

**Homework Cover Page**

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| Course: EGCP-381 | HW #: 5 |

Grading Criteria:

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| **Problem #** | **Earned Points** | **Possible Points** |
| RQ5.1 |  | 2 |
| RQ5.3 |  | 2 |
| RQ5.5 |  | 2 |
| RQ6.2 |  | 2 |
| RQ6.7 |  | 2 |
| P5.3 |  | 4 |
| P6.5 |  | 8 |
| Total: | 0 | 22 |

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Professor Comments:

RQ5.1 What are the key properties of semiconductor memory?

* Exhibits two (semi)stable states, which can be representative of 1 and 0 in binary.
* Capable of being written into to have state set.
* Capable of being read to sense the state.

RQ5.3 What is the difference between DRAM and SRAM in terms of application?

DRAM is simpler, smaller, less expensive, and more dense than SRAM. DRAM needs more supporting refresh circuits though, but their cost is more so fixed than variable cost. DRAM is used more things that require more RAM as a result. SRAM is faster than DRAM though. SRAM is used for the cache, and DRAM main memory thus.

RQ5.5 Explain why one type of RAM is considered to be analog and the other digital.

DRAM is able to hold any charge value with regards to a range, even if it is used to determine a single binary bit. SRAM is considered digital because the binary values are maintained with a flip flop logic gate.

RQ6.2 How are data written onto a magnetic disk?

Electric pulses are put into the write head, and magnetic patterns that result from the magnetic field produced by current flow are recorded on the below surface, and can have different patterns for positive and negative currents. The write head is made of extremely magnetizable material and has the shape of a rectangular donut with a gap along one side, and coiling wires on the opposing side of the gap.

RQ6.7 Define the terms *seek time, rotational delay, access time, and transfer time.*

Seek time: The time taken to position the head at the track.

Rotational Delay: Time taken for beginning of the sector to reach the head.

Access Time: Sum of seek time and rotational delay.

Transfer time: Time required for data transfer.

P5.3 Figure 5.16 shows a simplified timing diagram for a DRAM read operation over a bus. The access time is considered to last from t1 to t2. Then there is a recharge time, lasting from t2 to t3, during which the DRAM chips will have to recharge before the processor can access them again.

1. Assume that the access time is 60 ns and the recharge time is 40ns. What is the memory cycle time? What is the maximum data rate this DRAM can sustain, assuming a 1-bit output?

Memory cycle time = Access Time + Recharge time = 60 ns + 40 ns = 100 ns

Maximum Data rate (1 bit) = (1/100ns) = 1 x 10^7 Bitsps => 10^7 \* (1 MBit/10^6 Bits) =

10 MBits/ps

1. Constructing a 32-bit wide memory system using these chips yields what data transfer rate?

32 bit output instead of 1 bit => 10MBitps \* 32 = new data transfer rate = 320Mbit/ps = 40 MBps.

P6.5 A distinction is made between physical records and logical records. A logical record is a collection of related data elements treated as a conceptual unit, independent of how or where the information is stored. A physical record is a contiguous area of storage space that is defined by the characteristics of the storage device and operating system. Assume a disk system in which each physical record contains thirty 120-byte logical records. Calculate how much disk space (in sectors, tracks, and surfaces) will be required to store 300,000 logical records if the disk is fixed-sector with 512 bytes/sector, with 96 sectors/track, 110 tracks per surface, and 8 usable surfaces. Ignore any file header record(s) and track indexes, and assume that records cannot span two sectors

8 surfaces \* (110 tracks/surface) = 880 tracks

880 tracks \* 96 (sectors/track)= 84480 sectors

84480 sectors \* 512 bytes/sector = 43253760 bytes

X(120 bytes) < 512 bytes in a sector where X is the number of logical records per sector

X = 4 => so 480 bytes per sector since records cannot span two sectors.

300000 (logical records) /4 (logical records/ sector) = 75000 total sectors

75000 (total sectors) / 96 (sectors/track) = 781.25 tracks => 782 tracks (an impartial track is still a track, hence rounding up)

782 tracks / 110 (tracks/surface) = 7.109 => 8 surfaces