Agenda

Processes & Threads
Threaded program in Java
concurrency vs parallelism
single core vs multicore
context switching

code → compile → executable file → download & Install → HD program → RAM → process

process: program in execution

HD	RAM
slow	fast
1TB	1 TB
3K-5K	8GB

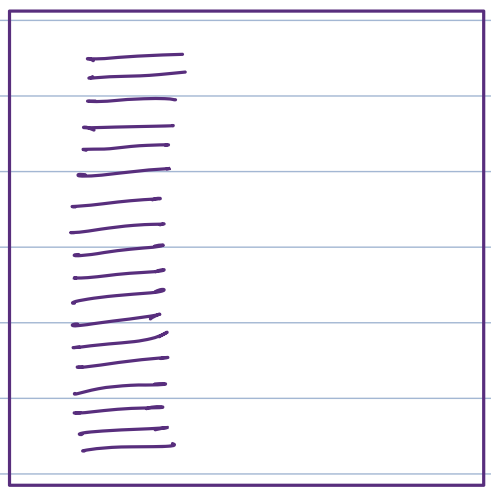
SSD

CPU → HD
↓
RAM

2.2 GHz
↓
$2.2 * 10^9$ ins/sec

```
for(i=0; i<n; i++)
{
    ...
}
```

COA → computer Architecture



Process : program in execution

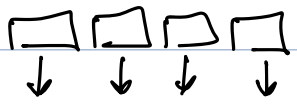
↓

PCB (Process Control Block)

↓

data structure which stores the complete info about a process.

```
class ProcessControlBlock {
    pid
    List<variables>
    memory details
    priority
    program counter  ⟶  current line of execution.
    Call stack
}
```



MS word

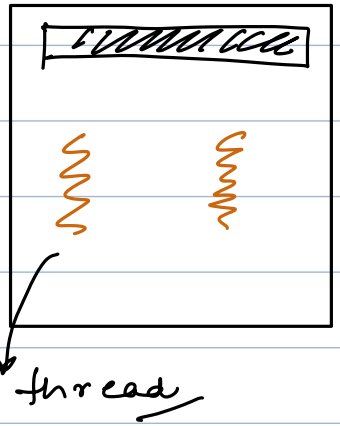
I/O consuming input : P1
displaying the output : P2
autosaving : P3
autocorrect — P4

Thread → part of the process

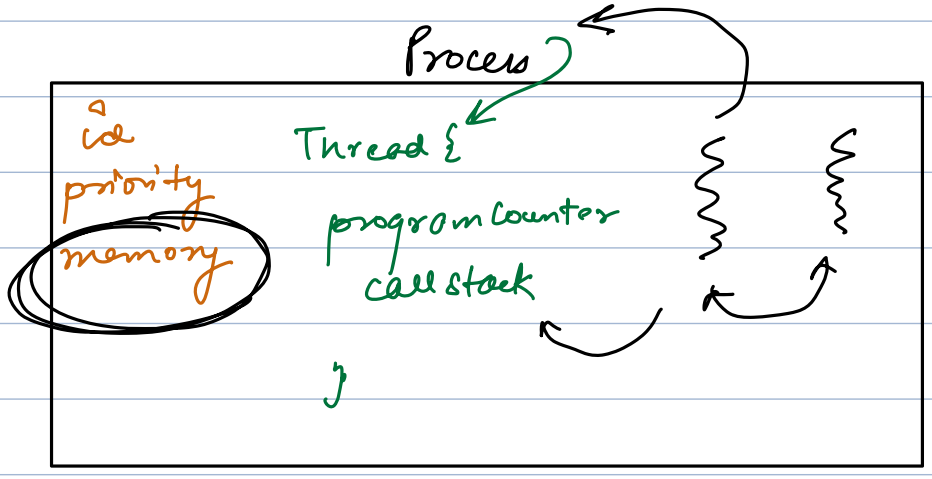
↓

unit of CPU execution

Process

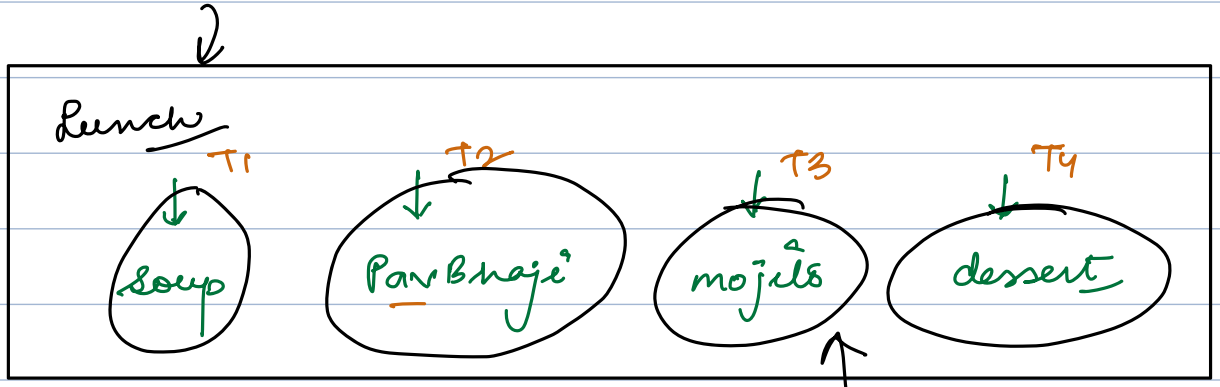


thread



① Data sharing is much easier in threads

② creation of threads takes less overhead.

