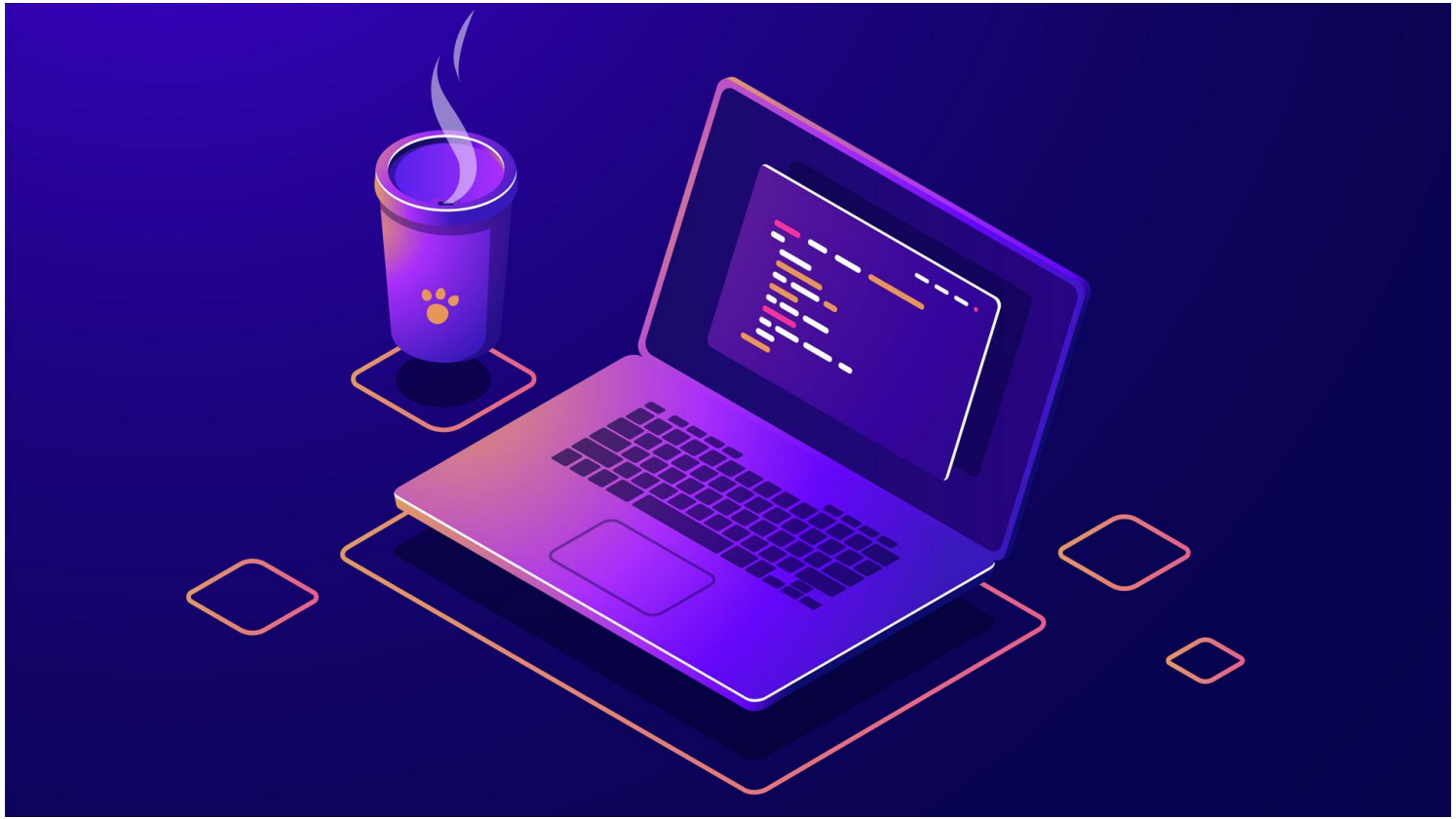
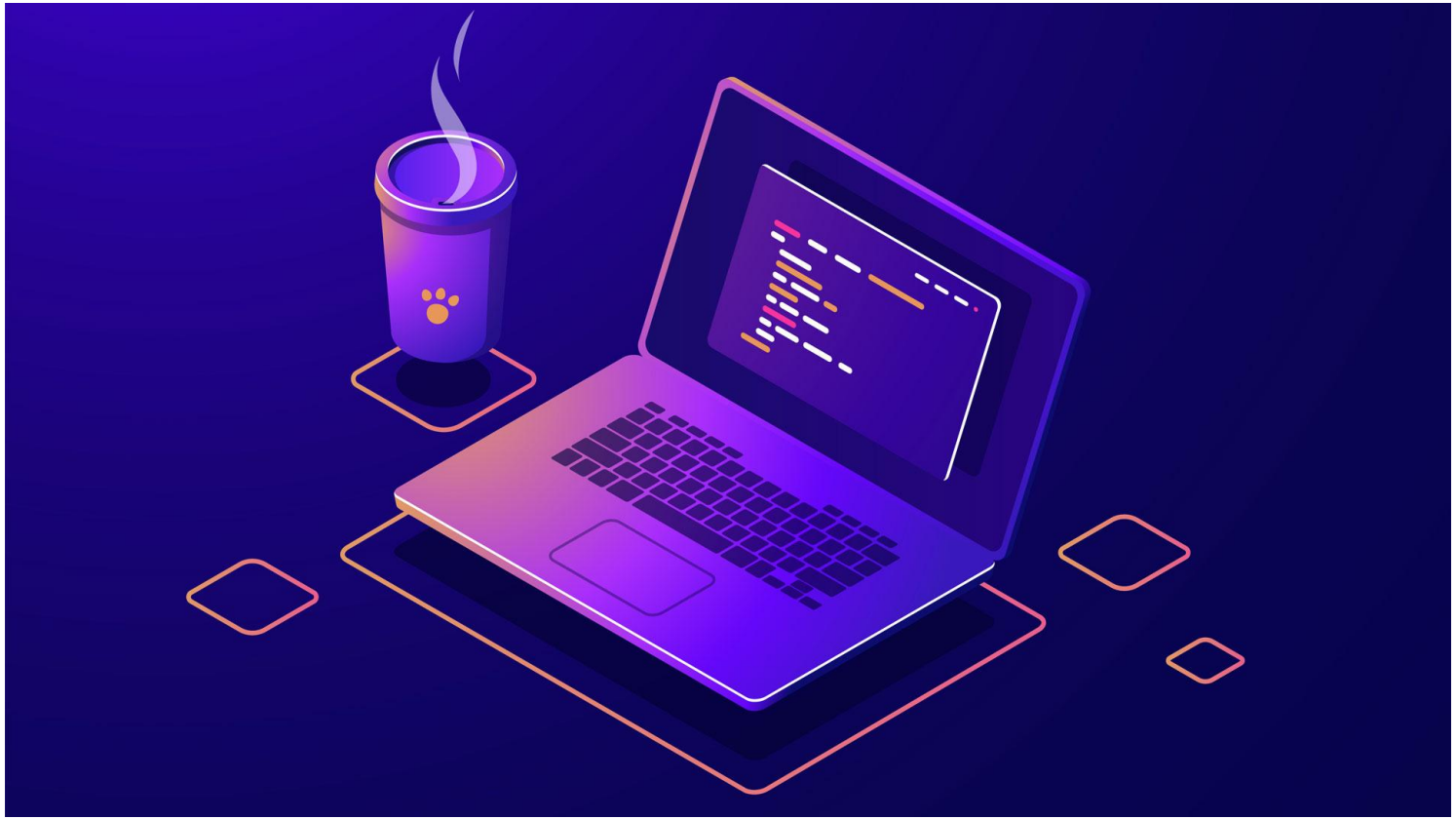
Parallelism Fundamentals Problems

