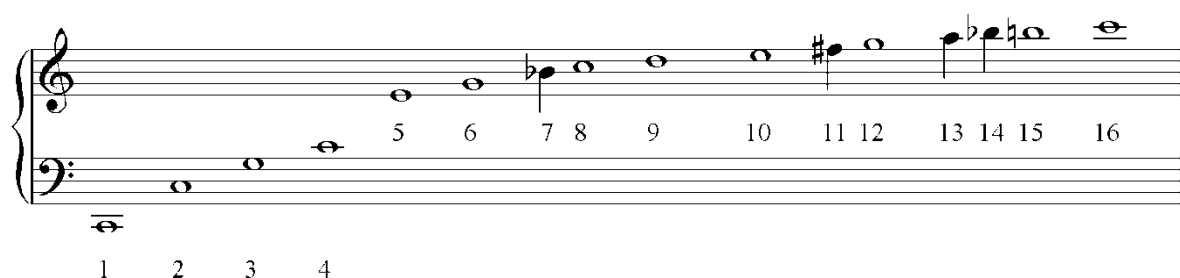


# Harmonics

---

An understanding of the harmonic content of musical sounds helps in arranging and composing.

The harmonic series for low C is given below. This pitch has been chosen so that notating the series requires the least number of ledger lines. The relationship between pitches is the same for most pitched notes. There are some exceptions, notably the Clarinet – more on that another time.



So that we speak the same language as written texts:-

1 is the Fundamental and also the 1<sup>st</sup> harmonic – ratio 1:1

2 is the first overtone and the 2<sup>nd</sup> harmonic – ratio 2:1

3 is the second overtone and the 3<sup>rd</sup> harmonic – ratio 3:1

and so on....

The ratio number indicates the relationship between the notes in terms of frequency or vibrations per second. So if number 1 above (Low C) was a pitch produced by about 64 vibrations per second – frequently called cycles per second (c per sec.), - then 2, the next C would be twice that at 128 vibrations per second. 3 or G would be 192 or 3 times 64. Middle C would be 256 etc.

Note:- the tuning of instruments is higher than this, tuning the A between numbers 6 and 7 above somewhere between 440 and 446 c per sec. depending on the country.

Notice how the pitch of the higher harmonics get closer together.

The crotchets are pitches that are not in tune and are also not member notes of the scale of C major to which all other notes belong.

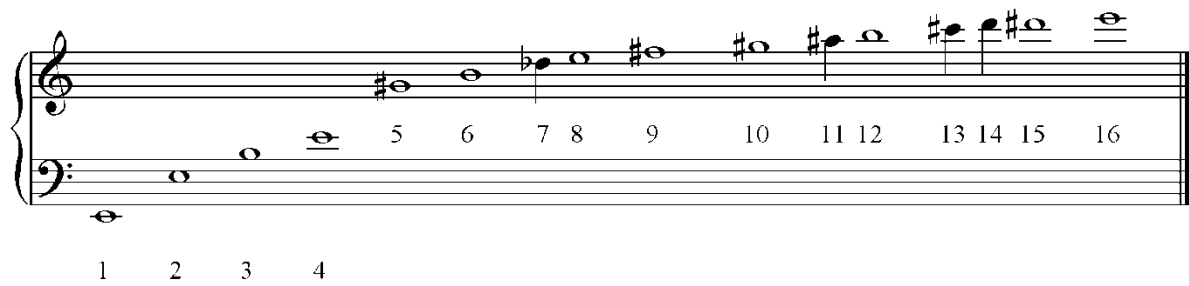
## Why should arrangers think about harmonics?

There are two main reasons:-

The listener is used to hearing a big gap at the bottom when listening to musical pitches.

The harmonic content of two notes that are close together will have clashing pitches.

What clashes would there be if Low C and Low E were sounded together?



**For C                      For E**

C clashes with B

G with G#

E & G with F#

And there are more clashes of harmonics. The interesting thing is that when notes are higher our ears are not offended by the resultant clashes. Low clashes sound muddy to our ears.

From these we should take the advice that:- **In part writing for either instruments or voices have large gaps or intervals between the lower pitches.**