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In[1]:= (* SquareDuino - Note Count Computation *)
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In[2]:= (* This is a table of frequencies corresponding to MIDI note values. *)
ConcertA := 440 (* Define this according to your desired pitch reference *)

(* Don't edit the following *)
A440 := 440

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


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

N[ftab] // InputForm

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Out[6]/InputForm= {8.175798915643707, 8.661957218027252, 9.177023997418987, 9.722718241315027, 10.300861
10.913382232281371, 11.562325709738575, 12.249857374429665, 12.978271799373285, 13.75
14.56761754744031, 15.433853164253879, 16.351597831287414, 17.323914436054505, 18.354
19.445436482630054, 20.60172230705437, 21.826764464562743, 23.12465141947715, 24.4997
25.95654359874657, 27.5, 29.13523509488062, 30.867706328507758, 32.70319566257483, 34
36.70809598967595, 38.89087296526011, 41.20344461410874, 43.653528929125486, 46.24930
48.99942949771866, 51.91308719749314, 55., 58.27047018976124, 61.735412657015516, 65.
69.29565774421802, 73.4161919793519, 77.78174593052023, 82.40688922821748, 87.3070578
92.4986056779086, 97.99885899543732, 103.82617439498628, 110., 116.54094037952248, 12
130.8127826502993, 138.59131548843604, 146.8323839587038, 155.56349186104046, 164.813
174.61411571650194, 184.9972113558172, 195.99771799087463, 207.65234878997256, 220.,
233.08188075904496, 246.94165062806206, 261.6255653005986, 277.1826309768721, 293.664
311.1269837220809, 329.6275569128699, 349.2282314330039, 369.9944227116344, 391.99543
415.3046975799451, 440., 466.1637615180899, 493.8833012561241, 523.2511306011972, 554
587.3295358348151, 622.2539674441618, 659.2551138257398, 698.4564628660078, 739.98884
783.9908719634985, 830.6093951598903, 880., 932.3275230361799, 987.7666025122483, 104
1108.7305239074883, 1174.6590716696303, 1244.5079348883237, 1318.5102276514797, 1396.
1479.9776908465376, 1567.981743926997, 1661.2187903197805, 1760., 1864.6550460723597,
1975.5332050244965, 2093.004522404789, 2217.4610478149766, 2349.3181433392606, 2489.0
2637.0204553029594, 2793.825851464031, 2959.955381693075, 3135.963487853994, 3322.437
3729.3100921447194, 3951.066410048993, 4186.009044809578, 4434.922095629953, 4698.636
4978.031739553295, 5274.040910605919, 5587.651702928062, 5919.91076338615, 6271.92697
6644.875161279122, 7040., 7458.620184289439, 7902.132820097986, 8372.018089619156, 88
9397.272573357042, 9956.06347910659, 10548.081821211837, 11175.303405856124, 11839.82
12543.853951415977}

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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. *)

preScaler := 26
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[

$$\frac{\frac{1}{2} \frac{1}{\text{Rationalize}[\#, \# 2^{-1024}]} - \text{timerRes}[\text{preScaler}, \text{clockFreq}]}{\text{timerRes}[\text{preScaler}, \text{clockFreq}]} \& /@ \text{ftab}] // N] // \text{InputForm}$$

targetTime - timerResolution
Out[10]=
timerResolution

Out[12]//InputForm=
{15288, 14430, 13620, 12855, 12134, 11453, 10810, 10203, 9630, 9090, 8580, 8098, 7644, 721
6066, 5726, 5404, 5101, 4815, 4544, 4289, 4049, 3821, 3607, 3404, 3213, 3033, 2862, 2702,
2272, 2144, 2024, 1910, 1803, 1702, 1606, 1516, 1431, 1350, 1275, 1203, 1135, 1072, 1011,
850, 803, 757, 715, 675, 637, 601, 567, 535, 505, 477, 450, 425, 401, 378, 357, 337, 318,
267, 252, 238, 224, 212, 200, 189, 178, 168, 158, 149, 141, 133, 126, 118, 112, 105, 99,
79, 74, 70, 66, 62, 59, 55, 52, 49, 46, 44, 41, 39, 37, 35, 33, 31, 29, 27, 26, 24, 23, 2
17, 16, 15, 14, 13, 12, 12, 11, 10, 10, 9}

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