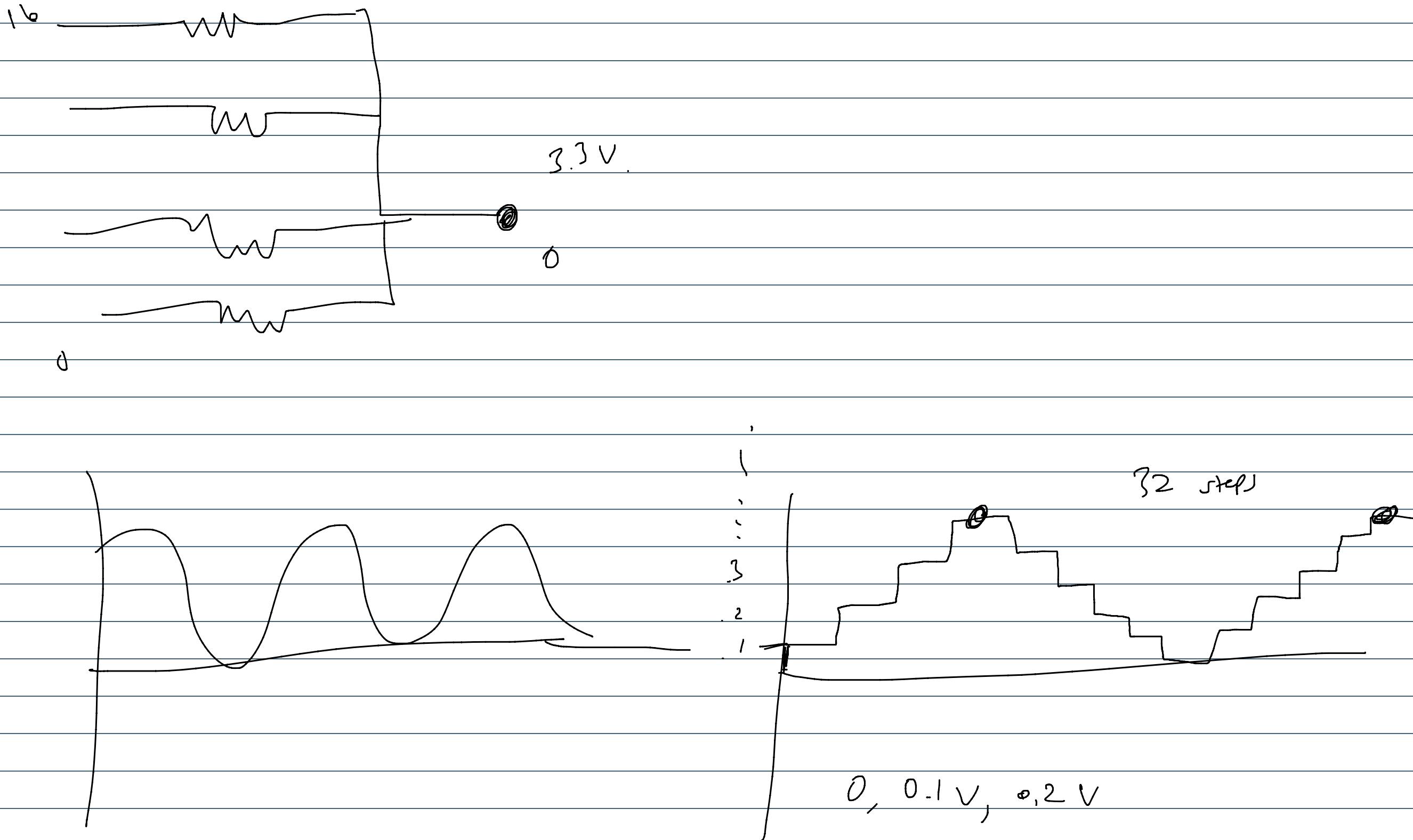


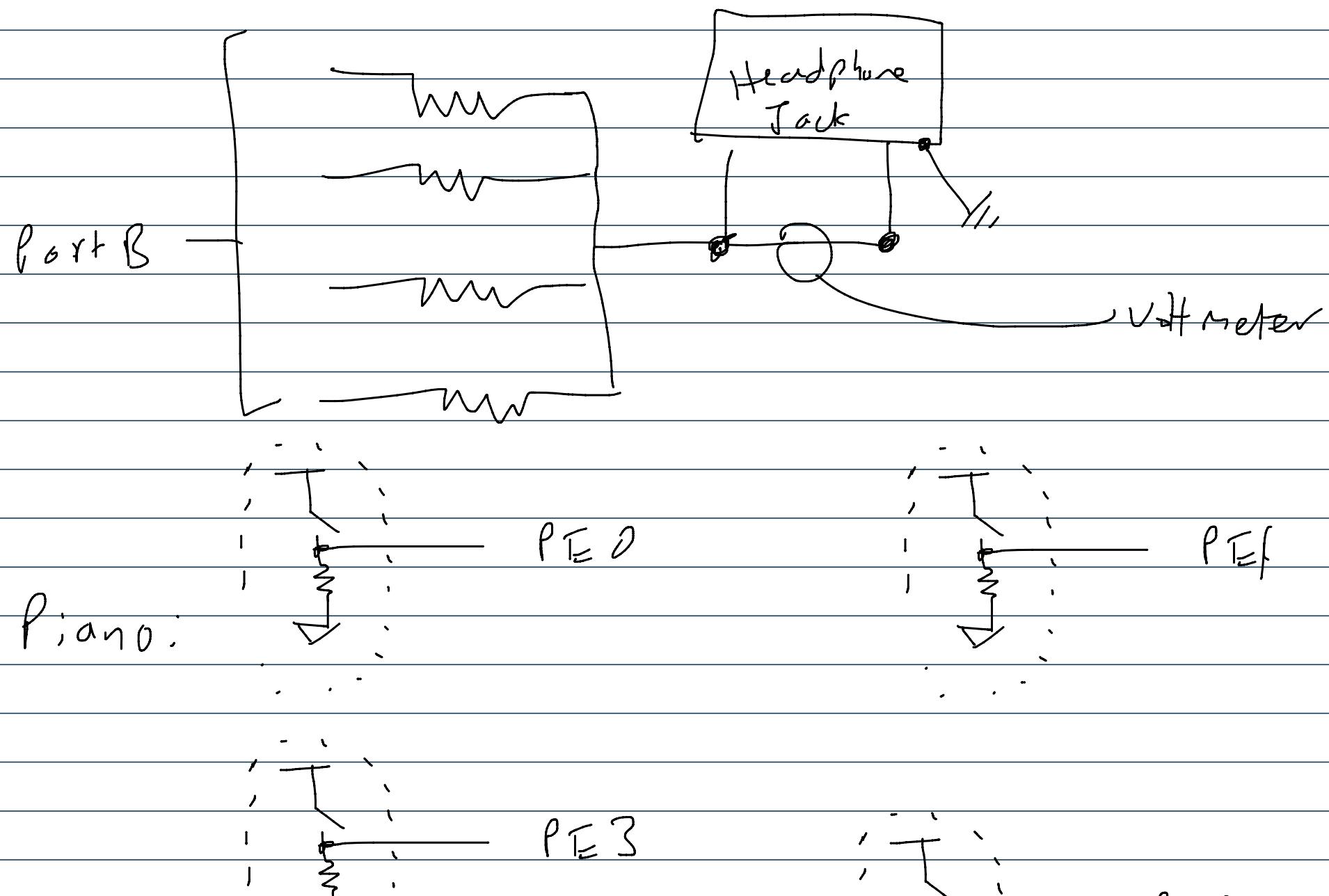
Lab Lecture #6

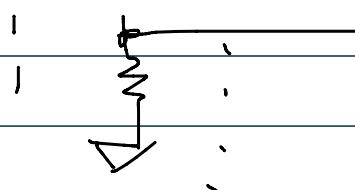
Friday, March 12, 2021 3:52 PM



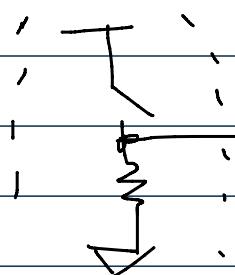
Port B[0:5] DAC output

Port E[0:3] → Piano Input





PE5



PE2

key.c piano.c

DAC.c Sound.c

→ DAC.c

DAC_Init()

$$4 \text{ bit DAC} \rightarrow [0, 16)$$

$$6 \text{ bit DAC} \rightarrow [0, 64)$$

DAC_Out(uint8_t data) {

write data into

Port B data register

}

Port B init
pins 0-3 output
pins 0-3 digital
UIU DAC_Init(uint8_t
SYSCTL_RCGCGPIO_R |= 0x02;

