

*In The Name of God*

# Computer Architecture Homework 1

Parham Alvani

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powered by L<sup>A</sup>T<sub>E</sub>X

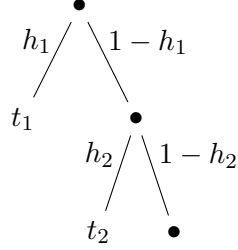
## Contents

<b>1</b>	<b>Problem 2</b>	<b>2</b>
<b>2</b>	<b>Problem 3</b>	<b>2</b>
<b>3</b>	<b>Problem 4</b>	<b>3</b>
<b>4</b>	<b>Problem 5</b>	<b>3</b>

## 1 Problem 2

1

2 According to following diagram :



- Average Memory Access Time, the exact formula

(1)

- Average Memory Access Time, an approximate formula

$$h_1 * t_1 + (1 - h_1)[h_2 * t_2 + (1 - h_2)(\dots)] \quad (2)$$

3

4

5

## 2 Problem 3

The following is the avrage memory access time equlation for memory with 3 level:

$$\bar{T} = h_1 * t_1 + (1 - h_1) * h_2 * t_2 + (1 - h_1) * (1 - h_2) * h_3 * t_3 \quad (3)$$

Substituting  $1ns$  for  $t_1$ ,  $0.1$  for  $h_1$ ,  $10ns$  for  $t_2$ ,  $0.5$  for  $h_2$ ,  $1000ns$  for  $t_3$  and  $1$  for  $h_3$  in (3) gives us:

$$\begin{aligned}
 \bar{T} &= 0.1 * 1 + (1 - 0.1) * 0.5 * 10 + (1 - 0.1) * (1 - 0.5) * 1000 \\
 &= 0.1 + 0.9 * 0.5 * 10 + 0.9 * 0.5 * 1000 \\
 &= 0.10 + 0.45 * 10 + 0.45 * 1000 \\
 &= 0.10 + 4.50 + 450.00 \\
 &= 454.60ns
 \end{aligned}$$

### 3 Problem 4

The following is the avrage memory access time equlation for memory with 4 level:

$$\bar{T} = h_1*t_1 + (1-h_1)*h_2*t_2 + (1-h_1)*(1-h_2)*h_3*t_3 + (1-h_1)*(1-h_2)*(1-h_3)*h_4*t_4 \quad (4)$$

Substituting  $1ns$  for  $t_1$ ,  $0.1$  for  $h_1$ ,  $10ns$  for  $t_2$ ,  $0.5$  for  $h_2$ ,  $8s$  for  $t_3$ ,  $0.63$  for  $h_3$ ,  $1000ns$  for  $t_4$ ,  $1$  for  $h_4$ , in (4) gives us:

$$\begin{aligned} \bar{T} &= 0.1 * 1 + (1 - 0.1) * 0.5 * 10 + (1 - 0.1) * (1 - 0.5) * 0.63 * 8 + \\ &\quad (1 - 0.1) * (1 - 0.5) * (1 - 0.63) * 1000 \\ &= 0.1 * 1 + 0.9 * 0.5 * 10 + 0.9 * 0.5 * 0.63 * 8 + 0.9 * 0.5 * 0.37 * 1000 \\ &= 0.10 + 0.45 * 10 + 0.28 * 8 + 0.16 * 1000 \\ &= 0.10 + 4.50 + 2.24 + 160.00 \\ &= 166.84ns \end{aligned}$$

### 4 Problem 5

**1** Address bits = 14 bits, Length = 2 bytes, Width =  $2^{14}$  words,  
The smallest unit available = 16 bits.

**2** Address bits = 15 bits, Length = 2 bytes, Width =  $2^{15}$  words,  
The smallest unit available = 16 bits.

**3** Address bits = 15 bits, Length = 1 bytes, Width =  $2^{15}$  words,  
The smallest unit available = 8 bits.

**4** Address bits = 13 bits, Length = 4 bytes, Width =  $2^{13}$  words,  
The smallest unit available = 32 bits.