CMT 115
Python for Computation

Coursework

Simulation Data

Simulation Data

Tasks that need to be carried out by a processor.

ID	Arrival	Duration
...	...	...

Simulation Data

- **ID**: A string of six characters. Each character is randomly chosen (uniform probability) from letters (’a’-’z’ and ’A’-’Z’), digits (’0’-’9’) and some special characters (’@’, ’_’, ’#’, ’*’, ’-’, and ’&’).
  - Choose six characters randomly from: qwertyuiopasdfghjklzxcvbnmQWERTYUIOPASDFGHJKLZXCVBNM0123456789@_#*-&
  - Example:
    - JoGY6A
    - l*@1D*
    - FJUBT4
    - *17hu-
    - ...

Simulation Data

- **Arrival**: A random real value generated by a uniform distribution from 0 to 100.
  - The uniform distribution is a continuous distribution.
  - This means that the arrival will be a real number from 0 to 100.
  - For example:
    - 47.847
    - 0.12434545
    - 12.236673
    - 85.18483830
    - ...

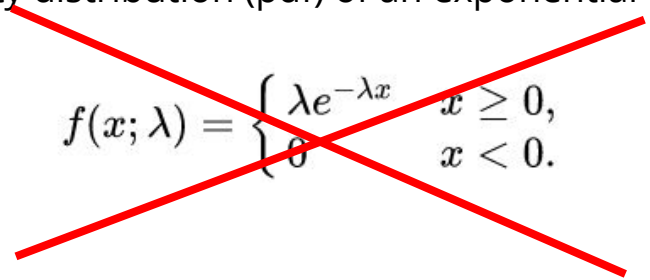
Simulation Data

- **Duration**: A random value generated by an exponential distribution of parameter 1, rounded up.
  - This time, the result will be an integer number.
  - The probability density distribution (pdf) of an exponential distribution is:

$$f(x;\lambda) = \begin{cases} \lambda e^{-\lambda x} & x \geq 0, \\ 0 & x < 0. \end{cases}$$

Simulation Data

- **Duration**: A random value generated by an exponential distribution of parameter 1, rounded up.
  - This time, the result will be an integer number.
  - The probability density distribution (pdf) of an exponential distribution is:



$$f(x;\lambda) = \begin{cases} \lambda e^{-\lambda x} & x \geq 0, \\ 0 & x < 0. \end{cases}$$

Simulation Data

- **Duration**: A random value generated by an exponential distribution of parameter 1, rounded up.
  - This time, the result will be an integer number.
  - Hint: *When it comes to “randomness”, what module should you use?*
  - Example:

Random exponential value, λ = 1	Rounded random exponential value, λ = 1
0.36242987	1
2.27409564	3
2.07593962	3
0.09725423	1

Simulation Data

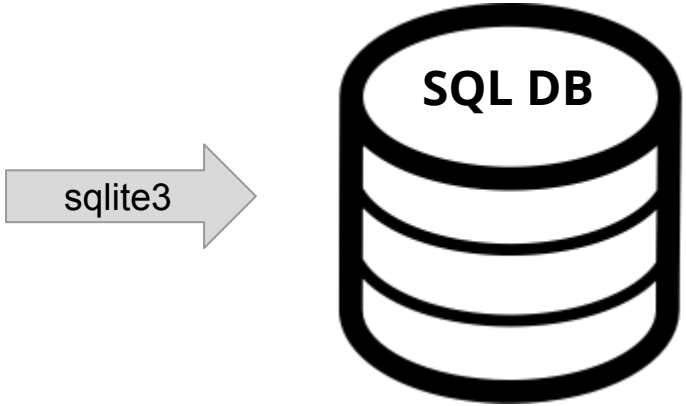
Tasks that need to be carried out by a processor.

ID	Arrival	Duration
JoGY6A	47.847	1
I*@1D*	0.12434545	3
FJUBT4	12.236673	3
*17hu-	85.18483830	1

Simulation Data

The code must store the dataset in an SQL database (using sqlite3).