asm {
NOP
NOP
}

GPTO_PORTR_DTR_R |= 0x3F;

```
GPIO_PORTB_DIR_R |= 0x3F;  
GPIO_PORTB_DEN_R |= 0x3F;
```

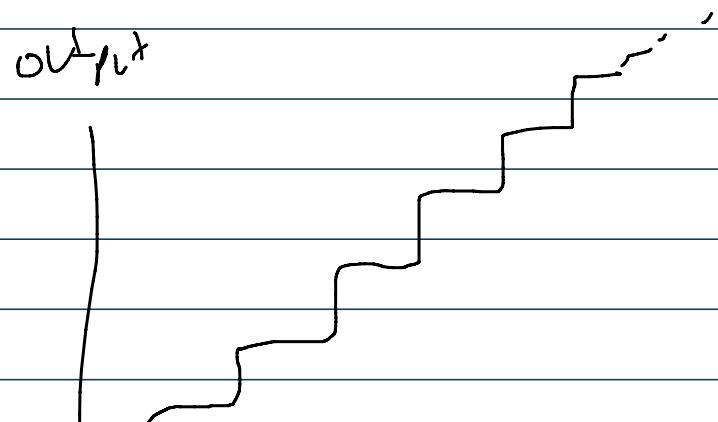
$$G = 0V$$

Test G.c :

$$g \rightarrow 1.6 \text{ mV}$$

```
test_main {  
    DAC_In();  
    for (int i = 0; i < 16; i++) {  
        DAC_Out(i);  
        for (int j = 0; j < 10,000,000; j++);  
    }  
}
```

$$IS = 3.3V$$





$$\text{period} = 1000$$

Sound . C

Sound_Init()

DAC_Init();

```
oid Sound_Init(void){  
    NVIC_ST_CTRL_R = 0;  
    NVIC_ST_CURRENT_R = 0;  
    NVIC_SYS_PRI3_R = (NVIC_SYS_PRI3_R&0x00FFFFFF) | 0x20000000;
```

Sound_Play(int period)

if (period == 0) {

Disable SysTick

return

}

Systk_reload = period - 1

Systk_control = 7;

}

}

1000 cycles.

if (period == 0) {

Systk_Handler()

```

if (period == 0) {
    NVIC_ST_CTRL_R = 0;
    return;
}
NVIC_ST_RELOAD_R = period-1;
NVIC_ST_CTRL_R = 7;

```

`Nint8_t sinWave[32] = {`

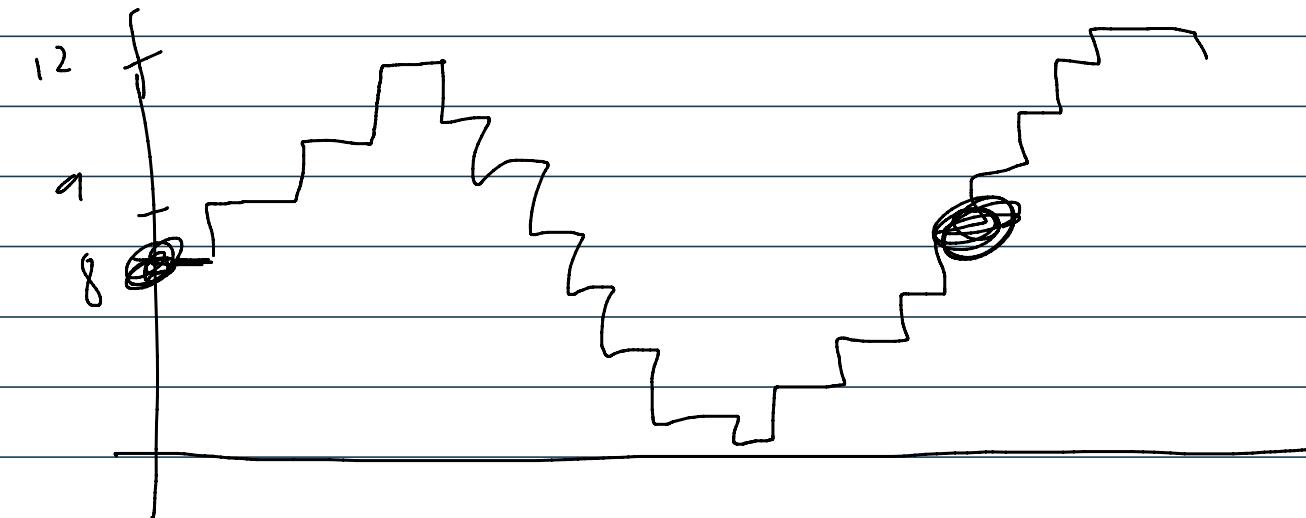
8,9,10,12,13,14,14,15,
15,15,14,14,13,12,10,9,
8,6,5,3,2,1,1,0,
0,0,1,1,2,3,5,6,

