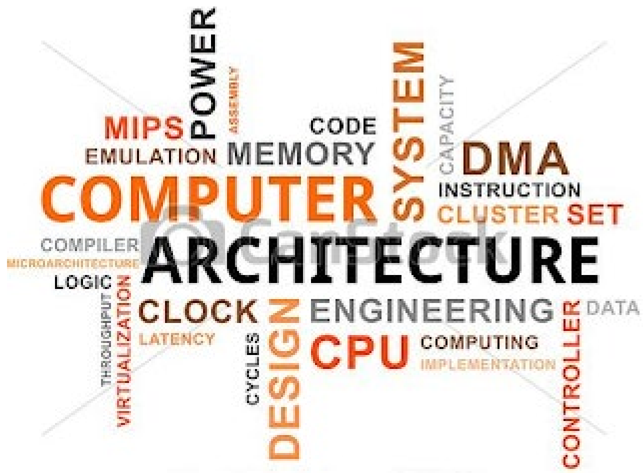
EE488 - Computer Architecture
HW Assignment 1



NAME : S A SABBIRUL MOHOSIN NAIM

ID : 20176

QUESTION ANS NO 01 :

(a) Option-1 :

Base cost \$5,000 and additional cost \$1,000.

New total cost (5,000+1,000)\$= \$6,000

Data transfer rate of disk = 40Mbytes/sec

Now,

Disk access time $_{original}$ = Data Size/Transfer Rate

= 20 Mbytes/sec20 Mbytes

=1 sec

Disk access time $_{new}$ = 20 Mbytes/sec40 Mbytes

= 0.5 sec

Overall impact performance,

Disk Access: 30% reduction in time (from 1 sec to 0.5 sec)

New web page access per second = 10,000 × (1/1-0.3*0.3)

≈ 10990 pages/sec

(b) Option-2 :

Here, Base cost $5,000 and additional cost $800.

New total cost (5,000+800)$= $5,800.

And replacing the processor with an 800MHz

Now,

Processing time $_{original}$ = 1/500MHz

= 0.002 sec

Processing time $_{new}$ = 1/800 MHz

= 0.00125 sec

Overall impact performance,

Reduction =100(0.00125/0.002)=62.5 =100-62.5= 37.5%

Processing: 37.5% reduction in time (from 0.002 sec to 0.00125 sec)

Access per second of new web pages = 10,000 × (1/1-0.2*0.375)

≈ 13,158 pages/sec

(c) Option-3 :

Using the two enhancements indicated in Option-1 & Option-2 together with an additional (compared to the base) cost of $1,500.

Total cost = (5,000+800+1,500)$= $8300

Now,

Combining overall impact from above,

Disk access reduction 30% in the time &

Processing reduction 37.5% in the time.

So now, new web page access per second = 10,000 × (1/1-0.2*0.3*0.3*0.375) ≈ 14,495 pages/sec

Now,

By doing a cost-performance analysis,

option-1 : $6,000 for 10,990 pages/sec

option-2 : $5,800 for 13,158 pages/sec

option-3 : $8,300 for 14,495 pages/sec

here,

per page costs for,

option-1 = $6,000/10,990

= $0.54 per page/sec

option-2 = $5,800/13,158

= $0.44 per page/sec

Option-3 = $8,300/14,495

= $0.57 per page/sec

So, here option-2 is the cost effective according to highest performance of the per page/sec cost.

QUESTION ANS NO 02 :

(a) Option A :

Let's specify S_A the whole speed-up. Now fraction f_A the enhanced part is sped up by 10 times and fraction $2f_A$ is slowed down by 5 times. Now the whole effect is given by,

$$S_A=(f_A\times 10+2f_A\times 1/5)/f_A+2f_A$$

Option B :

Similarly , Option B gives us,

$$S_B=(f_B\times 20+0.5f_B\times 1/2)/f_B+0.5f_B$$

Option C :

We get,

$$S_C=(f_A\times 4+f_A\times 1/0.8)/f_A+f_A$$

Let us examine now which choice an amateur architect could find more desirable.

Preference Analysis:

Option A:

It accelerates a higher percentage of instructions (f_A) but causes a higher dependant proportion to slow down ($2f_A$). This suggests that the overall gain might not be that large.

Option B:

Although the reliance impact is less strong, it speeds up a smaller proportion (f_B). In comparison to Option A, there may be a more equal speed increase in general.

Option C:

It accelerates a portion of instructions (f_A) with a modest dependent part slowness factor and a moderate speed-up factor. It's a middle ground between the two alternatives.

Conclusion:

Option B might be the better choice for a beginner architect. Here's the reason:

The greatest overall speed-up is provided, and the dependency impact is split between the two components. This choice minimizes the detrimental effects of dependence while offering a noticeable increase in speed. As a result, Option B might be a wise decision for improving the system design.

QUESTION ANS NO 03 :

By calculating the weighted average execution time for each system according to the proportionate utilization of each application, we can identify which system performs the best in the lab.

(a)

Determining each system's weighted average execution time,

For System 1:
$(0.45\times1.0)+(0.35\times10.0)+(0.20\times5.0)=0.45+3.5+1.0=4.95$ **seconds**

For System 2:
$(0.45\times2.0)+(0.35\times7.0)+(0.20\times3.0)=0.9+2.45+0.6=3.95$ **seconds**

For System 3:
$(0.45\times1.5)+(0.35\times5.0)+(0.20\times4.0)=0.675+1.75+0.8=3.225$ **seconds**

So, System 3 provides the best performance for the laboratory.

(b)

Cost-performance analysis:
By dividing the cost by the weighted average execution time, we can determine the cost-effectiveness ratio for each system:

For System 1:
$8000/4.95\approx1616.16$

For System 2:
$5000/3.95\approx1265.82$

For System 3:
$6500/3.225\approx2015.5$

Better cost-effectiveness is indicated by lower values. Thus, the most economical choice is System 2. As a result, System 2 is my choice since it strikes a compromise between affordability and performance.