ECE471: Embedded Systems – Homework 1

Due: Friday 11 September 2026, 5:00pm

For this homework short answers will suffice. There isn't necessarily a right or wrong answer for some of the questions, but be sure to explain your reasoning.

To submit, create a document with your answers (text, pdf, libreoffice, MS Office if you must) and e-mail them to *vincent.weaver@maine.edu* by the homework deadline. Title your e-mail "ECE471 Homework 1" and be sure your name is included in the document.

1. For each of the following three cases, classify if you would consider the device described as an embedded system or not. For each case use at least 2 of the characteristics given in class for what defines an "embedded system" and say whether the device meets them.

   (a) The iPhone 17. This phone has an Apple A19 processor in it. This 64-bit processor has six cores (two cores running at 4.26GHz and four cores running at 2.6GHz), totalling 15 billion transistors. It also includes a 16-core neural network accelerator capable of 35 trillion operations per second. It has 8GB of LPDDR5X RAM and a powerful 5-core GPU (graphics unit) with 2622x1206 resolution.

   (b) You open up a microwave and it has an 8-bit PIC processor in it. This processor runs at 10MHz and the only interface is an LED display, a keypad, and some circuitry to operate the fans and magnetron.

   (c) You open up a wall thermostat and it has an 8-bit PIC processor in it. This processor runs at 10MHz and the only interface is an LCD display, a small keypad, a temperature sensor, and some circuitry to turn on a relay when the temperature hits a certain level.

2. How many "bits" wide are the following systems? Why?

   (a) An ARM 1176 found in the original Raspberry Pi 1B. Its registers, integer ALU. program-counter, and address bus are all 32-bits. It executes instructions that are 32 or 16 bits long.

   (b) A MOS 6502 processor (found in older desktop and embedded systems). Its registers, data bus, and ALU are 8-bit while the instruction pointer and address bus are both 16-bit.

   (c) An ARM Cortex A76 processor (found in a Raspberry Pi 5B). Its ALU and registers are 64 bits. Its physical address size (memory bus) is 40 bits. Most instructions it executes are 32 bits long.

3. You are designing a small embedded system.

   (a) Describe one reason why using an ASIC (application-specific integrated circuit) might be better than using a microcontroller.

   (b) Describe one reason why using a microcontroller might be better than using an ASIC.

4. Be sure you have reviewed the contents of the syllabus found on the course website and answer this question:

   (a) In ECE471, what percentage of the final grade do Homework Assignments count as?