`}`

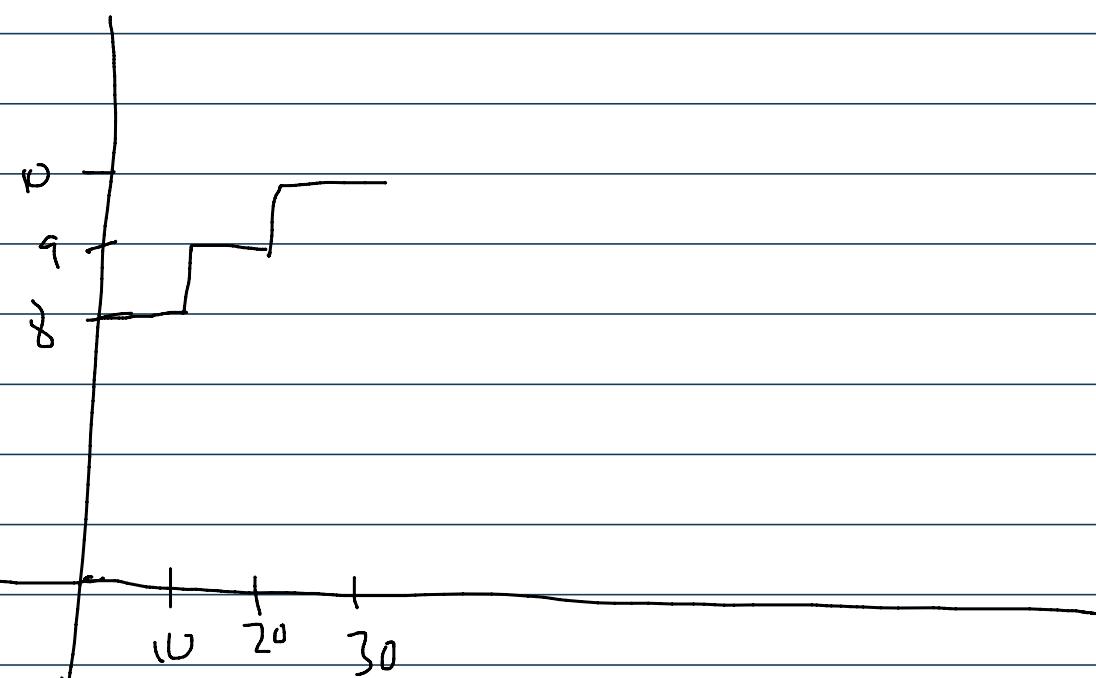
From <<https://www.daycounter.com/Calculators/Sine-Generator-Calculator2.phtml>>

