Name: Yahya Alhinai

2.

AD1CON2=0x412 = 0b0000010000010010

a. **BUFM** = 1 → Buffer configured as two 8-word buffers
b. **SMPI** = 0100 → Interrupts at the completion of conversion for each 5nd sample/convert sequence
c. **CSCNA** = 1 → Scan inputs selected by the AD1CSSL register

AD1CHS = 0x0002 = 0b10 = 2 → A/D Input Channel Select Register is 2 → Channel 0 positive input is AN2

AD1CSSL = 0x1001 = 0b1000000000001 → A/D Input Scan Select Registers → AN0 and AN12 analog channel are selected for sequential scanning

- When the program is executed for a long time, each buffer will hold an input from AN0 or AN8 alternatively for 5 registers in each of the 8-word buffer. It is going to be pressing one 8-word buffer while it is collecting inputs in the other 8-word buffer. So it's going to be like:
- First 8-word buffer:
  ADC1BUF0 = AN0
  ADC1BUF1 = AN12
  ADC1BUF2 = AN0
  ADC1BUF3 = AN12
  ADC1BUF4 = AN0

- Second 8-word buffer:
  ADC1BUF8 = AN12
  ADC1BUF9 = AN0
  ADC1BUF10 = AN12
  ADC1BUF11 = AN0
  ADC1BUF12 = AN12

3.

2.345 = 0b10.010110000 with quantization error of $0.64 * 10^{-9}$

0b10.010110000 = 2.34375

Error = |2.34375 - 2.345 | = $12.5 * 10^{-4}$

1.891 = 0b01.110111000 with quantization error of $0.192 * 10^{-9}$

0b01.110111000 = 1.890625

Error = |1.890625 - 1.891 | = $3.75 * 10^{-4}$

3.792 = 0b11.110010101 with quantization error of $0.504 * 10^{-9}$

0b11.110010101 = 3.791015625

Error = |3.791015625 - 3.792 | = $9.84375 * 10^{-4}$

(**1.891 * 3.792**) = 0b111.001010101

0b111.001010101 = 7.166015625

Error = |7.166015625 - 7.170672 | = 0.004656375

2.345 + (**1.891 * 3.792**) = 0b1001.100001000

0b1001.100000101 = 9.509765625

Error = |9.509765625 - 9.515672 | = 0.005906375

4.

Fcy = 16MHz

TSAMP ≥ 1us.

Samples = 20,000/second

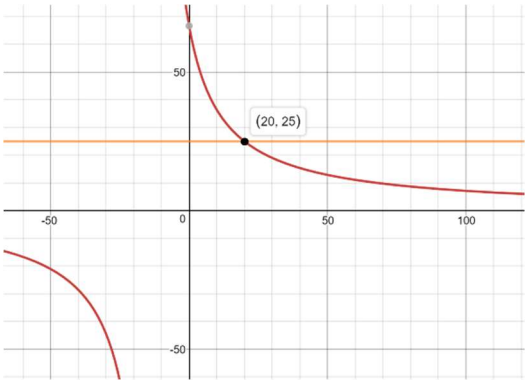
Time for each sample = 50us/sample

S = SAMC, A = ADCS + 1

Total Sample time = [12 * 62.5ns * A + S * 62.5ns * A] = 50us

A = (50 us)/(12 * 62.5ns + S * 62.5ns)

Solve for A and S:



SAMC = 20

ADCS = 24

Tsamp = 20 * 25 * 62.5 ns = 31.25 us

Total Sample time = [12 * 62.5ns * 25 + 20 * 62.5ns * 25] = 50us

6.

Frequency = 4 MHz → Tcy = 250 ns

250 ns > 75 ns → ADCS = 0 → Time = 1 * Tcy = 250 ns

Tsamp cutoff = $\left\lceil \frac{3.2\ micro}{250\ nano} \right\rceil = \lceil 12.8 \rceil$ = 13 → SAMC = 13

Actual Tad = 250 ns
Actual Tsamp time = 13 * Tad = 13 * 250 ns = 3.25 micro second
Sampling time = (13 + 12) * 250 ns = 6.25 micro second
Sampling rate = $\frac{1}{6.25\ \text{micro}}$ = 160 KHz