ID	Arrival	Duration
JoGY6A	47.847	1
I*@1D*	0.12434545	3
FJUBT4	12.236673	3
*17hu-	85.18483830	1



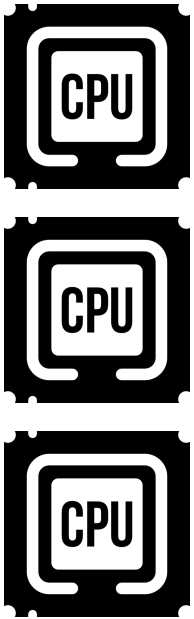
What should be the key of the table? Is the ID a candidate key?

Simulated System

Simulated System

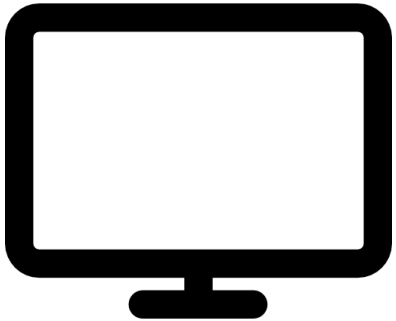
Tasks Queue

Processors



Clock

Output



Initialization

- The Database is loaded in the queue.
- Clock is set to 0.
- Processors are initialised and available.
- Message “** SYSTEM INITIALISED **” is displayed.

Simulated System

ID	Arrival	Duration
JoGY6A	3.2736	2
I*@1D*	0.12434545	3
FJUBT4	2.98452	1
*17hu-	3.2649	3
gT4Yg_	2.161761	2
##23eE	2.3628	4

Simulated System

ID	Arrival	Duration
JoGY6A	3.2736	2
I*@1D*	0.12434545	3
FJUBT4	2.98452	1
*17hu-	3.2649	3
gT4Yg_	2.161761	2
##23eE	2.3628	4

Simulated System

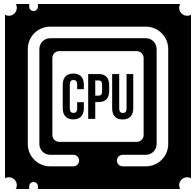
ID	Arrival	Duration
I*@1D*	0.12434545	3
gT4Yg_	2.161761	2
##23eE	2.3628	4
FJUBT4	2.98452	1
*17hu-	3.2649	3
JoGY6A	3.2736	2

Simulated System

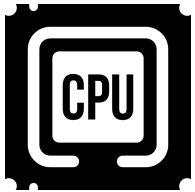
Tasks Queue

JoGY6A	*17hu-	FJUBT4	##23eE	gT4Yg_	l*@1D*
3.2736	3.2649	2.98452	2.3628	2.161761	**0.12434545**
2	3	1	4	2	3

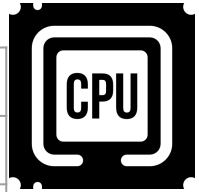
Processors



available



available



available

Clock = 0

Output

Task l*@1D* / 0.12434545 / 3 enters the system

- Clock is updated to 0.12434545.
- Message “** 0.12434545 : Task l*@1D* with duration 3 enters the system.” displayed
- The ID is checked:
  - Lowercase letter... X
  - Uppercase letter... ✓
  - Digit... ✓
  - Special characters... ✓

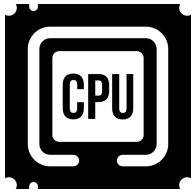
  It satisfies at least 3 of the rules. Message “** Task l*@1D* accepted.” is displayed.

- The task is assigned to processor 1. It ends at 3.12434545.
  Message “** 0.12434545 : Task l*@1D* assigned to processor 1.”

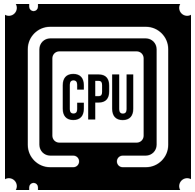
Simulated System

Clock = 0.12434545

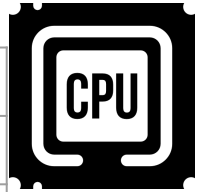
Processors



l*@1D*
3.12434545



available

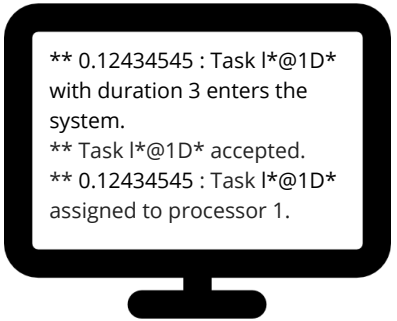


available

Tasks Queue

JoGY6A	*17hu-	FJUBT4	##23eE	gT4Yg_
3.2736	3.2649	2.98452	2.3628	**2.161761**
2	3	1	4	2

