In The Name of God

Computer Architecture Homework 1

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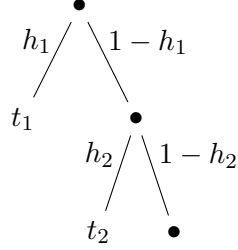
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1 Problem 2

1

2 According to following diagram :

- Average Memory Access Time, the exact formula

$$\tag{1}$$

- Average Memory Access Time, an approximate formula

$$h_1 * t_1 + (1 - h_1)[h_2 * t_2 + (1 - h_2)(\ldots)] \tag{2}$$

3

4

5

2 Problem 3

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

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

Substituting $1ns$ for t_1, 0.9 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:

$$\bar{T} = 0.9 * 1 + (1 - 0.9) * 0.5 * 10 + (1 - 0.9) * (1 - 0.5) * 1000$$
$$= 0.9 + 0.1 * 0.5 * 10 + 0.1 * 0.5 * 1000$$
$$= 0.9 + 0.5 * 10 + 0.5 * 1000$$
$$= 0.9 + 5 + 500.00$$
$$= 505.9ns$$

3 Problem 4

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

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

Substituting $1ns$ for t_1, 0.9 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_3, in (4) gives us:

$$\bar{T} = 0.9 * 1 + (1 - 0.9) * 0.5 * 10 + (1 - 0.9) * (1 - 0.5) * 0.63 * 8+$$
$$(1 - 0.9) * (1 - 0.5) * (1 - 0.63) * 1000$$
$$= 0.9 * 1 + 0.1 * 0.5 * 10 + 0.1 * 0.5 * 0.63 * 8 + 0.1 * 0.5 * 0.37 * 1000$$
$$= 0.90 + 0.50 * 10 + 0.31 * 8 + 0.18 * 1000$$
$$= 0.90 + 5.00 + 2.48 + 180.00$$
$$= 188.38ns$$

4 Problem 5

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

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

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

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