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CS823

Assignment 1

**Chapter 1 Problem 1:**

I used the command “**iostat –d -w5 -c 40**” to generate my results. Only a snapshot is shown. The last line is the calculated averages for the entire two minutes.

disk0

KB/t tps MB/s KB/s

|  |  |  |  |
| --- | --- | --- | --- |
| 21.71 | 3 | 0.07 | 65.13 |
| 0 | 0 | 0 | 0 |
| 15.19 | 9 | 0.14 | 136.71 |
| 16.31 | 18 | 0.28 | 293.58 |
| 20.8 | 1 | 0.02 | 20.8 |
| 11.12 | 10 | 0.11 | 111.2 |
| 17.84 | 7 | 0.13 | 124.88 |
| 13.24 | 9 | 0.12 | 119.16 |
| 15.1 | 61 | 0.9 | 921.1 |
| 32.22 | 11 | 0.34 | 354.42 |
| 14.79 | 13 | 0.18 | 192.27 |
| 6 | 1 | 0.01 | 6 |
| 16.71 | 111 | 1.82 | 1854.81 |
| 13.23 | 5 | 0.07 | 66.15 |
| 14.92 | 62 | 0.91 | 925.04 |
| ……………. |  |  |  |
| 21.22375 | 66.3 | 2.075 | 2123.1995 |

Therefore, the throughput of disk0 for my system is 2123.1995KB/second or 66.3 transactions/second.

You can successfully use average service time per transaction to compute the utilization of the disk. If average service time was D, the formula for utilization would be as follows:

S = average service time

U = X0 \* S

U = 66.3 \* S

**Chapter 1 Problem 3:**

Number of minutes in two days = 2 \* 24 \* 60 = 2880

Total downtime (minutes) = 34 minutes.

Availability = (2880 – 34) / 2880 = 0.98819444 = **98.819%**

**Chapter 1 Problem 4:**

Number of minutes in two days = 2 \* 24 \* 60 = 2880

Total downtime (minutes) = 34 minutes.

Availability = (2880 – 34) / 2880 = 0.98819444 = **98.819%**

The availability was the same for the online trading site in both cases. Howeer, the downtimes in the second section were at more inconvenient times, as they were when consumers would normally be accessing the service.

**Chapter 2 Problem 1:**

D =

No, the service demand of the packet does not change with the traffic on the link, as it is load independent.

**Chapter 2 Problem 3:**

A *mixed model* should be used for this computer system. This computer system has characteristics of both an open QN(a workload with an arrival rate and unbounded number of customers in the system), as well as a closed QN(a workload with a bounded and known number of customers and workload intensity specified by the customer population.)

**Chapter 2 Problem 4:**

*Disk 1 is replaced by a disk that is 40% faster.*

The service demand of disk1 would increase by 40%, so it would take:

Ddisk1 = (1-0.4) \* 100 = 60ms.

*Enough main memory is installed so that the hit rate on the database server’s cache is 30%.*

Ddisk1 = (0.3) \* 0 + 0.7 \* 100 = 70ms

Ddisk2 = (0.3) \* 0 + 0.7 \* 150 = 105ms

*The log option of the database management system is enabled. A log record is generated on disk 2 for each update transaction. Updates account for 30% of the transactions and recording a log takes 15 msec.*

Ddisk2 = 165 \* 0.3 + 150 \* 0.7 = 154.5ms

**Chapter 3 Problem 1:**

T = 1 hour

m = N = 5

C0 = 7200

R?

X0 = = 2 tps

R = = = **2.5 seconds** *By Little’s law*

**Chapter 3 Problem 2:**

T = 1 hour

UCPU = 0.25

Udisk1 = 0.35

Udisk2 = 0.30

C0 = 21,600

X0 = ?

DCPU = ?

Ddisk1 = ?

Ddisk2 = ?

R = ?

