**Operating Systems**

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Operating Systems Environments & Administration

* Refer to the following system characteristics to answer question 1:
  + CPU (average time to execute **1,000** instructions): 1.2ms
  + Four (4) Hard Drives with the following average **Seek Times**:
    - Drive A: 35ms
    - Drive B: 10ms
    - Drive C: 5ms
    - Drive D: 50ms
  + Track Requests (**unordered**): 31, 20, 15, 20, 31, 15
    - Note: Assume drive heads start at track 0.

1. Answer the following questions about the above system:
   1. Which drive would require the **least** amount of time to access all of the **unordered** track requests?

Answer: Drive C as it has the smallest average seek time.

* 1. Which drive would require the **most** amount of time to access all of the **unordered** track requests?

Answer: Drive D as it has the largest average seek time.

* 1. If the track requests were reordered, which drive would require the **least** amount of time to access all of the track requests (assume reordering requires 1,000 instructions)?

Answer: As all the drives share the same CPU, the drive that would require the least amount of time to access all of the track requests would still be the drive with the shortest average seek time which is Drive C.

* 1. If the track requests were reordered, which drive would require the **most** amount of time to access all of the track requests (assume reordering requires 1,000 instructions)?

Answer: As all the drives share the same CPU, the drive that would require the most amount of time to access all of the track requests would still be the drive with the largest average seek time which is Drive D.

1. Describe the following measurements of system performance:  
   1. Throughput

Answer: A composite measure of a system’s efficiency which counts the number of jobs served in a given unit of time.

* 1. Capacity

Answer: The maximum throughput level of a component.

* 1. Bottleneck

Answer: Occurs when a component reaches its capacity; resources become saturated and processes in the system don’t get passed.

* 1. Response Time

Answer: The speed at which a system responds to a user’s command.

* 1. Turnaround Time

Answer: The time it takes a system to execute a job and return the output to the user.

* 1. Resource Utilization

Answer: Used to measure how much each individual component contributes to the overall operation of a system.

* 1. Availability

Answer: A resource management tool which indicates how likely a resource will be ready when a user needs it. It is determined by the mean time between failures and the mean time to repair.

* 1. Reliability

Answer: It measures the probability that a unit will not fail during a given time period. It is a function of the mean time between failures.

1. Calculate the availability of a server with the following MTBF and MTTR values:
   1. MTBF: 3 years, MTTR: 8 hours

Answer: Availability = MTBF / (MTBF + MTTR) = 3 years / (3 years + 8 hours) = 26280 hours / (26280 hours + 8 hours) = 26280 / 26288 = 0.99969

* 1. MTBF: 2 weeks, MTTR: 36 hours

Answer: Availability = MTBF / (MTBF + MTTR) = 2 weeks / (2 weeks + 36 hours) = 336 hours / (336 hours + 36 hours) = 336 / 372 = 0.90323

* 1. MTBF: 1 day, MTTR: 25 hours

Answer: Availability = MTBF / (MTBF + MTTR) = 1 day / (1 day + 25 hours) = 24 hours / (24 hours + 25 hours) = 24 / 49 = 0.48980

1. Calculate the reliability of a server over the following time period and MTBF values:
   1. Time Period: 30 seconds, MTBF: 180 days

Answer: Reliability = e ^ [ - (1/MTBF) \* t] = e ^ [ - (1/180 days) \* (30 seconds)] = e ^ [ - (1/180 days) \* (0.00035 days)] = e ^ (-0.00000194444) = 0.99999805555

* 1. Time Period: 40 days, MTBF: 6 weeks

Answer: Reliability = e ^ [ - (1/MTBF) \* t] = e ^ [ - (1/6 weeks) \* (40 days)] = e ^ [ - (1/42 days) \* (40 days)] = e ^ (-0.00059523809) = 0.99940493902

* 1. Time Period: 25 hours, MTBF: 1 day

Answer: e ^ [ - (1/MTBF) \* t] = e ^ [ - (1/1 day) \* (25 hours)] = e ^ [ - (1/24 hours) \* (25 hours)] = e ^ (-1.04166666667) = 0.35286608145