

Embedded Systems (0907333)

Homework 3

Submit Handwritten Solutions

Problem 1: Draw a diagram that shows the connections of a synchronous master with three slaves.

Problem 2: State three disadvantages of synchronous communication compared with asynchronous communication.

Problem 3: Explain how asynchronous receiver usually synchronizes with an incoming asynchronous data signal.

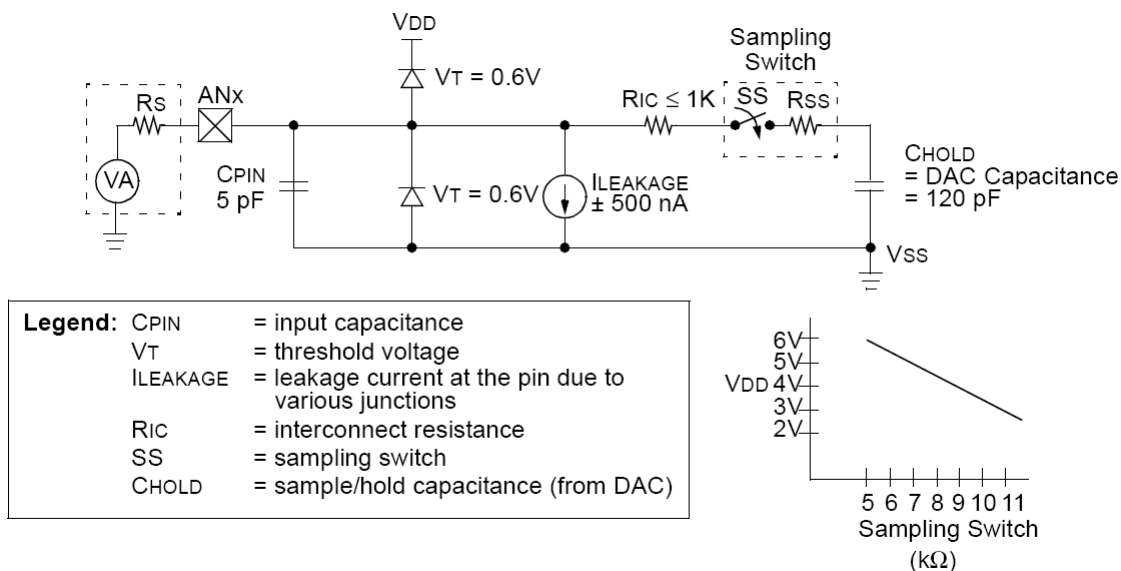
Problem 4: For a PIC 16P877A microcontroller running on an external clock of rate = 4 MHz, write the assembly instructions needed to initialize its USART for the following communication setup:

- 8-bit asynchronous continuous communication with parity bit.
- Baud rate = 25 kbps

Problem 5: Draw a block diagram that shows the elements of a typical data acquisition system.

Problem 6: Initialize the following two registers so that Timer 0 introduces a 100-second delay. Assume using an external 160-Hz crystal oscillator (show your calculations).

Problem 7: Refer to the analog input model of the PIC 16P877A's ADC shown below. What is the total acquisition and conversion time given $V_{DD} = 5V$, $R_{IC} = 1k\Omega$, $R_S = 0$, $Temp = 15^\circ C$, $T_{AD} = 1.6 \mu s$?



Problem 8: For a PIC 16P877A microcontroller running on an external clock of rate = 4 MHz, write the assembly instructions needed to initialize its ADC for the following setup:

- Right-justified result format
- All Port A's pins are analog inputs

Problem 9: Suppose you have the PIC 16F877A with $F_{osc} = 8$ MHz. If BRGH = 1, answer the following questions:

- a) What value of SPBRG should you use if you want to communicate at asynchronous 19200 baud rate?
- b) If we want to transmit "C" character that has the ASCII code 43_h, draw the waveform of the transmitted packet.
- c) What is the actual baud rate that you will achieve with this value of SPBRG?
- d) What is the resulting percent error in your baud rate?
- e) What is the lowest possible baud rate that can be achieved using the settings above?
- f) What is the highest possible baud rate that can be achieved using the setting above?

Problem 10: Two sensors need to be connecting to the PIC 16F877A microcontroller. The first one is temperature sensor that measures temperature from (15 to 45°C), with voltage range from (-0.5 to 4.5V), the second is distance sensor that measures distance from (1 to 40 cm), with voltage range from (0.5 to 5.5V). Answer the following Questions:

- a) Find the value of the ADRESH and ADRESL registers if the measured distance is 40 cm.

Result	ADRESH	ADRESL
Left justified		
Right justified		

- b) What is the digital value of the analogue input $V_{in} = 2$ V for the temperature sensor?