**HW\_Assignment1**

1. A web server with the architecture spends 20% on processing, 30% on disk access, and 50% on network transfer with a base system consisting of a 500MHz processor and a disk with 20Mbytes/sec data transfer rate. This system costs $5K and can support 10,000 average web page accesses/sec.

Cost of the base system = $5000

Throughput of base system = 20Mbytes/sec

Execution time of base system = 1/frequency of processor

= 1/500MHz

= 2nSec

Cost per nano sec for base system = cost/execution time

= 5000/2 = $2500

(1)

a) Performance is typically in units-per-second and bigger is better.

Additional cost = $1000

Total cost of new system = $5000+$1000= $6000

Throughput of the new system = 40Mbytes/sec which is twice that of the base system.

This implies that the new system is 100% faster than that of the base system.

Thus the execution time is 1 nsec and cost per nsec is $6000

b) Replacing processor with 800MHz with additional cost of $800

Cost of the system = $5000+$800 = $5800

Execution time of the new system after replacing processor = 1/800MHz=1.25nsec

Cost per nano sec for new system = cost/execution time

= 5800/1.25= $ 4640

c) With processor of 800MHz and throughput of 40Mbytes/sec

Additional cost = $1500

Total cost = $6500

Execution time = 1.25/2=0.625nsec

Cost per nano sec for new system = cost/execution time

= 6500/0.625=$10,400

(2)

Considering the time and cost per nsec of the 3 options, I consider option b would be effective if we consider the cost. But if we need to take into consideration the execution time also then option a can be chosen as the time is only 1nsec and cost is also moderate.

2. Given a system with 2 components A and B which can be considered as multiple optimization as both components are affected/enhanced during the enhancement process.

So, Speedup(overall) = 1/((1-F1-F2)+F1/S1+F2/S2)

(1)

1. Fa speeds up by 10 times → S1=10

2Fa slows down by 5 times → S2=1/5

Speedup(A) = 1/((1-Fa-2Fa)+Fa/10+2Fa/(1/5))

= 1/(1-3Fa+0.1Fa+10Fa)

| Speedup(A)= 1/(1+7.1Fa) |
| --- |

1. Fb speeds up by 20 times → S1=20

0.5Fb slows down by 2 times → S2=½ =0.5

Speedup(B) = 1/((1-Fb-0.5Fb)+Fb/20+0.5Fb/0.5)

= 1/(1-1.5Fb+0.05Fb+Fb)

| Speedup(B)= 1/(1-0.45Fb) |
| --- |

1. Fa speeds up by 4 times → S1=4

Fa slows down by 1.8 times → S2=1/1.8

Speedup(C) = 1/((1-Fa-Fa)+Fa/4+1.8Fa)

= 1/(1-2Fa+0.25Fa+1.8Fa)

| Speedup(C)= 1/(1+0.05Fa) |
| --- |

(2)

For positive values of Fa and Fb, Speedup(B) will be higher for any value of Fb and we prefer more speedup after enhancement.

So, I prefer option B as it gives more speedup value.

3.

Programs System 1 System 2 System 3

Programs 1 1.0 sec 2.0 sec 1.5 sec

Programs 2 10.0 sec 7.0 sec 5.0 sec

Programs 3 5.0 sec 3.0 sec 4.0 sec

This environment uses three types of programs with a relative usage of 45% (Program 1), 35% (Program 2), and 20% (Program 3) respectively.

(a)

* Execution time of System 1:

45% \* (time for program1)+35% \* (time for program2)+20% \* (time for program3)

= 0.45\*1 + 0.35\*10 + 0.20\*5

= 0.45+3.5+1.0

Execution time of system 1 = 4.95 sec

* Execution time of System 2:

45% \* (time for program1)+35% \* (time for program2)+20% \* (time for program3)

= 0.45\*2 + 0.35\*7 + 0.20\*3

= 0.9+2.45+0.6

Execution time of system 2 = 3.95 sec

* Execution time of System 3:

45% \* (time for program1)+35% \* (time for program2)+20% \* (time for program3)

= 0.45\*1.5 + 0.35\*5 + 0.20\*4

= 0.675+1.75+0.8

Execution time of system 2 = 3.225 sec

Comparing the execution time of all the 3 systems, execution time of system 3 is less in comparison with system1 and system2.

So, System3 provides the best performance in the laboratory.

(b)

**Cost - Performance analysis:**

**System1:**

Cost of system 1 = $8000

Execution time of system 1 = 4.95sec

Cost per second for system 1 = 8000/4.95 = $1616.16

**System2:**

Cost of system 2 = $5000

Execution time of system 2 = 3.95sec

Cost per second for system 2 = 5000/3.95 = $1265.82

**System3:**

Cost of system 3 = $6500

Execution time of system 3 = 3.225sec

Cost per second for system 3 = 8000/4.95 = $2015.50

Out of all the three systems, I choose system 2 as the cost of system 2 is less compared to other 2 systems though the time taken by system 2 is a little greater than that of system 3, it would be effective in terms of cost.