Q. A disk has **8 sectors** per track and spins at **600 rpm**. It takes the controller **10 ms** from the end of one I/O operation before it can issue a subsequent one. How long does it take to read all 8 sectors using the following interleaving systems?
(a) No interleaving
(b) Single interleaving
(c) Double interleaving

Ans:

- Interleaving is when sectors are arranged in alternate order.
- (a) When there is **no interleaving** then sectors would be like this
  S1->S2->S3->S4->S5->S6->S7->S8

- We know,
  In 60 sec disk revolves 600 rotations. [600 RPM]
  In 1 sec disk revolves 600/60 = 10 rotation.

  For 10 rotations it requires 1000 ms [1 sec = 1000 ms]
  For 1 rotation it requires 1000/10=100ms

  Total time spend on each sector = 100/8 = 12.5ms [$1/8^{th}$ of the track= 100/8]

  The time it takes to load another request is 10ms that is less than 12.5ms

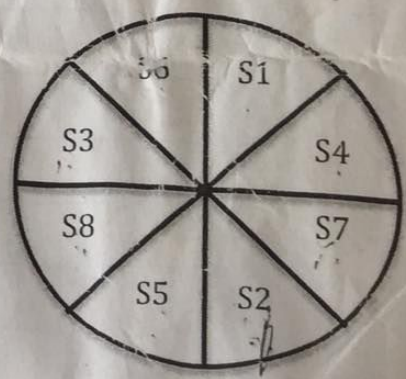
  In first request it read sector **S1** then while the disk is spinning the controller went to fetch another request. And **10msec** are waste out of **12.5msec** that means more than half of the **s2** had already passed therefore the heads to rotate again to fetch **S2**. So will be the case of all **8 sectors** meaning it will take **8 revolutions** while each revolution takes **100 msec** and that would be **800 msec.**

(b) When there is **Single Interleaving** then the sectors would be arranged in the order

S1->S5->S2->S6->S3->S7->S4->S8
therefore in 1 revolution 4 sectors will be read and
in 2 revolutions 4*2= 8 sectors will be read

for 1 rotation it takes 100msec
therefore for 2 rotations it takes 100*2 = 200 msec.

(c) When there is **Double Interleaving** then the sectors would be arranged in
S1->S4->S7->S2->S5->S8->S3->S6
therefore only 3 sectors will be read in 1 revolution.
for 1 rotations it takes 100msec
for 3 rotations it takes 100*3=300msec.



but 360/8 is 45 degrees, i.e. only 3/4 of the disk rev is required in the 3rd revolution
so we need to multiply 100*3/4 to get the actual time needed to read the last sector **S8**. Since it comprises only 3/4.
Upto 2^{nd} rotations it takes 200msec.
For 3^{rd} rotation it takes ¾*100 = 75msec
So total time = 200+75 = 275msec