X0 = = **6 tps**

DCPU = = =  **seconds** *By the service demand law*

Ddisk1 = = =  **seconds** *By the service demand law*

Ddisk2 = = =  **seconds** *By the service demand law*

R >= >= **0.15 seconds**

**Chapter 3 Problem 4:**

T = 30 minutes

C0 = 5400 transactions

Cdisk1 = 18,900 I/O operations

Udisk1 = 0.40

Vdisk1 = ?

Sdisk1 = ?

Vdisk1 =  **I/O operations per transaction**

X0 = = 3 tps

Xdisk1 = Vdisk1 \* X0 = 3.5 \* 3 = 10.5 tps *By the forced flow law*

Sdisk1 =  **seconds per visit**  *By the Utilization law*

**Chapter 3 Problem 5:**

T = 1 hour

C0 = 5400 transactions

Sdisk1 = 30ms

Vdisk1 = 3

Udisk1 = ?

X0 = = 1.5 tps

Xdisk1 = Vdisk1 \* X0 = 3 \* 1.5 = 4.5 tps = 0.0045 tpms *By the forced flow law*

Udisk1 = Xdisk1 \* Sdisk1 = 0.0045 \* 30ms = 0.135 = **13.5%**

**Chapter 3 Problem 6:**

X = 128 packets/sec = 0.128 packets/ms

T = 100ms

N = ?

N = XT = 0.128\*100 = **12.8 packets** *By Little’s law*

**Chapter 3 Problem 7:**

T = 60 minutes

C0 = 7200

Udisk1 = 0.30

Sdisk1 = 30ms

Vdisk1 = ?

X0 = = 2 tps = 0.002 tpms

*The service demand law*

*By the service demand law*

Vdisk1 = **5 visits**

**Chapter 3 Problem 10:**

M = 50

Z = 5 sec = 5000 ms

Udisk1 = 0.60

Sdisk1 = 30ms

Vdisk1 = 4 visits

R = ?

Xdisk1 = tpms *By the utilization law*

X0 = tpms *By the forced flow law*

R =  **seconds** *By the Interative Response Time law*

**Chapter 3 Problem 11:**

Xdisk = 0.0285ms (average)

Sdisk = 9ms (average)

Udisk = ?

Udisk = Xdisk \* Sdisk = 0.0285 \* 9 = 0.2565 = **25.65%** *By the Utilization law*

|  |  |  |  |
| --- | --- | --- | --- |
| **kpms** | **tps** | **serv(ms)** | **utilization** |
| 0.025 | 3 | 6 | 15.00% |
| 0.032 | 4 | 7 | 22.40% |
| 0.028 | 2 | 7 | 19.60% |
| 0.018 | 2 | 8 | 14.40% |
| 0.029 | 3 | 9 | 26.10% |
| 0.033 | 4 | 12 | 39.60% |
| 0.035 | 4 | 8 | 28.00% |
| 0.025 | 4 | 10 | 25.00% |
| 0.026 | 3 | 11 | 28.60% |
| 0.034 | 4 | 12 | 40.80% |

T = 100

ICPU = 0.74 (average time CPU spent idle)

UCPU = ?

BCPU = (1- ICPU) \* T = (1-0.74)\*5 = 1.3 seconds

UCPU =

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **us** | **sy** | **wt** | **id** | **utilization** |
| 19% | 3% | 0 | 78% | 22% |
| 13% | 4% | 0 | 83% | 17% |
| 20% | 3% | 0 | 77% | 23% |
| 24% | 2% | 0 | 74% | 26% |
| 18% | 5% | 0 | 77% | 23% |
| 23% | 3% | 0 | 74% | 26% |
| 25% | 5% | 0 | 70% | 30% |
| 32% | 4% | 0 | 64% | 36% |
| 28% | 4% | 0 | 68% | 32% |
| 22% | 6% | 0 | 72% | 28% |

**Chapter 3 Problem 12:**

Z = 5 seconds

X = 20 request/second

R = 2 seconds

M = ?

M = X0(R+Z) = 20(2 + 5) = 140 virtual users

*By the interactive reposnse time law*