Question 1

A disk rotates at 7200 RPM and can transfer 150 MB/s of data from its outer track. What is the maximum number of bytes of data that a single outer track can hold? Show your calculations, state any assumptions, and show your work so we can see how you derived your answer.

Answer

Assumption:

- the disk can rotate at constant speed
- Transfer 150 MB/s is the maximum transfer rate

Then use transfer rate * time of rotating one revolution = maximum number of bytes that a single outer track can hold.

7200 RPM = 120 r/sec which mean 1/120 sec/r

1/120 sec * 150 MB/sec = 1.25 MB = **1,250,000 bytes**

Question 2

Given an average seek time of 5ms, a rotational speed of 10,000 RPM, and a transfer rate of 200 MB/s, how long does a 65536-byte random read request take, in milliseconds, on average? What if the average seek time is 12ms and rotational speed is 5400 RPM? Show your calculations, state any assumptions, and show your work so we can see how you derived your answer.

Answer

1)

- Average seek time – 5ms
- Assume Average rotational delay – 3ms (i.e., ½ rotation and a rotational speed of 10,000 RPM) 10000 RPM = 166 r/sec -> ½ rotation takes 3ms
- Transfer rate – 200MB/s

5ms + 3ms + (65KB / 200KB/ms) = **8.325ms**

2)

- Average seek time – 12ms
- Assume Average rotational delay – 5.5ms (i.e., ½ rotation and a rotational speed of 5400 RPM) 5400 RPM = 90 r/sec -> ½ rotation takes 5.5ms
- Transfer rate – 200MB/s

12ms + 5.5ms + (65KB / 200KB/ms) = **17.825ms**

Question 3

If a system has an estimated mean time between failures of 20,000 days, what is its expected annual reliability expressed as a probability?

Answer
MTBF = 20,000 days

According to

$$R = e^{-t/MTBF}$$

expected annual reliability = (2.71828)^(-365days / 20,000 days) = 0.9819 = 98.19%

Question 4

A power control system is required to have an availability of at least 99.995% in accordance with regulations. The systems development team has conducted empirical testing and derived an mean time to restore of 1.5 hours and an mean time between failure of 3.1667 years. Will the system meet the expected availability?

Answer
MTTR = 1.5 hours
MTBF = 3.1667 years = 27740.292 hours

According to

$$A = \frac{MTBF}{MTBF + MTTR}$$

A = 27740.292 / (1.5+27740.292) = 0.999945 = 99.9945%

99.9945% < 99.995%.So it does **NOT** meet the expected availability.