Output



Task gT4Yg_ / 2.161761 / 2 enters the system

- Clock is updated to 2.161761.
- Message “** 2.161761 : Task gT4Yg_ with duration 2 enters the system.” displayed
- The ID is checked:
  - Lowercase letter... ✓
  - Uppercase letter... ✓
  - Digit... ✓
  - Special characters... ✓

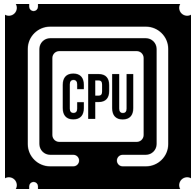
  It satisfies at least 3 of the rules. Message “** Task gT4Yg_ accepted.” is displayed.

- The task is assigned to processor 2. It ends at 4.161761.
  Message “** 2.161761 : Task gT4Yg_ assigned to processor 2.”

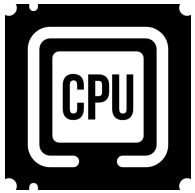
Simulated System

Clock = 2.161761

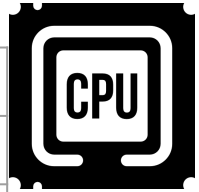
Processors



l*@1D*
3.12434545



gT4Yg_
4.161761

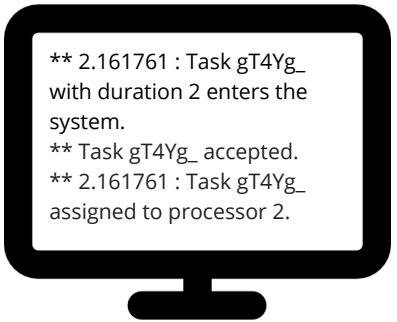


available

Tasks Queue

JoGY6A	*17hu-	FJUBT4	##23eE
3.2736	3.2649	2.98452	**2.3628**
2	3	1	4

Output



** 2.161761 : Task gT4Yg_ with duration 2 enters the system.
** Task gT4Yg_ accepted.
** 2.161761 : Task gT4Yg_ assigned to processor 2.

Task ##23eE / 2.3628 / 4 enters the system

- Clock is updated to 2.3628.
- Message “** 2.3628 : Task ##23eE with duration 4 enters the system.” displayed
- The ID is checked:
  - Lowercase letter... ✓
  - Uppercase letter... ✓
  - Digit... ✓
  - Special characters... ✓

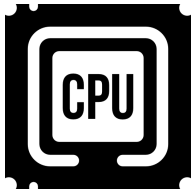
  It satisfies at least 3 of the rules. Message “** Task ##23eE accepted.” is displayed.

- The task is assigned to processor 3. It ends at 6.3628.
  Message “** 2.3628 : Task ##23eE assigned to processor 3.”

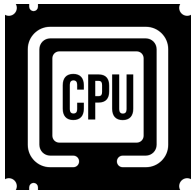
Simulated System

Clock = 2.3628

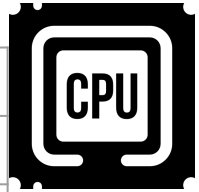
Processors



l*@1D*
3.12434545



gT4Yg_
4.161761

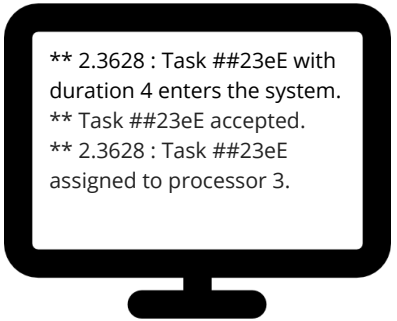


##23eE
6.3628

Tasks Queue

JoGY6A	*17hu-	FJUBT4
3.2736	3.2649	**2.98452**
2	3	1

Output



Task FJUBT4 / 2.98452 / 1 enters the system

- Clock is updated to 2.98452.
- Message “** 2.98452 : Task FJUBT4 with duration 1 enters the system.” displayed
- The ID is checked:
  - Lowercase letter... X
  - Uppercase letter... ✓
  - Digit... ✓
  - Special characters... X

  It does not satisfy at least 3 of the rules. Message “** Task FJUBT4 unfeasible and discarded.” is displayed.