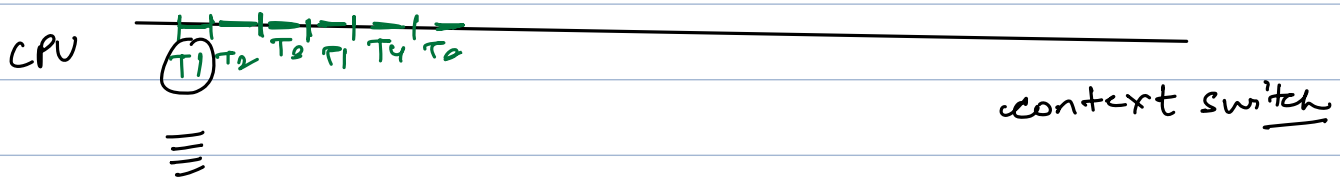


- boil vegetables
- Tadka
- gravy
- mixing
- pav

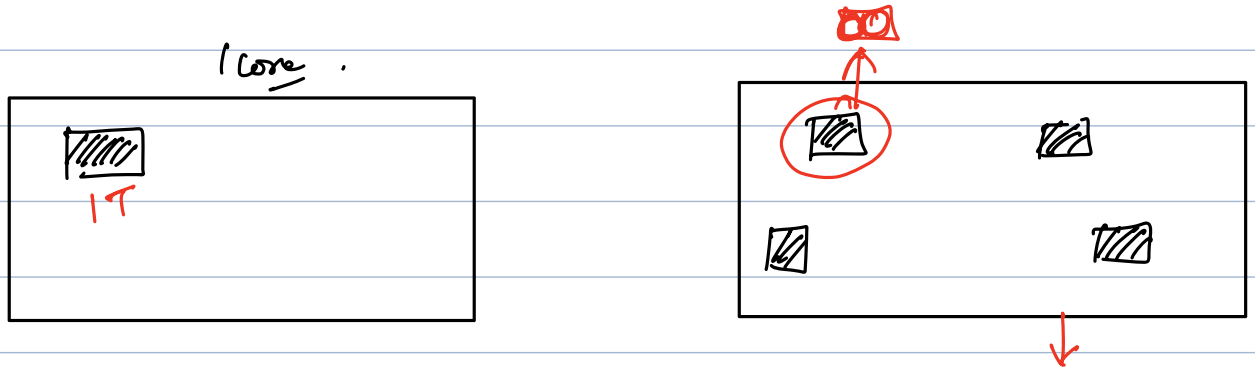
≠

- program counter

CPU scheduler → decides which thread to be executed



single core vs multi-core



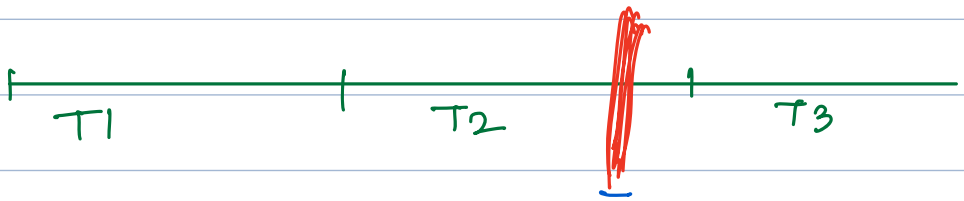
Each core can execute one thread at a particular moment

i3 – dual
i5 – quad
i7 – quad + hyperthreading → 2 threads

concurrency vs parallelism

case I

a single core → until one thread completely executes, the other thread can't start



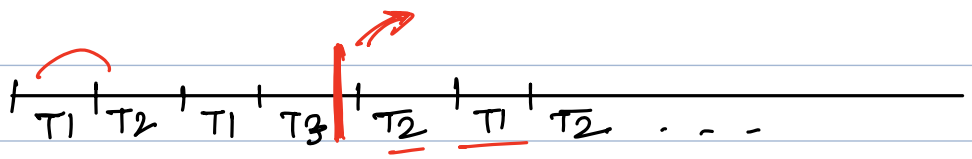
(1) How many threads are partially completed?

1

(2) How many threads are making progress?

