**CS621 Assignment #1 Fall 2023**

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**Answer:**

**1) Statically map (schedule) the given tasks in such a way that results in overall minimum possible execution time for the above-mentioned CPUs.**

*“Static mapping techniques distribute the tasks among processes prior to the execution of the algorithm.”*

First, we need to assign tasks to CPUs in a way that minimizes the overall execution time. For this we can do following things like:

* *Assign the tasks with higher computation requirements to the CPUs with higher computation capacities.*
* *Sort the tasks and CPUs based on their computation requirements and capacities.*

|  |  |  |  |
| --- | --- | --- | --- |
| **Task** | **Computation Requirements (MI)** | **Assigned CPU** | **CPU Capacity** |
| T10 | 70 | CPU3 | 20 |
| T9 | 60 | CPU3 | 20 |
| T8 | 50 | CPU2 | 15 |
| T7 | 40 | CPU2 | 15 |
| T6 | 30 | CPU1 | 10 |
| T5 | 25 | CPU1 | 10 |
| T4 | 20 | CPU1 | 10 |
| T3 | 15 | CPU0 | 5 |
| T2 | 15 | CPU0 | 5 |
| T1 | 10 | CPU0 | 5 |
| T0 | 5 | CPU0 | 5 |

**2) Calculate the expected maximum execution time (makespan) of all tasks.**

The makespan is the total time taken for all tasks to complete. It can be calculated by finding the maximum completion time among all tasks.

*makespan = max(completion\_time(T0), completion\_time(T1), completion\_time(T2),....., completion\_time(T10))*

The completion time of each task can be calculated by dividing the computation requirement by the assigned CPU capacity and summing up the results.

**Completion Time(T0) = 5 / 5 = 1**

**Completion Time(T1) = 10 / 5 = 2**

**Completion Time(T2) = 15 / 5 = 3**

**Completion Time(T3) = 15 / 5 = 3**

**Completion Time(T4) = 20 / 10 = 2**

**Completion Time(T5) = 25 / 10 = 2.5**

**Completion Time(T6) = 30 / 10 = 3**

**Completion Time(T7) = 40 / 15 = 2.67**

**Completion Time(T8) = 50 / 15 = 3.33**

**Completion Time(T9) = 60 / 20 = 3**

**Completion Time(T10) = 70 / 20 = 3.5**

So, the makespan will be 3.5 (maximum completion time).

**3) Compute Maximum Achievable Speedup.**

Speedup is defined as *“the ratio of the execution time on a single processor to the execution time on multiple processors.”*

**Speedup = Execution Time on Single Processor / Execution Time on Multiple Processors**

As we already know from the above that:

* Execution Time on Single Processor = 3.5
* Execution Time on Multiple Processors = 3.5

Thus, the Maximum Achievable Speedup = 3.5 / 3.5 which is equal to 1.

So, the maximum achievable speedup is equal to 1 which shows that there is no speedup achieved by using multiple processors.