ReadMe File for RTS Assignment on Automatic Time Demand Analysis

Programming Language Used : Java
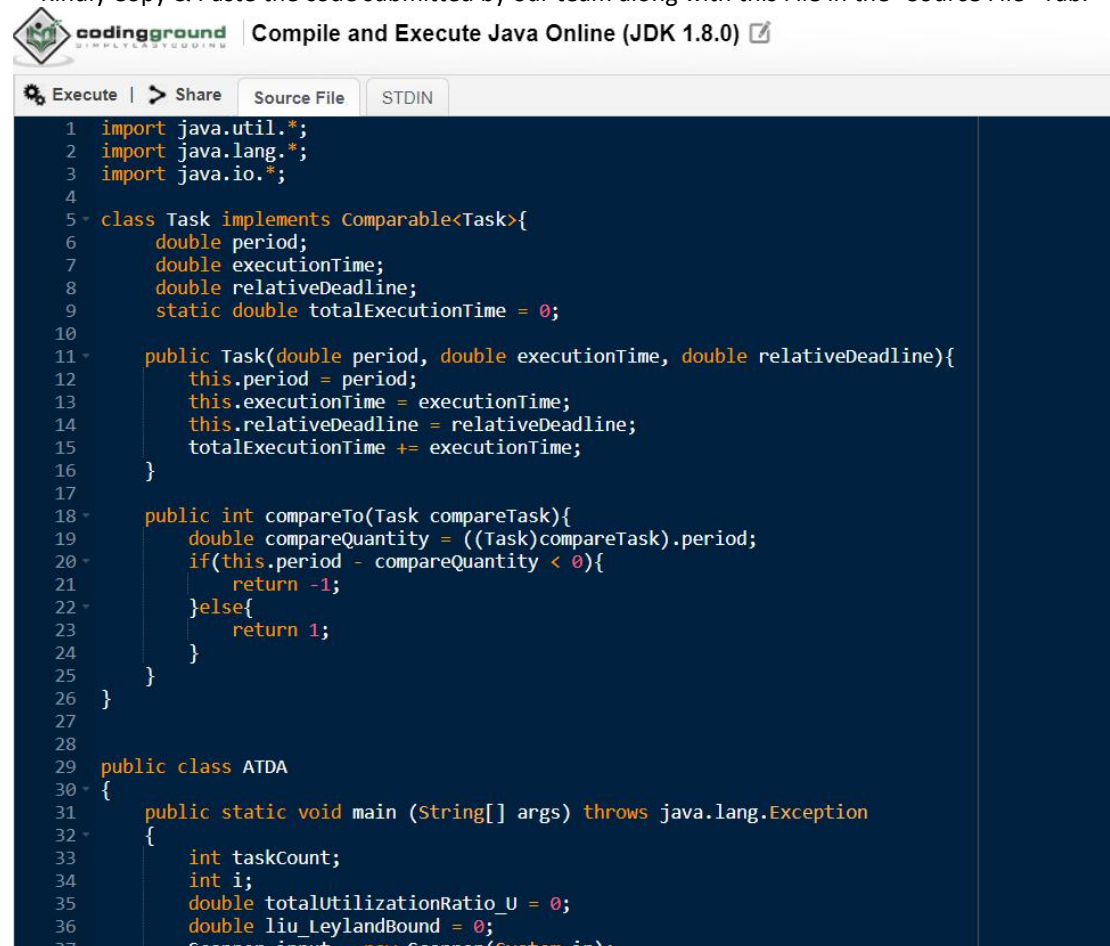
Sir, There are 2 ways in which you can Test our Code.
1) On an ONLINE Compiler.
2) On your Local Machine.

Below mentioned are the steps to be followed for both of these.

Steps to Compile & Run the Program on an ONLINE Compiler.

-> Kindly Visit, https://www.tutorialspoint.com/compile_java_online.php

-> Kindly Copy & Paste the code submitted by our team along with this File in the "Source File" Tab.
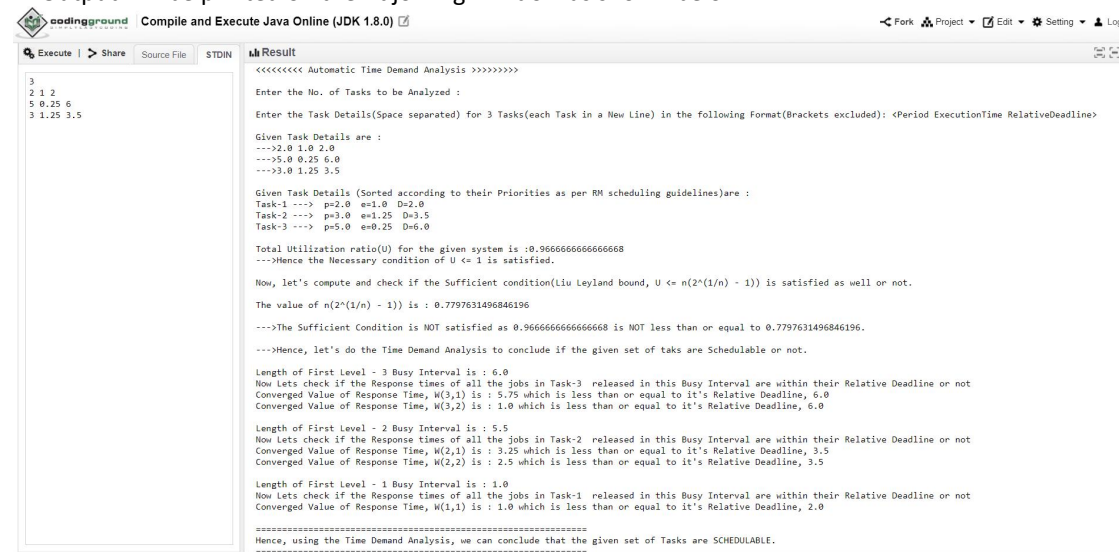

-> Give the input in the STDIN Tab as mentioned below(values can be altered as per your Test Cases).

