CSC373 Worksheet 1 Solution

August 15, 2020

1. The cpu utilization is 100%.

   The CPU utilization formula is given as

$$\text{CPU Utilization} = 1 - \prod_i \text{I/O blocked time of ith process} \tag{1}$$

   Since the processes do no I/O, we can write there is no I/O blocked time.

   Thus, we can conclude

$$\begin{aligned} \text{CPU Utilization} &= 1 - 0 && (2)\\ &= 1 && (3) \end{aligned}$$

   which is 100%.

   Notes

   - **CPU Utilization**
     - Means % of time CPU is in use
     - Formula is

$$\text{CPU Utilization} = 1 - \prod_i \text{I/O blocked time of ith process} \tag{4}$$

   - **Process**
     - Means a program in execution

- **PID**
  - Is a short hand form for 'process identifier'
- **Process States**
  - in simplified view, process can be in one of the three states
    1. **Running:**
       * Is running on a processor
       * Means 'Is executing instructions'
    2. **Ready:**
       * Is ready to run
       * But, OS chosen to not to run it at the moment
    3. **Blocked:**
       * Is not ready to run until some other event takes place

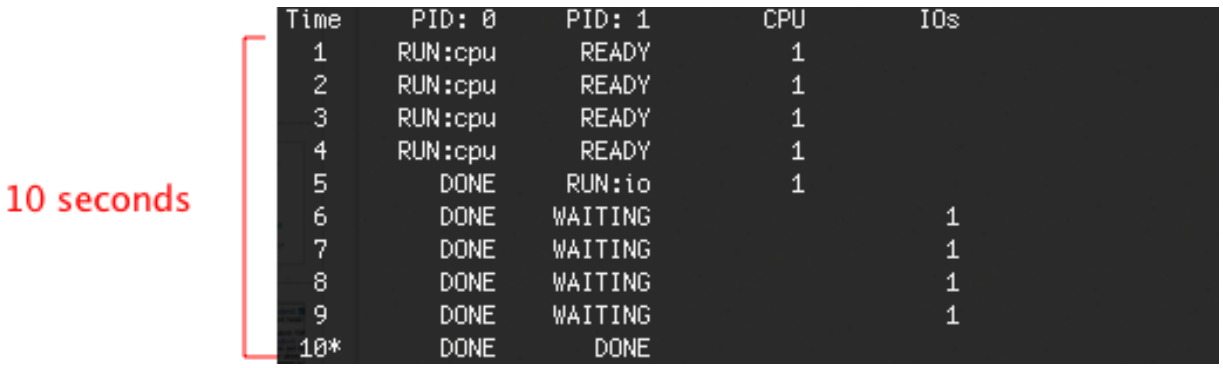
       Example
       Running an I/O request to disk → process blocked → other process can do their job while waiting

2. It takes total of 10 seconds to run.

   The first task only uses CPU, and takes 4 seconds.

   But, for the second task, on top of 4 seconds used for I/O, 1 second is used for preparing and initiating I/O, and the other 1 second is used for signaling that I/O is done.

   So in total, we have $4 + 4 + 1 + 1 = 10$ seconds.



3. Yes. Switching the order does matter.

   When the order is switched, the process 2 with I/O runs, and the process 2 enters the blocked state.

While at blocked state, the other process executes.

Since both take 4 seconds, by the time process 2 finishes, process 1 is finished.

Thus, total of 6 seconds are taken.

4. With flag SWITCH_ON_END, system runs as if it's without I/O. That is, process 2 runs after process 1 finishes.

   The only difference is that process 2 executes at the same time process 1 finishes.

   So instead of 10 seconds, there are 9 seconds in total

Process 1 finishes and process 2 starts at the same time

Time	PID: 0	PID: 1	CPU	IOs
1	RUN:io	READY	1	
2	WAITING	READY		1
3	WAITING	READY		1
4	WAITING	READY		1
5	WAITING	READY		1
6*	DONE	RUN:cpu	1	
7	DONE	RUN:cpu	1	
8	DONE	RUN:cpu	1	
9	DONE	RUN:cpu	1	

5. I need to write what happens when one is waiting for I/O.

   The result is the same as question 2.

   While process 1 is in blocked state, process 2 is executes.

```
moegu@MacBook-Pro-5 week_1 % python process-run.py -l 1:0,4:100 -c -S SWITCH_ON_IO
Time     PID: 0     PID: 1        CPU        IOs
  1      RUN:io      READY          1
  2     WAITING    RUN:cpu         1          1
  3     WAITING    RUN:cpu         1          1
  4     WAITING    RUN:cpu         1          1
  5     WAITING    RUN:cpu         1          1
  6*       DONE       DONE
```