

ECEN 449: Microprocessor System Design
Department of Electrical and Computer Engineering
Texas A&M University

Assignment #4

Due Monday, November 26, 2007

1. [10 points.]

A 32 GB flash drive is organized as follows:

- It can be accessed in 512-byte sectors
- It contains 2048 banks.

If the drive is accessed with a 40-bit address by a processor employing byte-level addressing, show how the address bits are used in accessing data from the flash drive.

2. [15 points.]

A memory is organized as an interleaved memory with 8 banks (also known as 8-way interleaving) and each memory bank contains a block of 64 bits (or 2 32-bit words). If a matrix A (64x64) is stored in this memory,

- (a) What is the fastest time to access all of the data in the matrix?
- (b) What is the slowest time to access all of the data in the matrix?

Each element of the matrix is 32 bits (1 word). You can assume that data is stored in a row-major fashion.

3. [15 points.]

Consider a wire on a printed circuit board (PCB). The board is made out of FR4 material ($\epsilon_r = 4.2$). Assume that the characteristic impedance of the board is 50Ω . The length of the wire is 0.1m. Suppose the driver (source) resistance is 10Ω , and the termination resistor (at the end of the wire) is 200Ω . The driver voltage changes from 0V to 5V at time $t = 0$.

- (a) What is the velocity of wave propagation in a wire on the PCB? The speed of light is $c = 3 \times 10^8$ m/s.
- (b) What is the inductance per unit length of the wire?
- (c) What is the capacitance per unit length of the wire?
- (d) What is the voltage at the receiving end of the wire, at time $t = \infty$?
- (e) Draw the waveform of the signal at the receiving end of the wire, up to time $t = 13t_d$.