-> Now click the Execute Button.
-> Output will be printed on the Adjoining Window as shown below.

Steps to Compile & Run the Program on your Local Machine.

-> Download & Install Java JDK/JRE from Oracle's Website.
https://www.oracle.com/java/technologies/downloads/

-> Open Command Prompt/Powershell and Navigate to the folder where our Source file(ATDA.java) is present.

-> Execute this command to compile the Program.
javac ATDA.java

-> Execute this command to run the Program.
java ATDA

-> Kindly provide the input to the program as prompted.

-> A Sample execution on a local machine would look like this.

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PS D:\ME@BITS\Semester_1\RTS\Assignment_3\Solution> javac ATDA.java
PS D:\ME@BITS\Semester_1\RTS\Assignment_3\Solution> java ATDA

<<<<<<<< Automatic Time Demand Analysis >>>>>>>>

Enter the No. of Tasks to be Analyzed :
3

Enter the Task Details(Space separated) for 3 Tasks(each Task in a New Line) in the following Format(Brackets excluded): <Period ExecutionTime RelativeDeadline>
4 1.5 5
6 2 8
4 1 6

Given Task Details are :
--->4.0 1.5 5.0
--->6.0 2.0 8.0
--->4.0 1.0 6.0

Given Task Details (Sorted according to their Priorities as per RM scheduling guidelines)are :
Task-1 ---> p=4.0  e=1.5  D=5.0
Task-2 ---> p=4.0  e=1.0  D=6.0
Task-3 ---> p=6.0  e=2.0  D=8.0

Total Utilization ratio(U) for the given system is :0.9583333333333333
--->Hence the Necessary condition of U <= 1 is satisfied.

Now, let's compute and check if the Sufficient condition(Liu Leyland bound, U <= n(2^(1/n) - 1)) is satisfied as well or not.

The value of n(2^(1/n) - 1)) is : 0.7797631496846196

--->The Sufficient Condition is NOT satisfied as 0.9583333333333333 is NOT less than or equal to 0.7797631496846196.

--->Hence, let's do the Time Demand Analysis to conclude if the given set of taks are Schedulable or not.

Length of First Level - 3 Busy Interval is : 11.5
Now Lets check if the Response times of all the jobs in Task-3  released in this Busy Interval are within their Relative Deadline or not
Converged Value of Response Time, W(3,1) is : 7.0 which is less than or equal to it's Relative Deadline, 8.0
Converged Value of Response Time, W(3,2) is : 5.5 which is less than or equal to it's Relative Deadline, 8.0

Length of First Level - 2 Busy Interval is : 2.5
Now Lets check if the Response times of all the jobs in Task-2  released in this Busy Interval are within their Relative Deadline or not
Converged Value of Response Time, W(2,1) is : 2.5 which is less than or equal to it's Relative Deadline, 6.0

Length of First Level - 1 Busy Interval is : 1.5
Now Lets check if the Response times of all the jobs in Task-1  released in this Busy Interval are within their Relative Deadline or not
Converged Value of Response Time, W(1,1) is : 1.5 which is less than or equal to it's Relative Deadline, 5.0

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Hence, using the Time Demand Analysis, we can conclude that the given set of Tasks are SCHEDULABLE.
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Sample Inputs

Input 1:

3
2 1 2
5 0.25 6
3 1.25 3.5

Input 2:
3
4 1.5 5
6 2 8
4 1 6

Logic Used to solve Automatic Time Demand Analysis:

1) Take the Input.(The Format accepted by our Program is <Period ExecutionTime RelativeDeadline>)
2) Sort the given tasks based on their priorities. (Here the priorities are decided by their period as we are using RM algorithm.)
3) Compute the Utilization Ratio U.
   If, U<=1(Necessary Condition), Proceed Further.
   Else, Return "NOT SCHEDULABLE"
4) Now check if the Liu-Leyland Bound is satisfied or not. U <= n(2^(1/n) - 1). (Sufficient Condition).
   If, U <= n(2^(1/n) - 1), Return "SCHEDULABLE".
   Else, proceed further to perform the Time Demand Analysis.

5) Compute the First Level-pi Busy Interval for a Task Ti using the Iterative Equation mentioned below,

$$t = \sum_{k=1}^{i} \lceil t/p_k \rceil e_k$$

6) Now compute the Response Time for all the jobs of Ti released in this Busy Interval using the Iterative Equation mentioned below.

$$w_{i,j}(t) = je_i + \sum_{k=1}^{i-1} \lceil (t+r_{i,j})/p_k \rceil e_k - r_{i,j}$$

7) Now check if the response times of all the jobs of this Task "Ti" are within their Relative Deadline.

$$W_i \le D_i$$

   If, YES, proceed further with this checking.
   Else, Return "NOT SCHEDULABLE".
8) Repeat Steps 5 to 7 for all the Tasks.
9) If the condition mentioned in Step 7 is satisfied for all the jobs in the respective tasks, Return, "SCHEDULABLE".