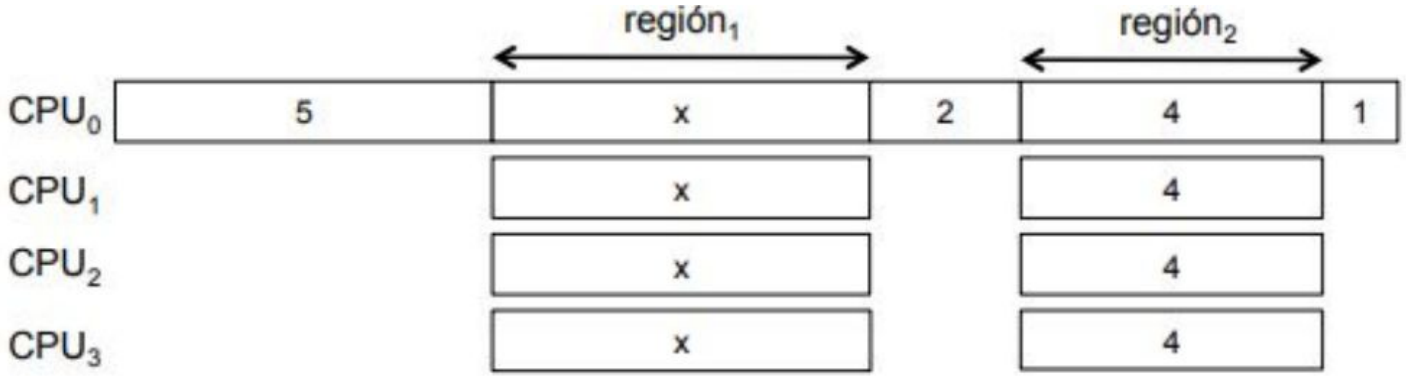


Problem 5



Problem 5

The following figure shows an incomplete time diagram for the execution of a parallel application on 4 processors:



Problem 5

The figure has a set of rectangles, each rectangle represents the execution of a task with its associated cost in time units. In the timeline there are two regions (1 and 2) with 4 parallel tasks each. The execution cost for tasks in $region_1$ is unknown (x time units each); the cost for each task in $region_2$ is 4 time units. The computation starts with a sequential task (with cost 5), then all tasks in $region_1$ running in parallel, followed by another sequential task (with cost 2), then all tasks in $region_2$ running in parallel followed by a final sequential task (with cost 1).

Knowing that an ideal speed-up of 9 could be achieved if the application could make use of infinite processors ($S_{p \to \infty} = 9$), and assuming that the two parallel regions can be decomposed ideally, with as many tasks as processors with the appropriate fraction of the original cost, **we ask:**

(a) What is the parallel fraction (ϕ) for the application represented in the time diagram above?

(b) Which is the "speedup" that is achieved in the execution with 4 processors (S_4)?

(c) Which is the value x in $region_1$?

Solutions

a)

$$S_{\infty} = 1 / 1 - \varphi$$

$$9 = 1 / 1 - \varphi \quad \Rightarrow \varphi = 0.8888$$

Solutions

b)

$$S_4 = 1 / ((1-\varphi) + \varphi/P4)$$

$$S_4 = 3$$

Solutions

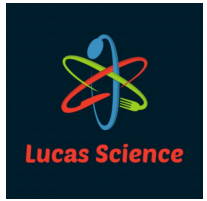
c)

$$\varphi = T_{PAR} / T_1 = 4x + 16 / 4x + 24$$

$$\Rightarrow x = 12$$

Instructor Social Media

Youtube: Lucas Science



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