime)
    arrivetime += 1.0
simulate(until=2000)
```

```
 0.0000 Klaus Here I am
 1.0000 Evelyn Here I am
 1.0785 Klaus Very nice
 2.0000 Virginia Here I am
 2.1308 Evelyn Very nice
 2.6894 Klaus Very nice
 3.0000 Tony Here I am
 3.1616 Virginia Very nice
 3.7466 Klaus Very nice
 4.4826 Evelyn Very nice
 4.6598 Virginia Very nice
 4.8043 Tony Very nice
 5.7221 Evelyn Very nice
 6.0248 Klaus Very nice
 6.1657 Virginia Very nice
 6.3050 Tony Very nice
 7.0273 Klaus Very nice
 7.0898 Evelyn Very nice
 7.4364 Tony Very nice
 7.8201 Virginia Very nice
 8.1946 Evelyn Very nice
 8.9096 Tony Very nice
 8.9237 Klaus Very nice
 9.4926 Virginia Very nice
10.0488 Tony Very nice
10.1369 Klaus Very nice
10.5527 Evelyn Very nice
11.0806 Tony Very nice
11.6777 Virginia Very nice
12.4128 Evelyn Very nice
12.4786 Tony Very nice
12.5037 Klaus Very nice
13.9344 Virginia Very nice
13.9938 Tony Very nice
14.5660 Evelyn Very nice
14.7059 Klaus Very nice
15.2447 Virginia Very nice
15.9071 Tony Very nice
16.3566 Evelyn Very nice
16.7176 Virginia Very nice
16.9199 Klaus Very nice
```

```
16.9199 Klaus How Refreshing!
17.5045 Tony Very nice
17.5045 Tony How Refreshing!
18.4867 Virginia Very nice
18.4867 Virginia How Refreshing!
18.5106 Evelyn Very nice
18.5106 Evelyn How Refreshing!
```

[4]: `'SimPy: No more events at time 18.51056569054076'`

Comment: This is a modification of the simple art-gallery model with several people and stochastic **lookTimes**.

[ ]: