HOMEWORK 1

Due date:

SA: Monday, Sept. 26
SB: Wednesday, Oct. 5

1- Prepare the basics for the project “Play a song”:

a. Modify the status (switch on / off) of the NUCLEO green LED, every time you snap your fingers. (Use the pin connected to the microphone as an External Interrupt)

   Hint: look at the files “Microcontroller Hands-on lab” and “Nucleo Schematic” and “Nucleo user manual” on Webeep in “Material/Laboratories/Documentation” and find the STM32 pin that connects to SND_IN.

b. Make the NUCLEO green LED blink at a 1 Hz rate using PWM generation on the corresponding channel.

2- Answer the following question, using NUCLEO manual and datasheet:

a. If you need information about the connection within the NUCLEO board (e.g. at which microcontroller pin is LD2 connected?) which document would you use?
b. At which page of the NUCLEO manual do you find the correspondence of extension connectors pins and microcontroller pins?
c. Which is the meaning of different blinking speed and colors of LD1 in the NUCLEO board?
d. What is the Jumper J6 used for?
e. What is a solder bridge?
f. What do you have to do if you want to use PH0 and PH1 as normal GPIO?
g. On your NUCLEO board how is the LSE clock configured? Can you use PC14 and PC15 as normal GPIO?
h. If you want to send/receive data with a virtual serial port (to communicate with a computer), which pins do you select and which solder bridge should be connected/disconnected?
i. In the NUCLEO board schematics which is the component name of the F401RE microcontroller and of the ST-Link microcontroller?
j. Which pin of the morpho connector can be connected to PA6?

3- Look at the STM32F401RE data-sheet and answer the following questions:

a. Which is the meaning of each part of the name STM32F401RE?
b. Which is the package of the STM32F401RE?

c. What voltages are allowed as Vdd power supply? Which is the maximum acceptable variations between different pins of Vdd? What is and how is Vbat used?
d. Which is the typical current consumption (order of magnitude)?
e. Which peripherals are connected to AHB1, APB1 and APB2?
f. Which is the difference in terms of clock frequency between APB1 and APB2?
g. How many channels does the ADC have? How many bits? Which is the maximum sampling frequency (and how is it affected by Vdda)?
h. What is the Analog Watchdog?
i. Which are the values of the S&H resistance and capacitance?
j. Which is the maximum CPU clock frequency?
k. Which is the range of operating frequencies of HSE and LSE clocks?
l. List all the communication interfaces (and also how many of them).
m. Which are the typical clock frequencies for the I2C and SPI interfaces?
n. What is the NVIC? How many priority levels can it mange?
o. How large is the embedded flash memory? And the SRAM memory?
p. What is the DMA? Which peripherals can use the DMA? How many streams are supported at maximum? What is the circular buffer management?
q. What is the RTC?
r. What is PIN60 in the STM32F401RE?
s. What is an alternate function? Make some examples.
t. Which is the maximum source/sink source current of the GPIOs? What are the output voltage levels of GPIOs?
u. Which is the value of the internal reference voltage?