1

case II single core. but switching b/w threads is allowed



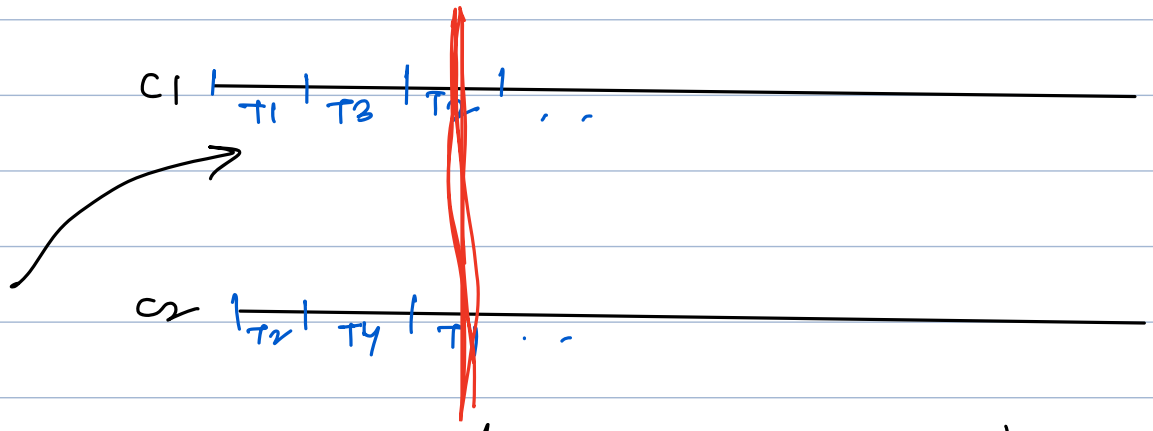
(1) How many threads are partially completed?

~~1~~ multiple

(2) How many threads are making progress?

1

Case III multi-core.



① How many threads are partially completed?

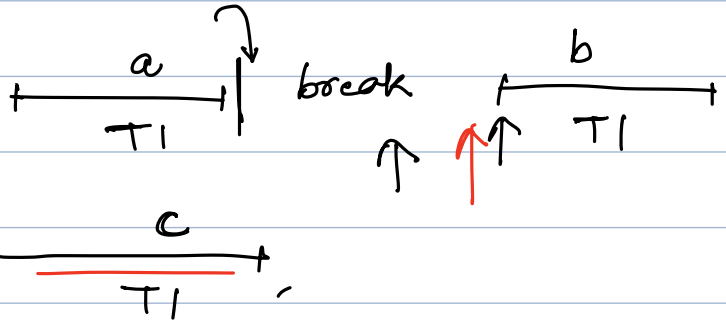
✗ multiple

② How many threads are making progress?

✗ 2

↓ parallelism

context switch



① a + b = c

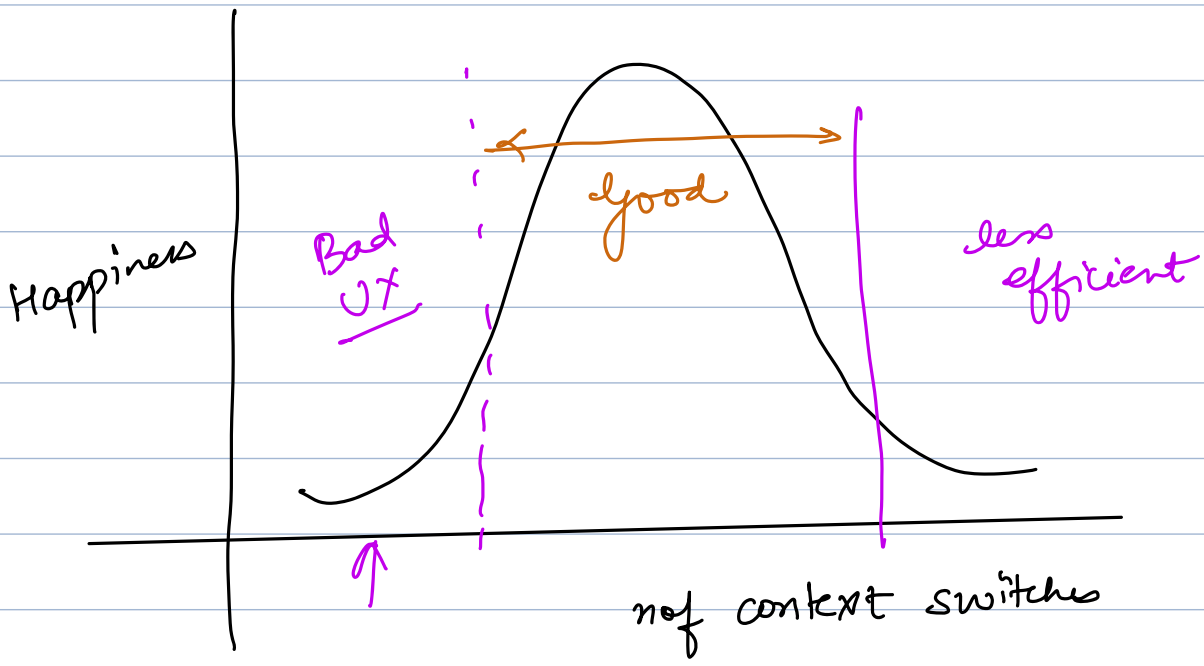
② a + b < c

③ a + b > c

T1 ⟶ T2

① Save the current state of T1
② Load the previous state of T2

} time



10:30 pm

Java: multi-threaded program