

ELEX 7660: Lab 3

Tone Generator

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# Questions

## How many registers are used in the tonegen module?

Two – ‘count’ and ‘freq’

## What are the possible values that can be loaded into each register?

Count can be loaded with ‘fclk’ and freq can be loaded with the tone frequency from ‘writedata’

## What are the conditions under which each value is loaded?

Count: The value gets loaded during a reset or when count <= 0.

Freq: The value gets loaded when ‘write’ is high.

# Code

## Tonegen.sv

// Nicholas Huttemann 2018-01-30

// tonegen.sv - tone generator for ELEX 7660 Lab 3

// Creates a square wave on the spkr (speaker) output at a

// frequency given by the 'freq' control register.

**module** tonegen

**#(logic** **[**31**:**0**]** fclk**)** // clock frequency, Hz

**(input** **logic** **[**31**:**0**]** writedata**,** // Avalon MM bus, data

**input** **logic** write**,** // " write strobe

**output** **logic** spkr**,** // on/off output for audio

**input** **logic** reset**,** clk **)** **;**

**int** count**;**

**logic** **[**31**:**0**]** freq**;**

**always\_ff** **@** **(posedge** clk**,** **negedge** reset**)** **begin**

**if** **(**reset**)** **begin**

freq **=** 0**;**

count **=** fclk**;**

spkr **=** 0**;**

**end**

**if** **(**write**)** **begin** // Get the tone freq from the data bus

freq **=** writedata**;**

**end**

// The half period of the tone freq has been reached; toggle the speaker

**if** **(**count **<=** 0**)** **begin**

spkr **^=** 1**;**

count **=** fclk**;**

**end**

// Subtract twice the tone frequency every clock tick

count **=** count **-** 2**\***freq**;**

**end**

**endmodule**

## Toneplayer.c

// toneplayer.c - play a tune using hardware tone generator ELEX 7660 201710 Lab 3

// outline by Ed. Casas 2017-1-22

// modified by: Nicholas Huttemann 2019-1-27

#include "unistd.h"   /\* for usleep() \*/

#define N 72

int freq [N] = { 330, 392, 440, 494, 523, 494, 440, 370, 294,

330, 370, 392, 330, 330, 311, 330, 370, 311, 247, 330, 392,

440, 494, 523, 494, 440, 370, 294, 330, 370, 392, 370, 330,

311, 277, 294, 330, 330, 587, 587, 554, 494, 440, 370, 294,

330, 370, 392, 330, 330, 311, 330, 370, 311, 247, 587, 587,

554, 494, 440, 370, 294, 330, 370, 392, 370, 330, 311, 277,

294, 330, 330} ;

int duration [N] = { 2, 4, 2, 3, 1, 2, 4, 2, 3, 1, 2, 4, 2, 3, 1, 2,

4, 2, 4, 2, 4, 2, 3, 1, 2, 4, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2,

6, 4, 6, 3, 1, 2, 4, 2, 3, 1, 2, 4, 2, 3, 1, 2, 4, 2, 6, 6,

3, 1, 2, 4, 2, 3, 1, 2, 3, 1, 2, 3, 1, 2, 6, 4} ;

#if 0

#include "system.h"   /\* peripheral base addresses \*/

#define SETFREQ(x) (\*(int\*)TONEGEN\_0\_BASE) = (x)

#else

#define SETFREQ(x) (printf("%d Hz",x))

#define usleep(x) (printf(" for %d ms\n",x/1000))

#endif

int main()

{

for (int i = 0; i <= N; i++) // Play all the tones in freq

{

   SETFREQ(freq[i]);

usleep(duration[i]\*150000);

}

SETFREQ(0) ;

return 0;

}

### Output

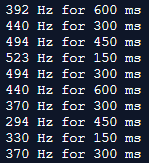


Figure 1: tongeplayer.c Output

# Testbench Waveforms

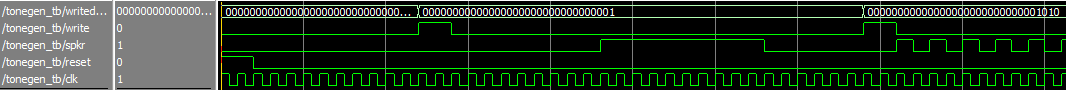


Figure 2: tonegen\_tb.sv

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