

Lab 1: Digital Signals – Pre-Laboratory Preparation

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As a future member of the engineering profession, the student is responsible for performing the required work in an honest manner, without plagiarism and cheating. Submitting this work with my name and student number is a statement and understanding that this work is our own and adheres to the Academic Integrity Policy of McMaster University and the Code of Conduct of the Professional Engineers of Ontario.

1. Record the exact name of the reference documentation for:
 - a. The core processing unit and its operation codes/language for the MSP432E0401Y. [2 marks]

The exact name of the reference documentation for the core processing unit (the Cortex-M4F) used in the MSP432E401Y is “ARM Cortex-M4 Processor Technical Reference Manual”. This document outlines the core processing unit and provides its operational codes, instruction set, and machine-level language for programming.

- b. The microprocessor logic systems and peripherals for the MSP432E401Y. [2 marks]

The exact name of the reference documentation that describes the microcontrollers logic systems and peripherals is “MSP432E401 Microcontroller Technical Reference Manual”.

2. Briefly explain the relationship between machine language, op code and mnemonic with an example. [6 marks]

Machine language is the lowest level of programming language. Its binary instructions that the hardware understands, and the processor executes. For example, the binary instruction 10100110 could tell the processor to preform a certain task.

Operation Code (op code) is a part of the machine learning instructions that specifies the operation the processor must preform. For example, the first few bits (1010) could represent the op code, indicating a certain operation.

Mnemonic is a representation of the operation code that is readable for us humans. It is used in assembly language and simplifies programming by assigning symbolic names to binary codes. For example, the mnemonic ADD R1, R2, R3 could translate into machine language that instructs the addition of resistor values R2 and R3 and stores it in R1.

3. In relation to the MSP432E401Y board, what core processor is used and define its registers (purpose and number of bits). [4 marks]

The MSP432E401Y board uses an ARM Cortex-M4F core processor

Register Name	Purpose and Number of Bits
General Purpose Registers (R0-R12)	32-bit general-purpose registers for data operations and can be accessed from either privileged or unprivileged mode.
Stack Pointer (R13)	32-bit register which changes depending on the ASP bit in the Control Register. When the bit is clear, it's the Main Stack Pointer. When the bit is set, it's the Process Stack Pointer. The MSP can only be accessed in privileged mode. The PSP can be accessed in either or.
Link Register (R14)	32-bit register that stores the return information for subroutines, function calls, and exceptions. It can be accessed from either privileged or unprivileged mode.
Program Counter (R15)	32-bit register that contains the current program address. On reset, the processor loads

	the PC with the value of the reset vector. It can be accessed in either privileged or unprivileged mode.
Program Status Register	32-bit register that has three functions. Status Register (APSR), Execution Program Status Register (EPSR), Interrupt Program Status Register (IPSR). They all can only be accessed in privileged mode; the APSR register can be accessed in either privileged or unprivileged mode.
Priority Mask Register	32-bit register that prevents activation of all exceptions with programmable priority. This register is only accessible in privileged mode.
Fault Mask Register	32-bit register that prevents activation of all exceptions except for the non maskable interrupt (NMI). This register is only accessible in privileged mode
Base Priority Mask Register	32-bit register that defines the minimum priority for exception processing. This register is only accessible in privileged mode.
Control Register	32-bit register that controls the stack used and the privilege level for software execution when the processor is in thread mode. This register is only accessible in privileged mode.
Floating-Point Status Control	32-bit register that provides all necessary user-level control of the floating-point system.

4. Create a flow chart showing the steps to configure GPIO port M on the MSP432E401Y. For each step of configuring a GPIO port, define the relevant register's purpose. [6 marks]

