# Assignment #2

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## Ans#1

Different desktop application that require the great power of contemporary microprocessor based system ① image processing ② Three-dimensional rendering ③ speech recognition ④ videoconferencing ⑤ Multimedia authoring ⑥ voice and video annotation of files ⑦ simulation ~~and~~ modelling.

## Ans#2

### Pipelining

Pipelining enables a processor to ~~increase~~ work simultaneously on multiple instruction by performing a diff phase for each of the multiple instructions at the same time.

### Branch prediction

Branch prediction potentially increase the amount of work available for the processor to execute.

### Superscalar execution

This is the ability to issue more than one instruction are dependent on eachother's

## Data Flow Analysis

The processor analyzes which instruction are dependent on each other's data to creat an optimized schedule of instruction.

## Speculative execution

This is the ability to issue the processor to keep its execution engines as busy as possible by executing instructions that are likely to be needed

## Ans#3

## Multicore

The use of multiple processors onthe same chip provides the potential to increase performance without increasing the clock rate.

Strategy is to use two simpler processor onthe chip rather than one more complex Processor

with two processors larger caches are

## MIC

Leap in performance as well as the challenges in developing software to exploit such a large number of cores

## GPUs

Core designed to perform parallel operations on graphics data.
Traditionally found on a plug-in graphic card.
used as vector processors for a variety of application that require.

## Ans#4

Effective CPI

CPI = (1*46000)+(2*33000)+(2*16000)+(2*9000)/100

CPI = 162000/100

CPI = 1620

Mips Rate

Mips rate = 60 MHZ/1620 * 10^6

Mips rate = 60*10^6 / 1620*10^6

Mips rate = 60/1620

Mips rate = 0.037

Execution Time

T = Ic/(MIPS*10^6)

T = 104000/(0.037*10^6)

T = 104000/37*10^3

T = 2811 * 10-3

T = 2.811 sec

## Ans# 5

For Machine A

$CPI = (1*8 + 3*4 + 4*2 + 5*4) * 10^6 / (8+4+2+4) * 10^6$

$CPI = 46 * 10^6 / 18 * 10^6$

$CPI = 2.22$

Mips rate $= 200\,MHZ / 2.22 * 10^6$

Mips rate $= 200 * 10^6 / 2.22 * 10^6$

Mips rate $= 90$

$T = IC / (MIPS * 10^6)$

$T = 18 * 10^6 / 90 * 10^6$

$T = 0.2$ Sec

For Machine B

$CPI = (1*10 + 2*8 + 4*2 + 3*4) * 10^6 / (10+8+2+4) * 10^6$

$CPI = 46/24$

$CPI = 1.92$

Mips rate $= 200\,MHZ / 1.92 * 10^6$

Mips rate $= 200 * 10^6 / 1.92 * 10^6$

Mips rate $= 104$

$T = IC / MIPS * 10^6)$

$T = 24 * 10^6 / 104 * 10^6$

$T = 0.23$ Sec

## Ans#6

The Mips rate could be computed as the following

Mips rate = IC / T * $10^6$

IC = Mips rate * T * $10^6$

$18^* 1x^* 10^6 / 1^* 12x^* 10^6$

= 18/12

= 1.5

## Ans#7

Regarding to the VAX11/780 the CPI = (25MHZ) / ($18^* 10^6$) = $5^* 10^6 / 1^* 10^6$.

= 5/1 = 5

Regarding to the IBMRS/6000 the CPI = (25MHZ) / $18^* 10^6$) = $25^* 10^6 / 18^* 10^6$

= 25/18 = 1.4

## Ans#8

Since we have the same instruction mix that means the additional instruction for each task could be allocated appropriately between the instruction types

| Instruction TYPE | CPi | instruction Mix |
|---|---|---|
| ALU | 1 | 60% |
| Load/store with Cache hit | 2 | 18% |

| | | |
|---|---|---|
| Branch | 4 | 12% |
| Memory reference with cache miss | 12 | 10% |

The average CPI = (1x0.6) + (2x0.18) + (4x0.12) + (12x0.1) = 2.64

MIPS = 400/2.64 = 152

The speedup factor equals to the ratio of the execution times. The execution time is calculated as

T = IC (MIPS * $10^6$)

For the one processor, $T_1$ = (2 * $10^6$) / (178 * $10^6$) = 11ms

For the 8 processor, each processor executes 1/8 of the 2million instruction plus the 25000

$T_8$ = 2 * $10^6$ ÷ 8 + 0.025 * $10^6$ / 152 * $10^6$

$T_8$ = 1.8ms

speed up = Time to execute program on a single processor / Time to execute program on N parallel processor

speedUP = 11/1.8

speedUP = 6.11

It is not obvious how to quantify this effect in Amdahl's equation. if it supposed that the fraction of code

Which is parallelizable is $F=1$ then Amdahl's Law decreases to Speedup = $N=8$. Therefore, The actual speedup is only about 75% of the theoratical speedup.