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Class: 19

10.11 Suppose that a disk drive has 5,000 cylinders, numbered 0 to 4,999. The drive is currently serving a request at cylinder 2,150, and the previous request was at cylinder 1,805. The queue of pending requests, in FIFO order, is:
2069, 1212, 2296, 2800, 544, 1618, 356, 1523, 4965, 3681
Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for each of the following disk-scheduling algorithms?

a. First Come First Serve (FCFS)
order: 2150, 2069, 1212, 2296, 2800, 544, 1618, 356, 1523, 4965, 3681
total distance = (2150-2069) + (2069-1212) + (2296-1212) + (2800-2296) + (2800-544) + (1618-544) + (1618-356) + (1532-356) + (4965-1523) + (4965-3681)
= 81 + 857 + 1084 + 504 + 2256 + 1074 + 1262 + 1167 + 3442 + 1284
= 13011 (cylinders)

b. Shortest Seek Time First (SSTF)
order: 2150, 2069, 2296, 2800, 3681, 4965, 1618, 1523, 1212, 544, 356
total distance = 81 + 227 + 504 + 881 + 1284 + 3347 + 95 + 311 + 668 + 188
= 7586 (cylinders)

c. SCAN
order: 2150, 2296, 2800, 3681, 4965, 4999, 2069, 1618, 1523, 1212, 544, 356
total distance = 146 + 504 + 881 + 1284 + 34 + 2930 + 451 + 95 + 311 + 688 +188
= 7492 (cylinders)

d. LOOK
order: 2150, 2296, 2800, 3681, 4965, 2069, 1618, 1523, 1212, 544, 356
total distance = 146 + 504 + 881 + 1284 + 2896 + 451 + 95 + 311 + 668 + 188
= 7424 (cylinders)

e. C-SCAN
order: 2150, 2296, 2800, 3681, 4965, 4999, 0, 356, 544, 1212, 1523, 1618, 2069
total distance = 146 + 504 + 881 + 1284 + 34 + 4999 + 356 + 188 + 668 + 311 + 95 + 451 = 9917 (cylinders)

f. C-LOOK
the order: 2150, 2296, 2800, 3681, 4965, 356, 544, 1212, 1523, 1618, 2069
total distance = 146 + 504 + 881 + 1284 + 4609 + 188 + 668 + 311 + 95 + 451
= 9137 (cylinders)

10.21 The reliability of a hard-disk drive is typically described in terms of a quantity called mean time between failures (MTBF). Although this quantity is called a “time,” the MTBF actually is measured in drive-hours per failure.

a. If a system contains 1,000 disk drives, each of which has a 750,000 hour MTBF, which of the following best describes how often a drive failure will occur in that disk farm: once per thousand years, once per century, once per decade, once per year, once per month, once per week, once per day, once per hour, once per minute, or once per second?

750000 drive-hours per failure divided by 1000 drives gives 750 hours per failure, which is about 31 days or once per month.

b. Mortality statistics indicate that, on the average, a U.S. resident has about 1 chance in 1,000 of dying between the ages of 20 and 21. Deduce the MTBF hours for 20-year-olds. Convert this figure from hours to years. What does this MTBF tell you about the expected life time of a 20-year-old?

The human-hours per failure is 8760 (hours in a year) divided by 0.001 failure, giving a value of 8760000 “hours” for the MTBF. 8760000 hours equals 1000 years. This tells us nothing about the expected lifetime of a person of age 20.

c. The manufacturer guarantees a 1-million hour MTBF for a certain model of disk drive. What can you conclude about the number of years for which one of these drives is under warranty?

The MTBF tells nothing about the expected lifetime. Hard disk drives are generally designed to have a lifetime of five years. If such a drive truly has a million-hour MTBF, it is very unlikely that the drive will fail during its expected lifetime.