ELEC 3300

HOMEWORK 2

Please complete the following and submit your worksheet electronically before the deadline

Name : _____LI, Yu-hsi_____ Student number : _____20819823_____

Question 1:

Part 1.a

Refer to **Tutorial for LAB2**, page 21, based on your student ID, you have Pin Set A to Pin Set G
Please fill in the following table based on your student ID. If the two digits are 00, then Pin number = 100
Pin Set G is filled as an example. ****PAY ATTENTION to the ORDER of your Pin Sets****

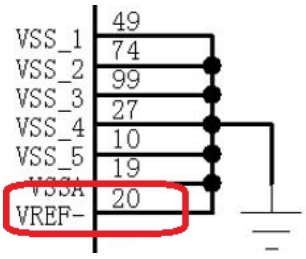
Pin Set	Actual Pin Number on STM32	Default Function of the pin on 100pin STM32F103VET6
A	23	PA0
B	82	PD1
C	98	PE1
D	19	VSSA
E	81	PD0
F	08	PC14
G	20	VREF–

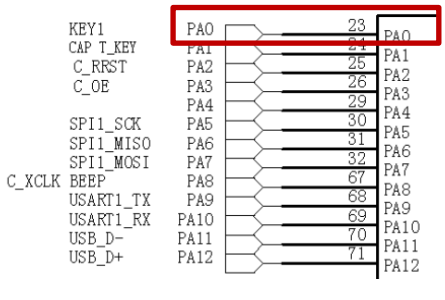
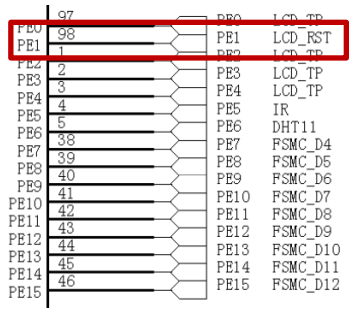
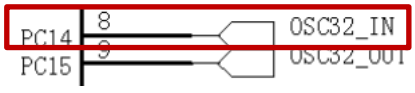
Part 1.b

With reference to the updated MINI V3 schematic dated 20210304, for Pin **Set A, C and F**, locate where the pins are connected. Cut and Paste the detailed schematic, highlight it and attached below.

DO NOT USE LEFT SIDE OF PAGE 2 which listed all the Port Pins from PA0 to PE15.

Example: Pin Set G



Pin Set A	Pin Set C	Pin Set F
		

Part 1.c
With the Pin Set A, C and F you have, suppose I can directly access the pin from the CPU at the center of the development board directly (i.e. even if it is connected to other peripherals on the development board).

If I want to set that pin to GPIO input via external connection, what mode I can program the pin into? (Hint: Pay attention to any resistor is being connected to that pin.)

	Pin Set A	Pin Set C	Pin Set F
Please circle **ALL** the possible options. If the pin cannot be programmed to input, please circle N/A	GPIO_PULLUP GPIO_PULLDOWN GPIO_NOPULL N/A	GPIO_PULLUP GPIO_PULLDOWN GPIO_NOPULL N/A	GPIO_PULLUP GPIO_PULLDOWN GPIO_NOPULL N/A

Question 2:
Part 2.a
For a **2-minute** 5.1 surround sound (https://en.wikipedia.org/wiki/5.1_surround_sound), assuming the 5 full-bandwidth channels (ignoring the low frequency channel for this question) are being sampled at 44 kHz with 16-bit per channel, what would be the data size of the sound file in bytes? Show your calculation.

Sample rate: 44 kHz = 44,000 samples per second
Bit depth: 16 bits per sample
Number of channels: 5

Data size = Sample rate x Bit depth x Number of channels x length of sound
= 44000 samples/s x 16 bits/sample x 5 channels x 120s
= 3520000 bits/s x 120s
= 440000 bytes/s x 120s
= 52800000 bytes
= 5.28×10^7 bytes

The data size of the sound file will be 5.28×10^7 bytes

Part 2.b
With the sampling rate at 44 kHz, what is the time between each sample? Show your calculation.

Sampling rate = number of sample in 1 second

44kHz = 44k samples in 1 second = 1/44k second between each sample

≅ 0.00002273 s

≅ $2.273 * 10^{-5}$ s

≅ $22.73\mu s$

Part 2.c

With the sample time that you calculate in *Part 2.b* if we want to implement the sampling from the ADC of STM32 with different settings below. What is the total number of cycles needed? Hence, calculate the conversion time (Tconv) for the different settings

Total conversion time, Tcycle = sample cycles + 12.5 (conversion cycles)
Tconv = Tcycle / ADCCLK

	CLK (MHz) at the input before ADC Prescaler	**ADC Prescaler (2/4/6/8)**	**ADCCLK (MHz) Max 14 MHz**	**ADC sample time register (cycles) (1.5 – 239.5)**	**Total conversion time, Tcycle Sample time (cycles)**	**Tconv (µsec)**
Setting 1	8	2	4	1.5	14	3.5
Setting 2	12	2	6	28.5	41	6.833
Setting 3	56	4	14	55.5	68	4.857
Setting 4	72	8	9	239.5	252	28

Part 2.d

Can sampling in *Part 2.b* be achieved with the conversion time (Tconv) you calculated in *Part 2.c* for Setting 1 to 4? Please circle the correct answer and calculate the additional delay needed for different settings to achieve the goal.

	Can sampling be achieved	**Additional Delay needed (µsec)**
Setting 1	YES / NO	22.73 – 3.5 = 19.23
Setting 2	YES / NO	22.73 – 6.83 = 15.9
Setting 3	YES / NO	22.73 – 4.857 = 17.873
Setting 4	YES / NO	N/A