Final Exam, 2020/2021

CENG2400 Embedded System Design

(20%) Question 1: Concept

(a) Why do we have so many different kinds of MCUs used in embedded systems?

(b) Explain how PID controller works.

(c) We can use polling, interrupt or DMA to control communication in embedded systems. Please use an example to explain how these techniques work and discuss their pros and cons.

(10%) Question 2: ADC

Given a 6-bit ADC with V_{ref} = 6.4V. Please calculate the digital code when the analog input is 1.9V and 4.5V, respectively. Suppose V_{ref}=6V, calculate again.

(20%) Question 3: Data transmission

Assume that we are transmitting letters 'DAC9' using UART protocol and I2C protocol. Draw the corresponding timing diagrams and specify the detailed steps. Assuming an error occurs with the transmission of the 'C' letter. (The binary values of letter 'D', 'A', 'C', and '9' are 01000100, 01000001, 01000011, and binary 01000000, respectively).

Hint: This is an open question, you need to detail the specifics of your transmission protocol. For example, when you transmit data using UART, you need to define odd or even parity bit, the number of stop bits, LSB or MSB, etc.