ECGR4101/5101 → Lecture 3

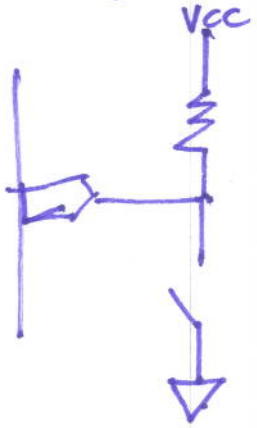
PORTD.DR.BIT.B0 ← better do be LED1

```
#define  SW1    PORT4.PORT.BIT0
#define  LED1   PORTD.DR.BIT.B0

#define  LED_ON   1
#define  LED_OFF  0

LED1 = LED_ON;

if (SW1==0) LED1 = LED_ON;
if(!SW1) LED1 = LED_ON;
```

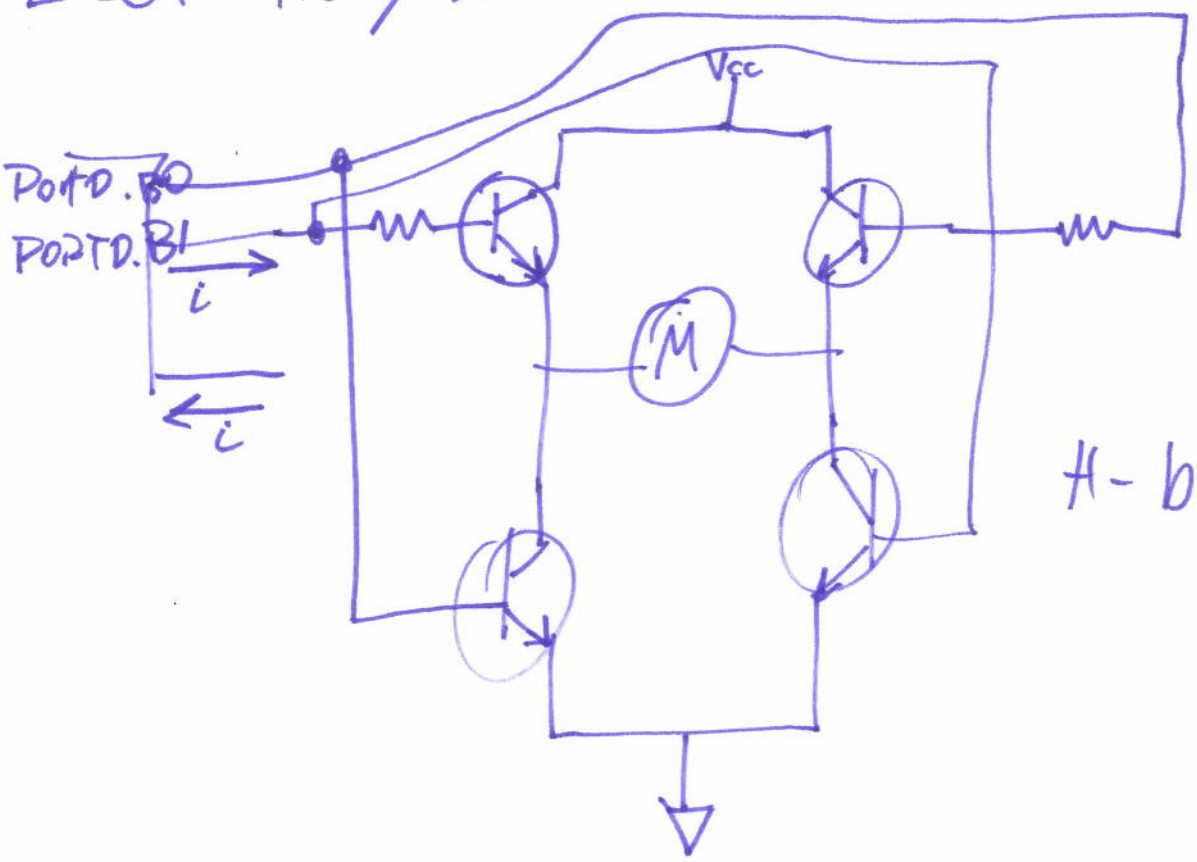
examined code on pages 18 & 19

make two #defines "SWITCH_IS_OFF" or ON

```
#define  SWITCH_IS_OFF   1
#define  SWITCH_IS_ON    0
```

