

```

In[1]:= (* SquareDuino - Note Count Computation *)
(* (c) 2014, Alfred "Ben" Roney, Ph.D. *)
(* All rights reserved. *)

In[2]:= (* This is a table of frequencies corresponding to MIDI note values. *)
(* They are scaled by three to facilitate generating root-fifth-sub *)
(* by dividing the core oscillator with 3-2-6, respectively. *)
ConcertA := 440 (* Define this according to your desired pitch reference *)

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(* Don't edit the following *)

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A440 := 440

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FreqScale := 
$$\frac{\text{Rationalize}[\text{ConcertA}, \text{ConcertA} 2^{-1024}]}{A440}$$


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ftab = Table[FullSimplify[ $3 \frac{\text{FreqScale} A440}{32} 2^{\frac{i-9}{12}}$ ], {i, 0, 127}];

```

```

N[ftab] // InputForm

```

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Out[6]/InputForm= {24.52739674693112, 25.98587165408176, 27.53107199225696, 29.168154723945083, 30.90258.
32.740146696844114, 34.68697712921573, 36.74957212328899, 38.93481539811986, 41.25, 4.
46.30155949276164, 49.05479349386224, 51.97174330816352, 55.06214398451392, 58.336309.
61.805166921163114, 65.48029339368823, 69.37395425843145, 73.49914424657798, 77.86963.
87.40570528464187, 92.60311898552328, 98.10958698772448, 103.94348661632704, 110.1242.
116.67261889578033, 123.61033384232623, 130.96058678737646, 138.7479085168629, 146.99.
155.73926159247944, 165., 174.81141056928374, 185.20623797104656, 196.21917397544897,
207.88697323265407, 220.24857593805567, 233.3452377915607, 247.22066768465245, 261.92.
277.4958170337258, 293.99657698631194, 311.4785231849588, 330., 349.6228211385675, 37.
392.43834795089793, 415.77394646530814, 440.49715187611133, 466.6904755831214, 494.44.
523.8423471495058, 554.9916340674516, 587.9931539726239, 622.9570463699176, 660., 699.
740.8249518841862, 784.8766959017959, 831.5478929306163, 880.9943037522227, 933.38095.
988.8826707386098, 1047.6846942990117, 1109.9832681349033, 1175.9863079452477, 1245.9.
1320., 1398.49128455427, 1481.6499037683725, 1569.7533918035917, 1663.0957858612326,
1761.9886075044453, 1866.7619023324855, 1977.7653414772196, 2095.3693885980233, 2219.
2351.9726158904955, 2491.8281854796705, 2640., 2796.98256910854, 2963.299807536745, 3.
3326.191571722465, 3523.9772150088907, 3733.523804664971, 3955.5306829544393, 4190.73.
4439.933072539613, 4703.945231780991, 4983.656370959341, 5280., 5593.96513821708, 592.
6279.013567214367, 6652.38314344493, 7047.954430017781, 7467.047609329942, 7911.06136.
8381.477554392093, 8879.866145079226, 9407.890463561982, 9967.312741918682, 10560., 1.
11853.19923014698, 12558.027134428734, 13304.76628688986, 14095.908860035563, 14934.0.
15822.122731817757, 16762.955108784186, 17759.732290158452, 18815.780927123964, 19934.
21120., 22375.86055286832, 23706.39846029396, 25116.054268857468, 26609.53257377972,
28191.817720071125, 29868.19043731977, 31644.245463635514, 33525.91021756837, 35519.4.
37631.56185424793}

```

```
In[7]:= (* This generates a table of timer count comparison values that *)
(* corresponds to the MIDI note frequencies above. *)
(* It is accurate to less than ±1 cent from C0-C5. *)
(* For higher registers, adjust the prescaler. *)
(* Make sure that note 0 doesn't exceed the max count of your timer. *)
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```
preScaler := 25
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```
clockFreq := 16 × 106
```

```
timerRes[prescale_, clockFreq_] := (prescale (clockFreq)-1)
```

```
timerCounts /. 
```

```
Solve[targetTime == timerResolution (timerCounts + 1), timerCounts][[1]]
```

```
periodToCount[targetTime_, prescale_, clockFreq_] =
```

```
FullSimplify[% /. timerResolution → timerRes[prescale, clockFreq]];
```

```
Round[FullSimplify[ $\left(\frac{1}{2} \frac{1}{\text{Rationalize}[\#, \# 2^{-1024}]} - \text{timerRes}[\text{preScaler}, \text{clockFreq}]\right) /$ 
```

```
timerRes[preScaler, clockFreq] & /@ ftab] // N] // InputForm
```

```
targetTime - timerResolution
```

```
Out[10]= 
$$\frac{\text{targetTime} - \text{timerResolution}}{\text{timerResolution}}$$

```

```
Out[12]//InputForm=
```

```
{10192, 9620, 9080, 8570, 8089, 7635, 7206, 6802, 6420, 6060, 5719, 5398, 5095, 4809, 4539,
3817, 3603, 3400, 3209, 3029, 2859, 2699, 2547, 2404, 2269, 2142, 2021, 1908, 1801, 1700,
1429, 1349, 1273, 1202, 1134, 1070, 1010, 953, 900, 849, 802, 757, 714, 674, 636, 600, 56
476, 449, 424, 400, 378, 357, 336, 318, 300, 283, 267, 252, 238, 224, 212, 200, 188, 178,
149, 141, 133, 125, 118, 112, 105, 99, 94, 88, 83, 79, 74, 70, 66, 62, 59, 55, 52, 49, 46
37, 34, 32, 31, 29, 27, 26, 24, 23, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 12, 11, 10, 1
7, 6, 6, 6}
```