Processor Execution Simulation Assignment

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Configuration

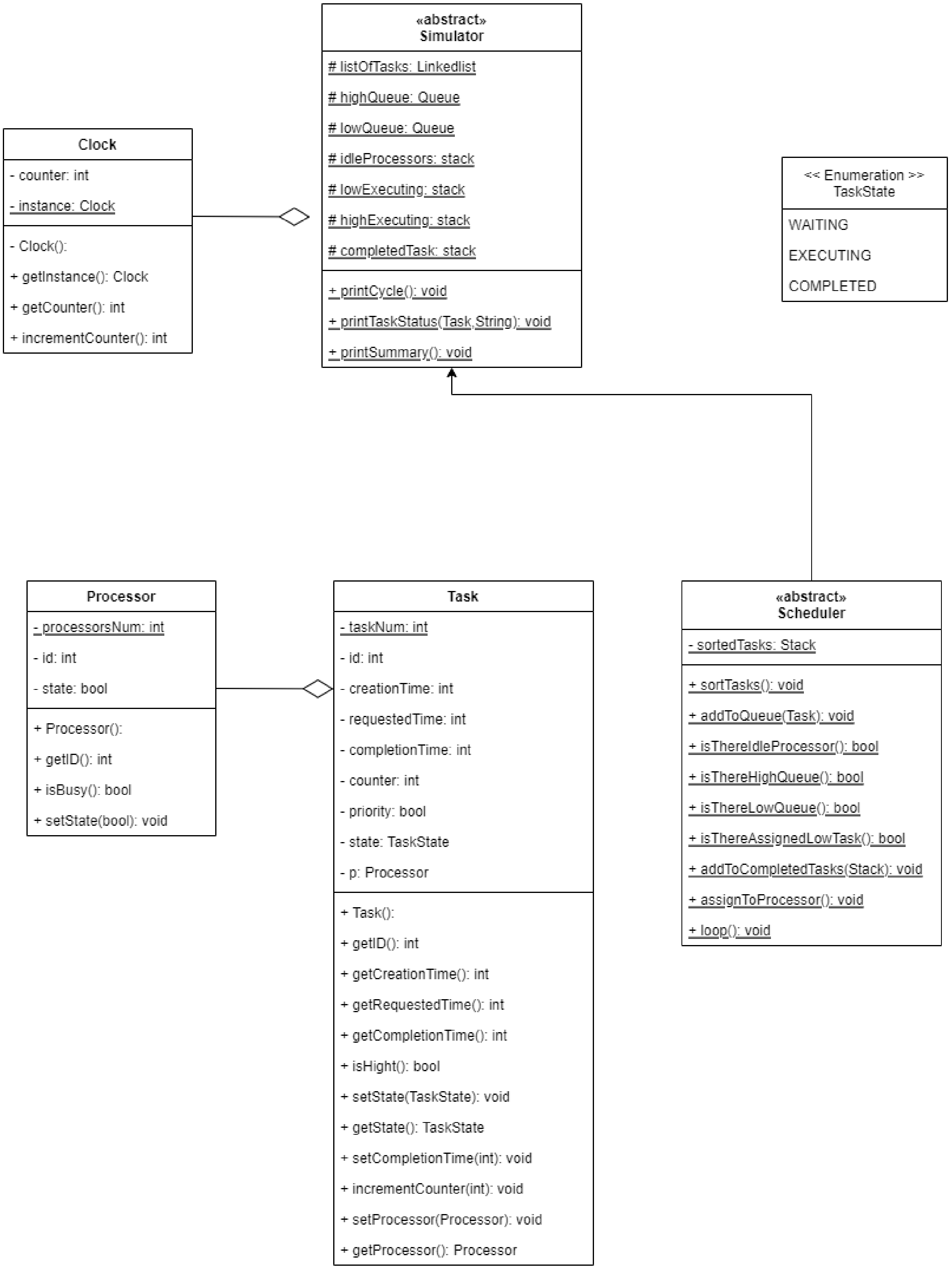
- “configuration.txt”
- First line represents the number of processors ex: 5
- Each line after represents task information’s separated by comma using the following format: Creation time, Requested time, Priority
- **example:**

  ```
  5
  20,5,high
  23,3,low
  30,10,high
  ..etc.
  ```

Main Method:

- Reads configuration settings from a file “configuration.txt”
- Read the first line which represents number of Processors
- While end of file reads each line that represents Task information Creation Time, Requested Time, Priority and create new object of task for each line
- Start the Scheduler loop to simulate the process execution
- Handle the exception in case of any error like wrong configuration format

UML:


