

Problem 5.1

Consider dynamic RAM that must be given a refresh cycle 64 times per ms. Each refresh operation requires 150 ns. What percentage of the memory's total operating time must be given to refreshes?

Solution:

In 1 ms, the time devoted to refresh is $64 * 150 \text{ ns} = 9600 \text{ ns}$

$1 \text{ ms} = 1000000 \text{ ns}$

In 1000000 ns refreshing occur 9600 ns

In 1 ns refreshing occur $(9600/1000000) \text{ ns}$

In 100 ns refreshing occur $(9600 * 100) / 1000000 \text{ ns} = 0.96 \text{ ns}$

Which is approximately 1%

Problem 5.3

Assume that the access time is 60ns and the recharge time is 40ns.

- a) What is the memory cycle time? What is the maximum data rate this DRAM can sustain, assuming a 1-bit output?
- b) Constructing a 32-bit memory system using these chips yields what data transfer rate?

Solution a:

Memory cycle time = $(60 + 40) \text{ ns} = 100 \text{ ns}$

Therefore, the maximum data rate is 1 bit in every 100 ns,

$100 \text{ ns} = 1 \text{ bit}$

$$10^{-7} \text{ s} = 1 \text{ bit}$$

$$1 \text{ s} = 10^7 \text{ bit}$$

$$1 \text{ s} = 10000000 \text{ bit}$$

$$1 \text{ s} = 10000 \text{ Kilobit}$$

$$1 \text{ s} = 10 \text{ Megabit}$$

$$1 \text{ sec} = 10 \text{ Mbps}$$

Solution b:

If 1 bit in every 100ns then

For 32-bit memory system data rate is = $32 * 10 \text{ Mbps} = 320 \text{ Mbps}$

Which is 40 MB/s (MB/ second)