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 ns = 9600 ns

1ms = 1000000 ns

In 1000000 ns refreshing occur 9600 ns

In 1 ns refreshing occur (9600/1000000) ns

In 100 ns refreshing occur (9600 x 100) / 1000000 ns = 0.96 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) ns = 100 ns

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

100 ns = 1 bit

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

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

1 s = 10000000 bit
1 s = 10000Kilobit
1 s = 10Megabit
which is 10 Mbps

Solution b:

If 1 bit in every 100ns then

For 32-bit memory system data rate is = 32* 10 Mbps = 320 Mbps

Which is 40 MB/s (MB/ second)