«abstract»
Simulator
# listOfTasks: Linkedlist
# highQueue: Queue
# lowQueue: Queue
# idleProcessors: stack
# lowExecuting: stack
# highExecuting: stack
# completedTask: stack
+ printCycle(): void
+ printTaskStatus(Task,String): void
+ printSummary(): void
Clock
- counter: int
- instance: Clock
- Clock():
+ getInstance(): Clock
+ getCounter(): int
+ incrementCounter(): int
<< Enumeration >>
TaskState
WAITING
EXECUTING
COMPLETED
Processor
- processorsNum: int
- id: int
- state: bool
+ Processor():
+ getID(): int
+ isBusy(): bool
+ setState(bool): void
Task
- taskNum: int
- id: int
- creationTime: int
- requestedTime: int
- completionTime: int
- counter: int
- priority: bool
- state: TaskState
- p: Processor
+ Task():
+ getID(): int
+ getCreationTime(): int
+ getRequestedTime(): int
+ getCompletionTime(): int
+ isHight(): bool
+ setState(TaskState): void
+ getState(): TaskState
+ setCompletionTime(int): void
+ incrementCounter(int): void
+ setProcessor(Processor): void
+ getProcessor(): Processor
«abstract»
Scheduler
- sortedTasks: Stack
+ sortTasks(): void
+ addToQueue(Task): void
+ isThereIdleProcessor(): bool
+ isThereHighQueue(): bool
+ isThereLowQueue(): bool
+ isThereAssignedLowTask(): bool
+ addToCompletedTasks(Stack): void
+ assignToProcessor(): void
+ loop(): void

Clock:

- Used singleton class to create clock class
- The instance of the clock used in the Simulator because it’s shared between all processors
- Attributes: Counter
- Methods: incrementCounter used to increment the counter at the end of each cycle

Task State:

- Enum used to implement the three states of the task
- WAITING, EXECUTING, COMPLETED

Processor:

- Class used to make instance for each processor in the scheduler
- Attributes:
    - ProcessorNum static variable increased every new object instantiation used for assign ID for each new processor
    - ID
    - State Boolean true for busy false for idle
- Methods:
    - Constructor: sets the attribute ad push the processor to idleProcessors stack in the simulator
    - getID
    - setState
    - isBusy

Task:

- Class used to make instance for each task in the scheduler
- Attributes:
    - taskNum static variable increased every new object instantiation
      used for assign ID for each new processor
    - ID
    - State of type TaskState
    - creationTime, requestedTime, CompletionTime
    - counter, to keep counting until the counter reaches the requested time needed
    - priority (true for high, false for low)
    - P, object of type Processor: assigned when the task is executing to a processor and assigned to null if its completed or in the queue
- Methods:
    - Constructor: sets the attribute ad push the Task to listOfTasks linkedList in the simulator
    - Getters and setters for the attributes
    - IncrementCounter: method used at the end of each cycle to increment the counter of task and checks if the counter==requested time to set the state to Completed

Simulator (Abstract class):

- Class used to define the data structures needed in the simulation process
- Attributes:
  - **LinkedList<Task> listOfTasks = new LinkedList<Task>**
    to store the tasks when created
  - **Queue<Task> highQueue = new ArrayDeque<Task>**
    to store the high priority tasks in the state of WATING
  - **Queue<Task> lowQueue = new ArrayDeque<Task>**
    to store the low priority tasks in the state of WATING
  - **Stack<Processor> idleProcessors = new Stack<Processor>**
    to store the idles processors
  - **<Task> lowExecuting = new Stack<Task>**
    to store the high priority tasks in the state of EXECUTING
  - **<Task> highExecuting = new Stack<Task>**
    to store the low priority tasks in the state of EXECUTING
  - **<Task> completedTask = new Stack<Task>**
    to store the tasks in the state of COMPLETED
  - **Clock clock = Clock.getInstance()**
    shared clock in the simulation process
- Methods:
  - printCycle: used to print the cycle number on the screen
  - printTaskStatus: used to print the task and a message indicates what is going on with the task now
  - printSummary: print summary on the screen after the completion of simulation process

Scheduler (Abstract class):

- Class used to define the methods needed for the scheduling methods that are needed to start the simulation of scheduling process
- The class extends the Simulator class to inherit all the data structures that are needed
- Attributes:
    - sortedTasks: stack used to store the tasks sorted by the creation time
- Methods:
    - sortTasks: sort the listOftasks and store them in the sortedTasks Stack
    - addToQueue(Task): add the task to the appropriate queue based on the priority
    - isThereIdleProcessor: return Boolean if there is idle processor in the stack
    - isThereHighQueue: return Boolean if there is a high priority task WATING
    - isThereLowQueue: return Boolean if there is a low priority task WATING
    - isThereAssignedLowTask: return Boolean if there is low priority task EXECUTING for the case of INTERRUPT s
    - addToCompletedTasks: loop through EXECUTING tasks and check if there is COMPLETED tasks to add in the stack
    - assignToProcessor:
      check if there are tasks WAITING and assign them to an idle processor then set their state to EXECUTING, and handle the INTERREPUT if needed
    - loop():
        - start the scheduler and start the clock cycle
        - check if there is a creation of a task at the current cycle
        - handle the scheduling process for the tasks
        - finish until all the tasks are completed
        - print the cycle, tasks, processors statues at each cycle
        - print summary at the end of the simulation