period =

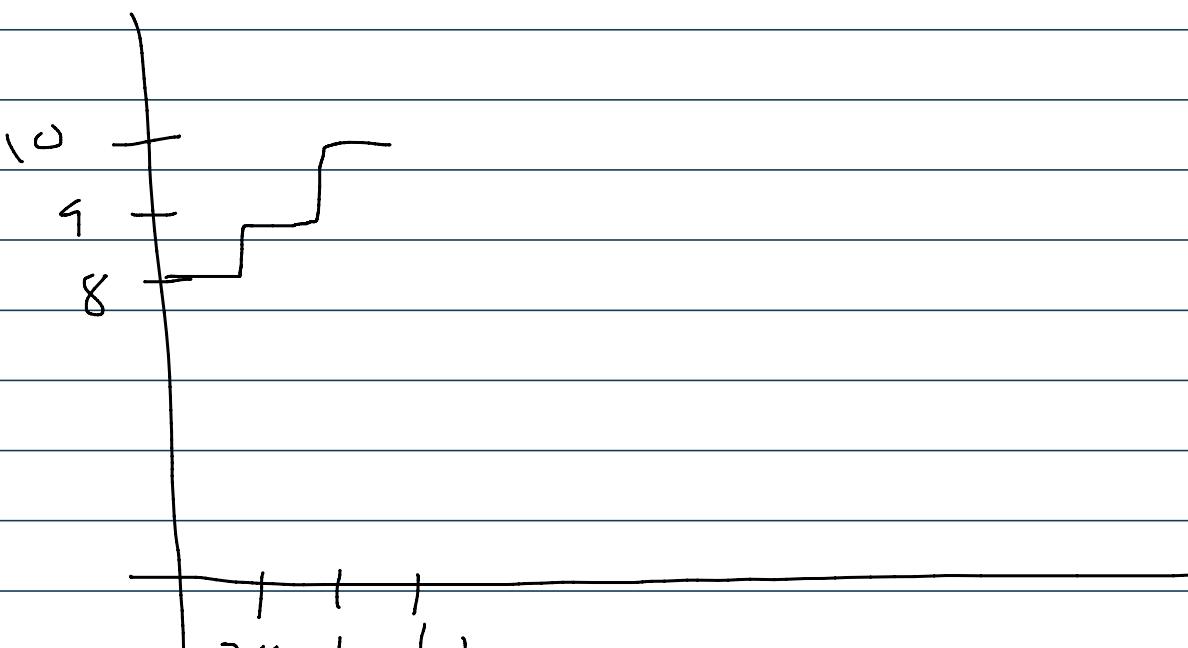
32° systuk-reload



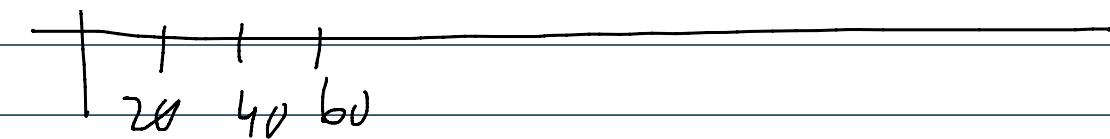
Reload = 10



Reload = 20



J 10 20 30



Period = 320 cycles

$$\text{period} = 20 \cdot 32 = 640$$

Still in S0r0.c

uint8_t sinwave[32] = {
8,9,10,12,13,14,14,15,
15,15,14,14,13,12,10,9,
8,6,5,3,2,1,1,0,
0,0,1,1,2,3,5,6,

From <<https://www.daycounter.com/Calculators/Sine-Generator-Calculator2.phtml>>

int index = 0

Systick_Handler (void) {

index++;

index = index & 0x01F;

Dac_Out(sinwave[index]);

}

key.c

```
..  
// Input from piano key inputs  
// Input: none  
// Output: 0 to 15 depending on keys  
// 0x01 is just Key0, 0x02 is just Key1, 0x04 is just Key2, 0x08 is just Key3  
// bit n is set if key n is pressed
```

Key Init

enable clock PE

wait 2 cycles

init PE 0-3 as

Digital and input

```
--  
21 // Output: none  
22 void Piano_Init(void){  
23     SYSCTL_RCGCGPIO_R |= 0x10;  
24  
25     __asm__ {  
26         NOP  
27         NOP  
28     }  
29  
30     GPIO_PORTE_DIR_R &= ~0x0F;  
31     GPIO_PORTE_DEN_R |= 0x0F;  
32 }
```

PE | 0 0 0 1 | press 1

PE | 0 0 1 0 | press 2

return PE_DATA_R & 0F;

Lab 6.c

Sound - Init();

Key - Init();

while(true) {

int buttons = Key-in(void);

:if(buttons == 1) {

Sound-Play(S061);

}

elif(buttons < 4) {

Sound-Play(B1);

}

clf(buttons < 8) {

Btr0: 1

Btr1: 2, 3

Btr2: 4, 5, 6, 7

0 0 0 1 = 1

0 0 1 0 = 2

0 0 1 1 = 3

-

0 1 0 0 = 4

1 0 0 0 = 8

: 1 1 1 1 = 15

SoundPlay(B2);

}

else {

SoundPlay(D1);

}

}

Btn 0: Play sound of 494 Hz

$$\text{Period (s)} = \frac{1}{494} = 0.002024$$

$$\frac{1}{x} \cdot \frac{1}{12.5 \cdot 10^{-9}}$$

$$\text{Period (cycles)} = 0.002024 \cdot \frac{1}{12.5 \cdot 10^{-9}} = 161943$$

32

$$\text{Value to pass} \rightarrow \text{increasing period} = \frac{\text{Period (cycles)}}{32}$$

$= \frac{2.5 \cdot 10^6}{x}$

$\hookrightarrow 161943 \cdot \frac{1}{32} = 5061 \text{ cycles}$

To calculate values for Sound play:

x : frequency of note

$$\text{Value} = \frac{2.5 \cdot 10^6}{x}$$

Extra code | ..

tempo = 1 second

$$\text{frequency Array} = \{ 440, 440, 495, 560, 10000, \dots \}$$

tempo - Array $\{ 1s, 0.5s, 0.8s \dots \}$

EC 2:

wav_file = {
8,9,10,12,13,14,14,15,
15,15,14,14,13,12,10,9,
8,6,5,3,2,1,1,0,
0,0,1,1,2,3,5,6,
}

From <<https://www.daycounter.com/Calculators/Sine-Generator-Calculator2.phtml>>

frequency of file = 11kHz

<https://audio.online-convert.com/convert-to-wav>

Byte = X X X X X X X X

New Byte = (Byte & 0xF0) >> 4