**ENGR 260 (Microcontroller Systems)**

**Homework 1**

**Problem 1:**  Microprocessor data and address manipulation

A microprocessor has a 32-bit address bus and a 16-bit data bus, also its data registers are 16-bit registers.

1. What is the size of the address space this microprocessor can address?
2. Would you consider this to be a 16-bit or a 32-bit microprocessor? Please justify your answer.

**Problem 2:** The TM4C123GH6PM

The memory map for the TM4C123GH6PM is shown on pages 92-94 of the datasheet (Tiva\_C\_Datasheet.pdf).

1. The table has 20 memory ranges that are marked as *reserved*. We know that this microcontroller has 4 GB (232) of addressable memory space, of this 4 GB address space how much space is *reserved*?
2. Provide two possible reasons for reserving these memory ranges.
3. There is an internal 2Kbytes EEPROM. Please provide this memory’s start and end addresses as provided on the memory map.
4. How many bits does this memory hold?
5. How many 32-bit words does this memory have?
6. Given that 16 words make a block, determine the number of blocks the memory has.
7. What is the address of bit 31 of word0 i.e. the first word of this memory?

**Problem 3:** Memories

1. Is ROM volatile or non-volatile?
2. List the devices that can drive the address bus during a CPU write cycle

**Problem 4:** Major components of a microcontroller

Please explain the function of the following microcontroller components: ROM, RAM, EPROM, EEPROM, I/O Data Registers and Control and Status registers

**Problem 5:** On-Chip Flash Memory

From the memory map of page 92, on-chip Flash Memory occupies memory locations 0x0000.0000 to 0x0003.FFFF. What is the size of this on-chip Flash memory? Show your work based on the provided address range.