

### Assignment 1.5b

Problem 1.12

Consider a memory system with the following parameters:

$$T_c = 100 \text{ ns}$$

$$C_c = 0.01 \text{ cents/bit}$$

$$T_m = 1,200 \text{ ns}$$

$$C_m = 0.001 \text{ cents/bit}$$

a) What is the cost of 1 MByte of main memory?

$$1 \text{ MByte} \left( \frac{2^{20} \text{ bits}}{1 \text{ MByte}} \right) \left( \frac{0.001 \text{ cents}}{1 \text{ bit}} \right) = \$1,048.58$$

b) What is the cost of 1 MByte of main memory using cache memory technology?

$$1 \text{ MByte} \left( \frac{2^{20} \text{ bits}}{1 \text{ MByte}} \right) \left( \frac{0.01 \text{ cents}}{1 \text{ bit}} \right) = \$10,485.76$$

c) If the effective access time is 10% greater than the cache access time, what is the hit ratio  $H$ ?

$$T_{\text{eff}} = 1.1(100 \text{ ns}) = 110 \text{ ns}$$

$$T_{\text{eff}} = (1-H)T_m + HT_c$$

$$H = \frac{T_m - T_{\text{eff}}}{T_m - T_c} = \frac{1200 \text{ ns} - 110 \text{ ns}}{1200 \text{ ns} - 100 \text{ ns}} = \frac{1090 \text{ ns}}{1100 \text{ ns}} = 0.99$$