

I'm Going to Pop Some Tags: Using SAS® CALL SOUND Routines

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ABSTRACT

Are you a SAS® programmer? Does your computer have speakers? Well then look no further than the CALL SOUND routine for all your musical needs. Leveraging an undoubtedly easy approach to initiating sounds from your computer through SAS®, along with an elementary knowledge of sheet music, your programs will evolve into something beyond data management, reporting, and analysis, and become your own personal stereo. Examples will be provided.

INTRODUCTION

While the beeps initiated using the SAS® CALL SOUND routine sound archaic, that which is required to produce songs familiar to even the slightly musically inclined individual is a minimal understanding of octaves, frequencies, and sheet music. We will demonstrate how this minimal understanding can lead to some quite amusing and often impressive melodies.

SOUND

Crudely, sound can be thought of as beginning with the vibration of an object. The vibrations of the object cause the particles in the atmosphere to move, which in turn move the particles next to them, so on and so forth. This compression within our atmosphere causes the vibration, which began with the object, to move in an outward direction. The pressure changes caused by the vibration within the atmosphere dictate the frequency of the sound wave. Quick pressure changes caused by a vibration will result in higher frequencies, and vice versa. The higher the frequency, the higher the pitch we hear:

Note	Octave 1	Octave 2	Octave 3	Octave 4	Octave 5	Octave 6	Octave 7	Octave 8
C	32.703	65.406	130.813	261.626	523.251	1046.502	2093.005	4186.009
Db	34.648	69.296	138.591	277.183	554.365	1108.731	2217.461	4434.922
D	36.708	73.416	146.832	296.665	587.330	1174.659	2349.318	4698.636
Eb	38.891	77.781	155.563	311.127	622.254	1244.508	2489.016	4978.032
E	41.203	82.407	164.814	329.628	659.255	1318.510	2637.020	5274.041
F	43.653	87.307	174.614	349.228	698.456	1396.913	2793.826	5587.652
Gb	46.249	92.499	184.997	369.994	739.989	1479.978	2959.955	5919.911
G	48.999	97.999	195.998	391.995	783.991	1567.982	3135.963	6271.927
Ab	51.913	103.826	207.652	415.305	830.609	1661.219	3322.438	6644.875
A	55.000	110.000	220.000	440.000	880.000	1760.000	3520.000	7040.000
Bb	58.270	116.541	223.082	446.164	892.328	1784.655	3569.310	7138.620
B	61.735	123.471	246.942	493.882	987.767	1975.533	3951.066	7902.133

USING THE CALL SOUND ROUTINE

Among the number of CALL routines that SAS® makes available is SOUND. CALL SOUND(frequency,duration) allows you to play a specific sound, dictated by frequency, for a specific duration, in milliseconds. It's worth noting that SAS® allows frequencies from 20 hertz to 20,000, representing the frequency range for an individual without a hearing loss.

There are a number of applications for this routine that can be found and reviewed in *Making Music in SAS: Using Sound to Alert users of Errors and Data Discrepancies* (David Fielding, SUGI 29).

LOOKING FOR FUN AND FEELIN' GROOVY

In the day of the internet, one can easily obtain sheet music to his or her favorite tune, with many pieces conveniently labeling each note:



With such sheet music, one only needs to reference the aforementioned table of notes and corresponding frequencies to begin writing your favorite songs in SAS®.

THE 2010s, MACKLEMORE – THRIFT SHOP

```
DATA NULL;
CALL SOUND (207.652,200) ; *Ab;
CALL SOUND (415.305,100) ; *Ab;
CALL SOUND (415.305,100) ; *Ab;
CALL SOUND (311.127,150) ; *Eb;
CALL SOUND (277.183,200) ; *Db;
CALL SOUND (415.305,250) ; *Ab;
CALL SOUND (622.254,100) ; *Eb;
CALL SOUND (493.882,150) ; *B;
CALL SOUND (415.305,150) ; *Ab;
CALL SOUND (207.652,200) ; *Ab;
CALL SOUND (415.305,100) ; *Ab;
CALL SOUND (415.305,100) ; *Ab;
CALL SOUND (311.127,150) ; *Eb;
CALL SOUND (277.183,200) ; *Db;
CALL SOUND (415.305,250) ; *Ab;
CALL SOUND (622.254,100) ; *Eb;
CALL SOUND (493.882,150) ; *B;
CALL SOUND (415.305,150) ; *Ab;
RUN;
```