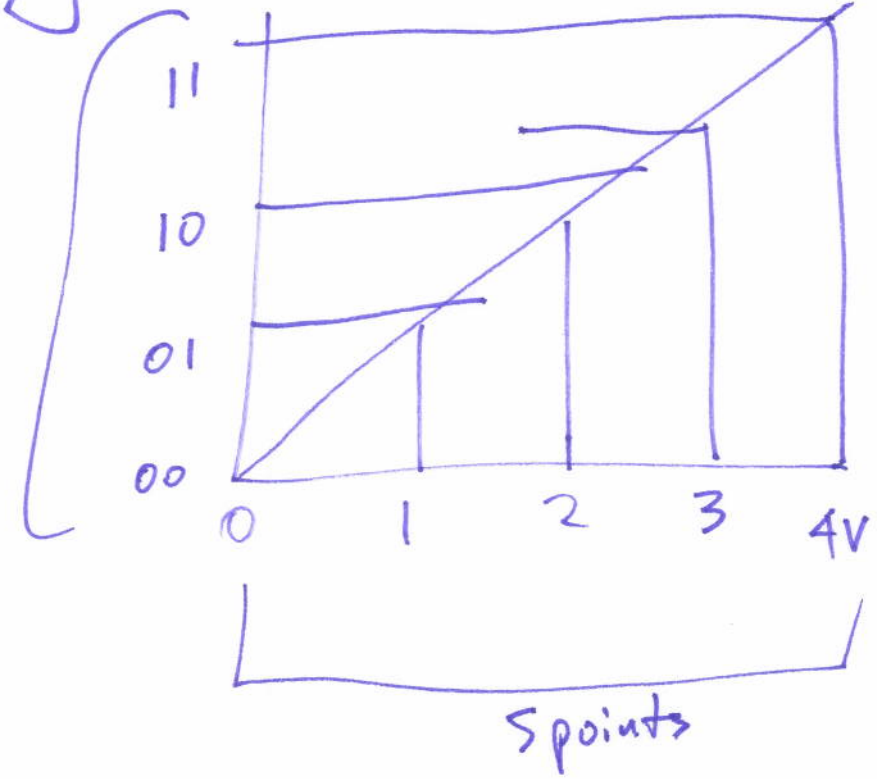



```
if (SW1==SWITCH_IS_OFF)
    LED1 = LED_ON;
```



H- bridge

Analog



$$\text{Resolution of each bit} = \frac{V_{ref^+} - V_{ref^-}}{2^{N\text{bits}}}$$

V_{ref^+} = + side of your ADC conversion

V_{ref^-} = − side of your ADC conversion

Usually $V_{ref^-} = 0V$

Usually $V_{ref^+} = V_{cc}$

Nbits = what you store

- 8-bit
- 10-bits
- 12-bits

---

eg. Renesas board 3.3V

8 bits of resolution

$$\text{resolution of each bit:} = \frac{3.3V}{256} = 0.01289V$$

$$= 12.9mV \quad (\text{"mV per step"})$$

Board = 3.3V

12 bits of resolution

resolution of each bit = 0.000800566 V

ECGR 4101/5101 LECTURE 3

$V_{ref+} = 5.0V$ (assume $V_{ref-} = 0V$)