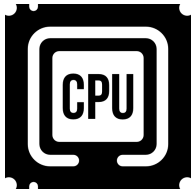
- The task is discarded.

Simulated System

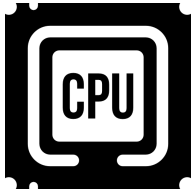
Clock = 2.98452

Tasks Queue

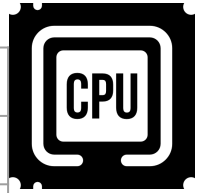
Processors



l*@1D*
3.12434545



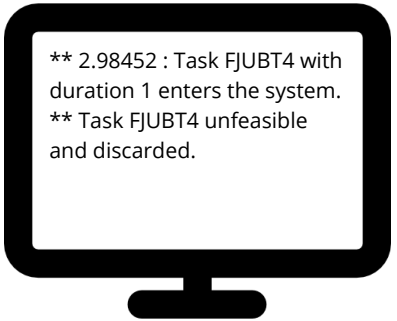
gT4Yg_
4.161761



##23eE
6.3628

JoGY6A	*17hu-
3.2736	3.2649
2	3

Output



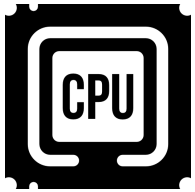
Task l*@1D* / 0.12434545 / 3 completed

- Clock is updated to 3.12434545.
- Message “** 3.12434545 : Task l*@1D* completed.” displayed.
- Processor 1 is available.

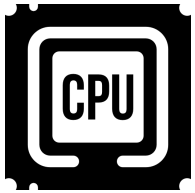
Simulated System

Clock = 3.12434545

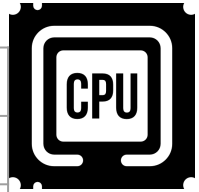
Processors



available



gT4Yg_
4.161761

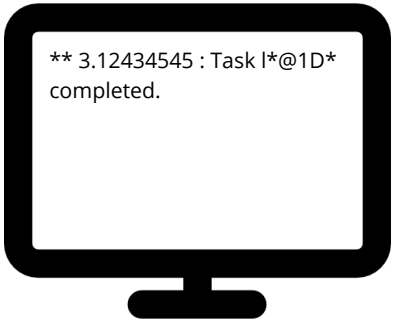


##23eE
6.3628

Tasks Queue

JoGY6A	*17hu-
3.2736	**3.2649**
2	3

Output



Task *17hu- / 3.2649 / 3 enters the system

- Clock is updated to 3.2649.
- Message “** 3.2649 : Task *17hu- with duration 4 enters the system.” displayed
- The ID is checked:
  - Lowercase letter... ✓
  - Uppercase letter... X
  - Digit... ✓
  - Special characters... ✓

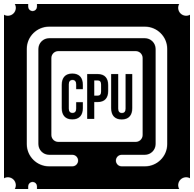
  It satisfies at least 3 of the rules. Message “** Task *17hu- accepted.” is displayed.

- The task is assigned to processor 1. It ends at 6.2649.
  Message “** 3.2649 : Task *17hu- assigned to processor 1.”

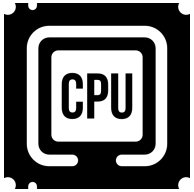
Simulated System

Tasks Queue

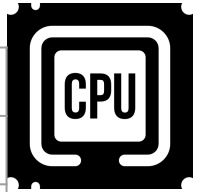
Processors



*17hu-
6.2649



gT4Yg_
4.161761

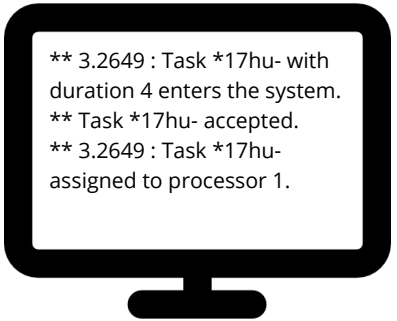


##23eE
6.3628

JoGY6A
3.2736
2

Clock = 3.2649

Output



Task JoGY6A / 3.2736 / 2 enters the system

- Clock is updated to 3.2736.
- Message “** 3.2736 : Task JoGY6A with duration 2 enters the system.” displayed
- The ID is checked:
  - Lowercase letter... ✓
  - Uppercase letter... ✓
  - Digit... ✓
  - Special characters... X

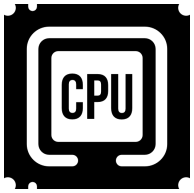
  It satisfies at least 3 of the rules. Message “** Task JoGY6A accepted.” is displayed.