THE 1990s, BLINK 182 – WHAT'S MY AGE AGAIN?

```
DATA NULL;
CALL SOUND (246.942,100) ; *B;
CALL SOUND (369.994,80) ; *Gb;
CALL SOUND (466.164,80) ; *Bb;
CALL SOUND (369.994,80) ; *Gb;
CALL SOUND (184.997,100) ; *Gb;
CALL SOUND (369.994,80) ; *Gb;
CALL SOUND (466.164,80) ; *Bb;
CALL SOUND (369.994,80) ; *Gb;
CALL SOUND (138.591,100) ; *Db;
CALL SOUND (369.994,80) ; *Gb;
CALL SOUND (466.164,80) ; *Bb;
CALL SOUND (369.994,80) ; *Gb;
CALL SOUND (155.563,100) ; *Eb;
CALL SOUND (369.994,80) ; *Gb;
CALL SOUND (466.164,80) ; *Bb;
CALL SOUND (369.994,80) ; *Gb;
RUN;
```

THE 2000s, SUM 41 – FAT LIP

```
DATA NULL;
CALL SOUND (207.652,85) ; *Ab;
CALL SOUND (220.000,85) ; *A;
CALL SOUND (246.942,85) ; *B;
CALL SOUND (0,125) ; *Rest;
CALL SOUND (415.305,300) ; *Ab;
CALL SOUND (207.652,85) ; *Ab;
CALL SOUND (220.000,85) ; *A;
CALL SOUND (246.942,85) ; *B;
CALL SOUND (0,125) ; *Rest;
CALL SOUND (369.994,300) ; *Gb;
CALL SOUND (207.652,85) ; *Ab;
CALL SOUND (220.000,85) ; *A;
CALL SOUND (246.942,85) ; *B;
CALL SOUND (0,125) ; *Rest;
CALL SOUND (415.305,300) ; *Ab;
CALL SOUND (207.652,85) ; *Ab;
CALL SOUND (220.000,85) ; *A;
CALL SOUND (246.942,85) ; *B;
CALL SOUND (0,125) ; *Rest;
CALL SOUND (369.994,85) ; *Gb;
CALL SOUND (329.628,300) ; *E;
RUN;
```

THE 1980s. MICHAEL JACKSON – BEAT IT

```
DATA NULL;
CALL SOUND (164.814,220) ; *E;
CALL SOUND (195.998,107) ; *G;
CALL SOUND (246.942,107) ; *B;
CALL SOUND (391.995,107) ; *G;
CALL SOUND (329.628,350) ; *E;
CALL SOUND (369.994,200) ; *B;
CALL SOUND (329.628,150) ; *B;
CALL SOUND (296.665,175) ; *B;
CALL SOUND (0,105) ; *Rest;
CALL SOUND (296.665,175) ; *B;
CALL SOUND (0,200) ; *B;
CALL SOUND (164.814,220) ; *E;
CALL SOUND (195.998,107) ; *G;
CALL SOUND (246.942,107) ; *B;
CALL SOUND (391.995,107) ; *G;
CALL SOUND (329.628,350) ; *E;
CALL SOUND (369.994,200) ; *B;
CALL SOUND (329.628,150) ; *B;
CALL SOUND (296.665,175) ; *B;
RUN;
```

THE 1970s, LED ZEPPELIN – STAIRWAY TO HEAVEN

```
DATA NULL;
CALL SOUND (220.000,150) ; *A;
CALL SOUND (261.626,150) ; *C;
CALL SOUND (329.628,150) ; *E;
CALL SOUND (440.000,150) ; *A;
CALL SOUND (493.882,150) ; *B;
CALL SOUND (440.000,150) ; *A;
CALL SOUND (329.628,150) ; *E;
CALL SOUND (493.882,150) ; *B;
CALL SOUND (523.251,150) ; *C;
CALL SOUND (440.000,150) ; *A;
CALL SOUND (329.628,150) ; *E;
CALL SOUND (523.251,150) ; *C;
CALL SOUND (369.994,150) ; *Gb;
CALL SOUND (296.665,150) ; *D;
CALL SOUND (220.000,150) ; *A;
CALL SOUND (369.994,150) ; *Gb;
CALL SOUND (329.628,150) ; *E;
CALL SOUND (261.626,150) ; *C;
CALL SOUND (220.000,150) ; *A;
CALL SOUND (261.626,200) ; *C;
CALL SOUND (329.628,150) ; *E;
CALL SOUND (261.626,150) ; *C;
CALL SOUND (220.000,150) ; *A;
CALL SOUND (195.998,150) ; *G;
CALL SOUND (220.000,150) ; *A;
CALL SOUND (220.000,250) ; *A;
RUN;
```

CONCLUSION

The utility of SAS® extends beyond programmatic, analytic, and management capabilities. Functional exploration can yield fairly amusing finds, with fairly trivial implementations. The CALL SOUND routine serves as a source of not only amusement, but business application, which can be read about in David Fielding's aforementioned paper.

REFERENCES

Fielding, David, 2004, *Making Music in SAS: Using Sound to Alert Users of Errors and Data Discrepancies*, presented at SUGI 29 (paper 048-29).

MIDI Note Number to Frequency Conversion Chart. <http://www.subsynth.sourceforge.net/midinote2freq.html>.

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