$V_{in} = 2.2V$

10 bit ADC

n = digital code that represents 2.2V

$$n = \left[\frac{(2^{N\,bits} - 1)\, V_{in}}{V_{ref+}} + 0.5 \right]$$

$$= \frac{(2^{10} - 1)\, 2.2V}{5.0V} = \frac{1023 * 2.2}{5.0} + 0.5$$

$$= 450.62$$

$$= 450$$

$$450 - 256 = 194$$

$$194 - 128 = 66$$

$$66 - 64 = 2$$

$\rightarrow$ 01|11000010b

0x1C2

Battery life = $\frac{\text{Capacity}}{\text{current}}$

$\frac{200\text{ mAhr}}{10\text{ mA}} = 20\text{ hrs}$

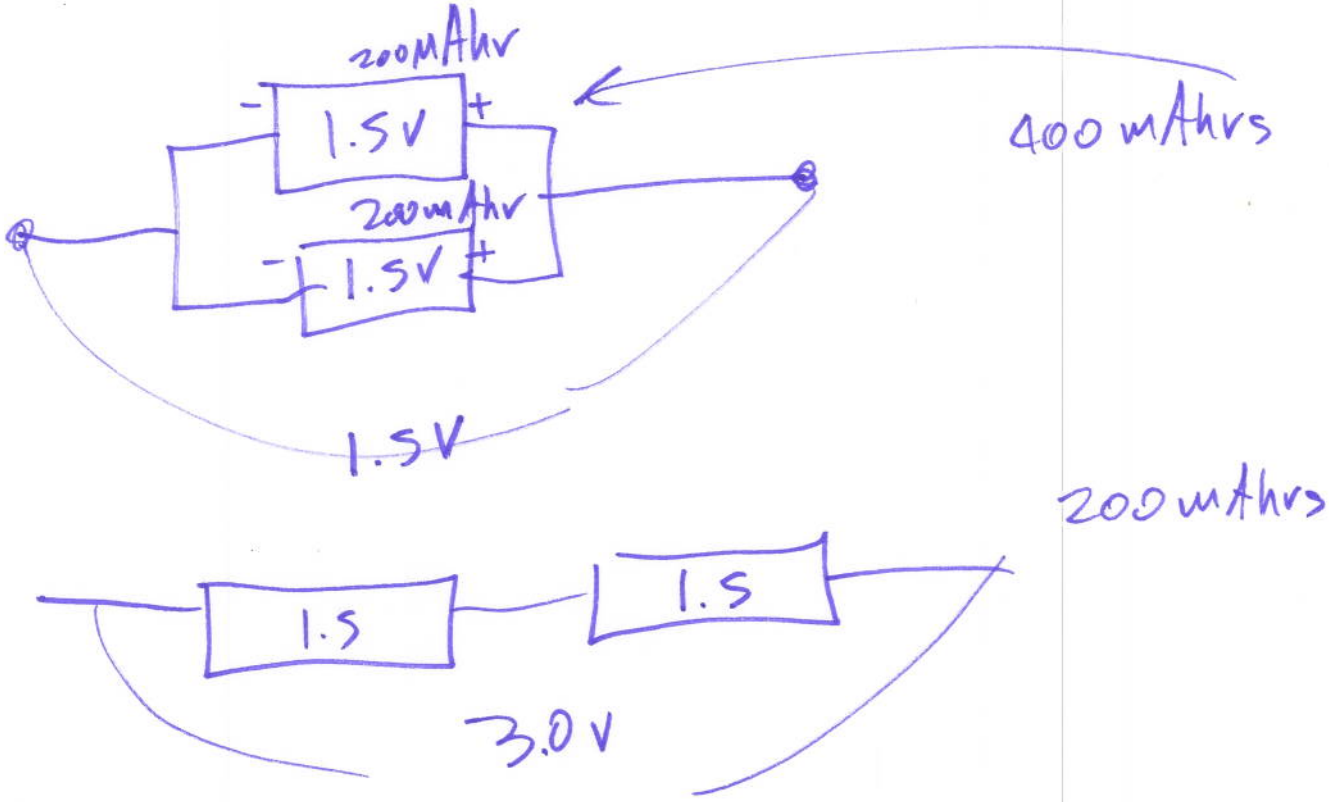
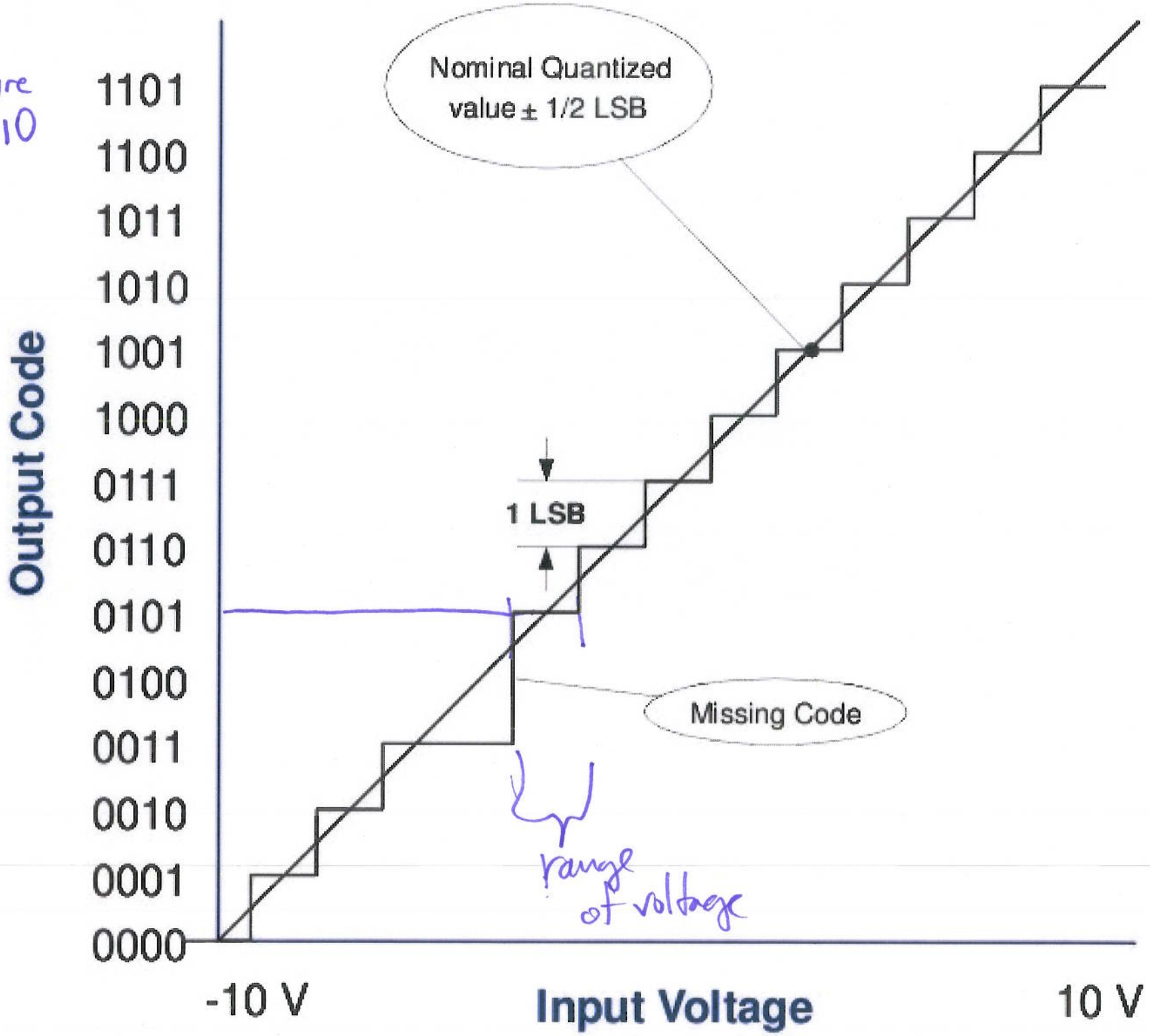


Figure 2.10


Nominal Quantized value ± 1/2 LSB
1 LSB
Missing Code
range of voltage
1101
1100
1011
1010
1001
1000
0111
0110
0101
0100
0011
0010
0001
0000
Output Code
-10 V
Input Voltage
10 V

Batteries

Battery ≡ >1 cell

Cell can be modeled as ideal voltage source with a series resistance

- Series resistance induces a voltage drop as current rises

How long will it last?

- Cells can be modeled as having a constant capacity (1 amp-hour = 3600 coulombs = 3600 amp-seconds) *(less accurate)*
  - Battery life (hours) = capacity (amp-hours)/current (amps)
- Can also predict life based on discharge plot *(more accurate)*

What if voltage or current isn't right?

- Can put cells in series (add voltages) or parallel (add currents)
- Can use a voltage regulator (linear or switch-mode)

Battery Power

A 800 mAhr battery will power a device that draws 200mA for how long?

800 mAhr / 200mA = 4 hr

Practice: 720 mAhr cell phone battery will power a phone that draws 4 mA average for how long?