1. Disks

We have a disk with the following parameters:

- Capacity = 1 TB (NOTE: 1TB = 1024 GB)
- RPM = 10000
- **Average** Seek = 9 ms
- Maximum Transfer Rate = 10^8 B/s

Assume there are **no cache or buffer**, and you will need to wait for a whole rotation if you want to access the same sector twice. We are always reading or writing a whole sector of size **512 bytes**.

a. How many sectors do we have?

b. How long would it take to serve 10 random reads on average?

c. How long would it take to serve 10 random updates on average? An update is a read followed by a write to the same sector, so the access pattern will be R0W0R1W1...R9W9 rather than R0R1...R9W0W1...W9

d. How long would it take to serve 10 sequential reads? You may assume they are on the same track.

e. How long would it take to serve 10 sequential updates? Note that the access pattern is R0W0R1W1...R9W9, and all 10 sectors are on the same track.

2. Disk Scheduling

In this question, we will perform some calculations on a simplified disk. Assume the **maximum rotational delay** on this disk is **R**, the **time to seek between 2 adjacent tracks** is **S**, and the **transfer time** is so fast that we just consider it to be **free**. Also assume $S \gg R$. All requests are already received. The disk head can start from any position.

a. Assume the disk has only a **single track**, and a **FIFO** (First In First Out) scheduling policy. What is the (approximate) **worst case** execution time for **3 different requests** (i.e., the three requests are issued to three **different** sectors on the disk)?

b. Assume the disk has only a **single track**, and a **SATF** (Shortest Access Time First) scheduling policy. What is the **worst case** execution time for **3 different requests**?

c. Assume the disk has **3 tracks**, and a **FIFO** scheduling policy. What is the **worst case** execution time for **3 different requests**?

d. Assume the disk has **3 tracks**, and a **SATF** scheduling policy. What is the **worst case** execution time for **3 different requests**?

e. Assume the disk has **3 tracks**, and a **C-SCAN** scheduling policy. What is the **worst case** execution time for **3 different requests**? Recall that in C-SCAN the disk head is only allowed to scan in one direction.

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