- There are no processors available. The task must be put on hold.
  Message “** Task JoGY6A on hold.”

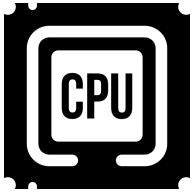
Simulated System

Tasks Queue Empty

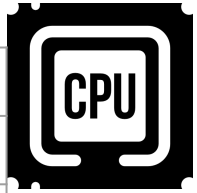
Processors



*17hu-
6.2649



gT4Yg_
4.161761

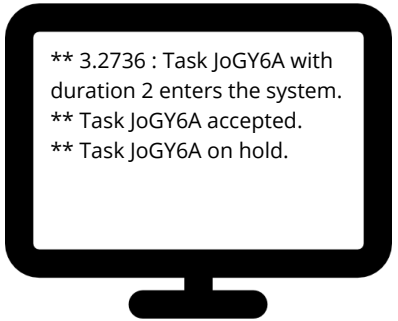


##23eE
6.3628

JoGY6A
on hold
2

Clock = 3.2736

Output



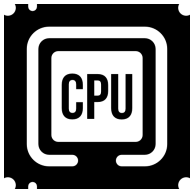
Task gT4Yg_ / 2.161761 / 2 completed

- Clock is updated to 4.161761.
- Message “** 4.161761 : Task l*@1D* completed.” displayed.
- Processor 2 is available.

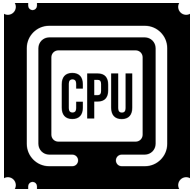
Simulated System

Tasks Queue

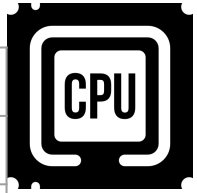
Processors



*17hu-
6.2649



available

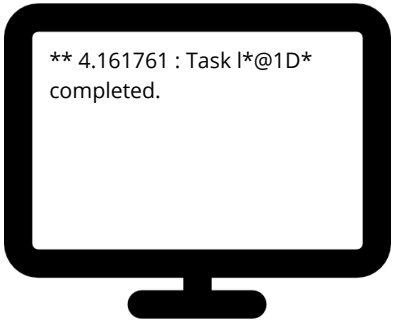


##23eE
6.3628

JoGY6A
on hold
2

Clock = 4.161761

Output



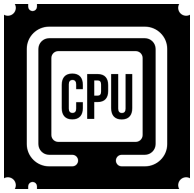
Task JoGY6A / 3.2736 / 2 is assigned.

- Clock is NOT updated (clock = 4.161761)
- The task is assigned to processor 2. It ends at 6.161761.
  Message “** 4.161761 : Task JoGY6A assigned to processor 2.”

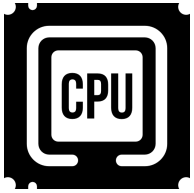
Simulated System

Tasks
Queue
Empty

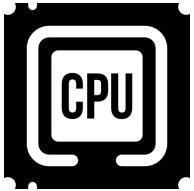
Processors



*17hu-
6.2649



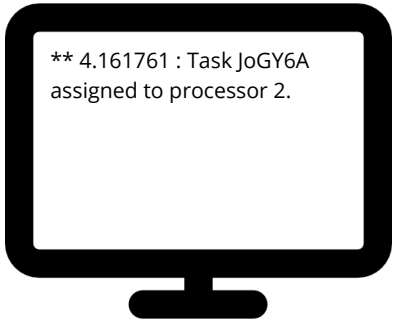
JoGY6A
6.161761



##23eE
6.3628

Clock = 4.161761

Output



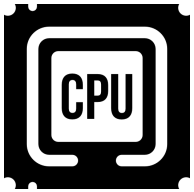
Task JoGY6A / 3.2736 / 2 completed

- Clock is updated to 6.161761.
- Message “** 6.161761 : Task JoGY6A completed.” displayed.
- Processor 2 is available.

