Microavionics Lab 6 (5067)

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Lab Questions

Warm Up Questions

1a

To calculate the voltage per bin, given that the ADC on the PIC board is a 12-bit ADC, the following expression can be used to determine voltage per bin

$$(VREF+ \ - \ VREF-)/(2^n) \rightarrow (5-1)/(2^{12}) = 0.9766mV per\ bin \tag{1}$$

1b

For an input voltage of 0x080, taking the decimal representation of this number, which is 128, tells us we are in bin 128 out of 4096. Multiplying the bin number by the previously calculated voltage value per bin and adding 1 (due to starting VREF of 1 V) gives the input voltage

$$(128 * 0.9766mV) + 1 = 1.125V\ input \tag{2}$$

Following the same process for values of 0x200 and 0x3FA

$$0x200 \rightarrow 512 \rightarrow (0.9766emV * 512) + 1 = 1.5V\ input \tag{3}$$

$$0x3FA \rightarrow 1018 \rightarrow (1018 * 0.9766mV) + 1 = 1.9941V\ input \tag{4}$$

Gaonkar Q13.6

13.6 - transmitting Z in asynchronous mode w/ 56K baud rate & 1 Stop bit

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Z ascii(capital) => 5A => 0101 1010, 56K baud => $\frac{56{,}000 \text{ bits}}{\text{second}}$ => 1.7857e-4 $\frac{\text{sec}}{\text{bit}}$

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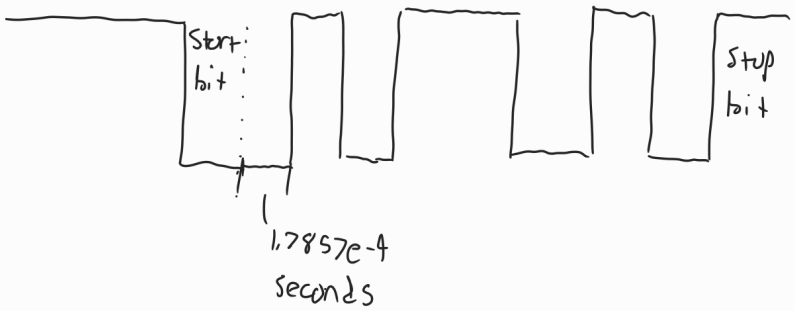

Gaonkar Q13.7, using 1 $\frac{1}{2}$ stop bits

To calculate the total time to transmit 250 characters, at 56 k baud, using 1 $\frac{1}{2}$ stop bits

$$(1 + 8 + 1.5) * 250 * (\frac{1}{56000}) \ = \ 0.046875 \ seconds \tag{5}$$

This calculation assumes that no parity bit is used.

Gaonkar Q13.13

For a low speed baud rate, BRGH = 0, and given baud to be set is 9600 in asynchronous mode, F_{OSC} = 16 MHz → SPBRG= $\frac{16MHz}{64*9600} - 1 \ = \ 25.0417$ Round this value to 25 → load 25 → 0001 1001 into SPBRG

Gaonkar 13.14

Baud percent error → $\frac{16MHz}{64*(25+1)}$ = 9615.4 → $\frac{(9615.38-9600)}{9600}$ → 0.0016 → 0.16% baud percent error

Gaonkar 13.15

If BRGH is 1 (high speed), then SPBRG = $\frac{MHz}{16*9600} - 1 \ = \ 103.167$ round this to 103 → load 103 into SPBRG → 0110 0111 loaded into SPBRG

baud percent error calculated as $\frac{16MHz}{16*(103+1)}$ = 9615.38 → $\frac{(9615.38-9600)}{9600}$ → 0.16% baud percent error.