Autumn 2018 TCES430 – Microprocessor System Design

Final Review Examples

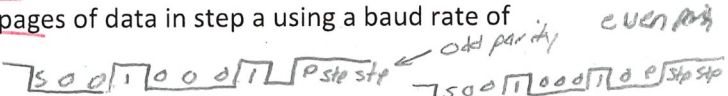
(GPIO): Show how SYSCTL_RCGCA_R |= 0x20;

a. To enable the clock to PORTF;
b. To enable the digital I/O feature of pins for PORTF1, PORTF2, and PORTF3.

GPIO_PORTF_AHB_DEN_R = GPIO_PORTF_AHB_DEN_R | 0x08 | 0x04 | 0x02;

(UART): Answering following questions

a. What's the total number of bits used in transferring 50 pages of text, each with 80*25 characters. Assume 8 bits per character and 1 stop bit. 50·80·25·10 = 1000000 bits
b. What's the time it takes to transfer the entire 50 pages of data in step a using a baud rate of
   a. 9,000 $\frac{10^6}{9000}$ = 111.11 seconds
   b. 57,600 $\frac{10^6}{57600}$ = 17.36 seconds
c. Assume that we are transmitting letter "D", with odd parity bit and 2 stop bits. Show the sequence of bits transferred. 'D' ~ 0x44 ~ 01000100_2 ~ 00100010_2



d. Calculate the time it takes to transfer 400 characters as in step c if we use 1200bps. What percentage of time is wasted due to overhead? $\frac{400 \times 12}{1200}$ = 4 seconds
   12 bits per char
   $\frac{4 \text{ 00} \times 8}{1200}$ = 2.66
   $\frac{8}{12} = \frac{2}{3}$ $1 - \frac{2}{3} = \frac{1}{3}$

(Timer): For CPU Frequency = 16MHz calculate the largest delay in seconds using

a. 32 bit Timer A without prescaler $\frac{2^{32}}{16 \cdot 10^6}$ = 268.435805 seconds
b. 16 bit Timer A with prescaler $\frac{2^{16} \cdot 2^8}{16 \cdot 10^6}$ = 1.048565 seconds
c. 16 bit Timer A without prescaler $\frac{2^{16}}{16 \cdot 10^6}$ = 0.004096 seconds
d. System Timer (page 135, p. 149-153) $\frac{2^{24}}{16 \cdot 10^6}$ = 1.048565 seconds

(Interrupt): Answer each question

a. What interrupt is associated with IRQ20? (Table 2-9, page 116) 16/32-bit Timer 0B
b. To assign priority to IRQ20, which PRIn register we need to program?
   Pg 159 Register 29

(ADC): Answer each question

$\frac{2.59}{2^8} = \frac{2^8}{2^8} \cdot 10^{-2} = 10^{-2}$ $\frac{1.7}{10^{-2}} - 1 = 169$

a. For a given 8-bit ADC, we have Vref = 2.56v. Calculate the D0-D7 output if the analog input is (a) 1.7v, and (b) 2.1v
   $\frac{3.1}{10^{-2}} - 1 = 219$
b. Give the digital converted output if the analog input voltage is 1.2v for the TI Tiva LaunchPad.
   w/3.3 volts
c. The TM4C1294NCPDT microcontroller provides analog functions integrated into the device, including: Two 12-bit Analog-to-Digital Converters (ADC) , with a total of 20 analog input channels and each with a sample rate of two million samples/second. Global Alternate Clock (ALTCLK) resource or System Clock (SYSCLK) can be used to generate ADC clock. System Control Block registers (p. 148, p. 234)

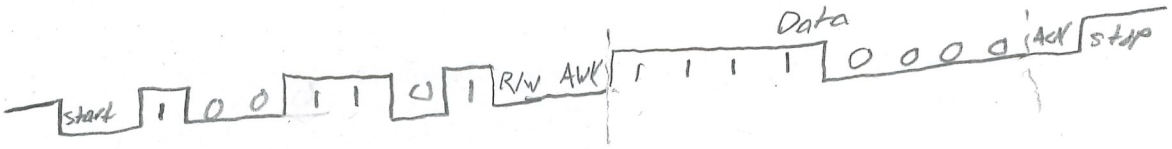
$\frac{1.2}{\frac{3.3}{2^{12}}} = 1489.454545$

(I2C): Answer each question given below:

a. Show how a master initiate a write to a slave with address 1001101?
b. Show how a master writes data value 11110000 to a slave with address 1001101?
c. If two master A and B start at about the same time. What happens if master A wants to write to slave 0010000 and master B wants to write to slave 0001111?
d. Assume a system clock frequency is 16Mhz. Find the values for I2CMTPR register if we want I2C clock of (a) 100Kbps, (b) 400Kbps, and (c) 1Mbps Pg 1284 low speed Pg 1285 high speed

a)

b)



c) I2C bus arbitration
The first master to write a 1 loses
so master B goes first

d) Pg 813

$$\left\lfloor \frac{1}{\frac{100\cdot10^3}{2*(4+6)*\frac{1}{16\cdot10^6}}} - 1 \right\rfloor = 7 \quad \therefore I2CMTPR = 0x07; \quad // \text{low speed}$$

$$\left\lfloor \frac{1}{\frac{400\cdot10^3}{2*(4+6)\cdot\frac{1}{16\cdot10^6}}} - 1 \right\rfloor = 1 \quad \therefore I2CMTPR = 0x01; \quad // \text{low speed}$$

$$\left\lfloor \frac{1}{\frac{1\cdot10^6}{2(1+2)*\left(\frac{1}{16*10^6}\right)}} - 1 \right\rfloor = 1 \quad I2CMTPR = 0x81 \quad // \text{high speed}$$

* Pg 1313 *