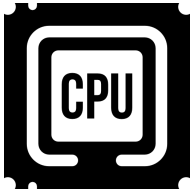
Simulated System

Tasks
Queue
Empty

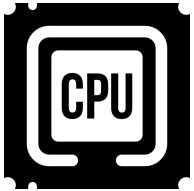
Processors



*17hu-
6.2649



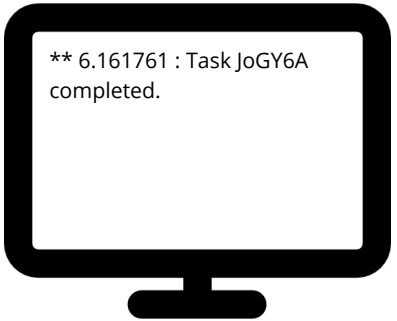
available



##23eE
6.3628

Clock = 6.161761

Output



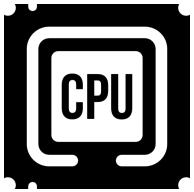
Task *17hu- / 3.2649 / 3 completed

- Clock is updated to 6.2649.
- Message “** 6.2649 : Task *17hu- completed.” displayed.
- Processor 1 is available.

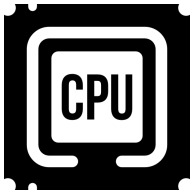
Simulated System

Tasks
Queue
Empty

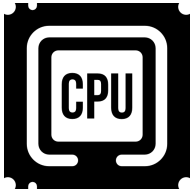
Processors



available



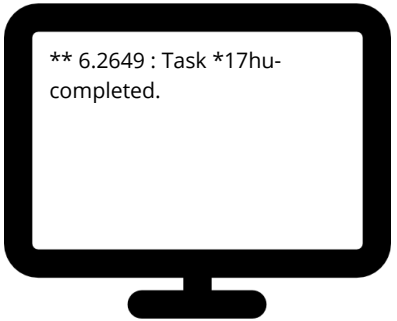
available



##23eE
6.3628

Clock = 6.2649

Output



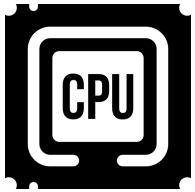
Task ##23eE / 2.3628 / 4 completed

- Clock is updated to 6.3628.
- Message “** 6.3628 : Task ##23eE completed.” displayed.
- Processor 3 is available.

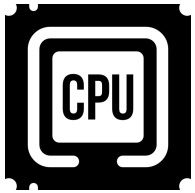
Simulated System

Tasks
Queue
Empty

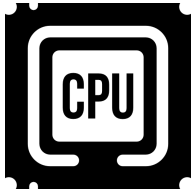
Processors



available



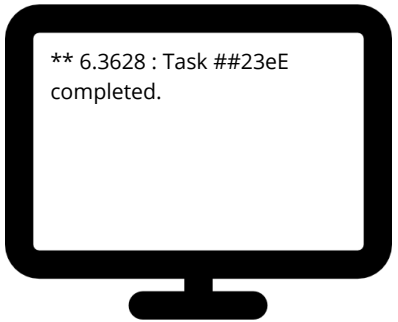
available



available

Clock =
6.3628

Output



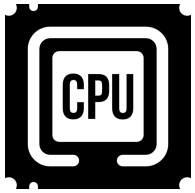
Simulation completed!

- Clock is not updated (clock = 6.3628).
- Message “** 6.3628 : SIMULATION COMPLETED. **” displayed.
- All’s well

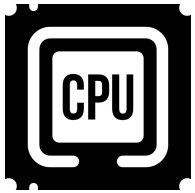
Simulated System

Tasks
Queue
Empty

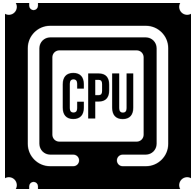
Processors



available



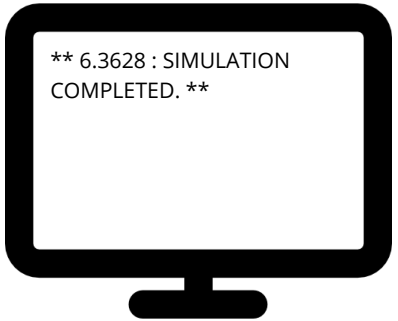
available



available

Clock =
6.3628

Output



Questions?