07 Nov '24

HW: Play with wave properties in python code and save the images in each case.
Eg: (1) Small amplitude (2) Large amplitude
Do that for λ, ν, v, f, A

→ Velocity of sound in air is fixed. It doesn't change. But velocity will be different if it's not going through air but through a solid.

→ HW: Make a telephone using two match boxes, two match sticks and one long string.

(use plastic cups if not match boxes)

→ try with both people in the same room and the string not touching anything

→ try with both in different rooms and string touching the walls

→ **Harmonics**: Two waves with frequencies (or wavelengths) such that one is an integer multiple of the other are called harmonics.

$\frac{\lambda_2}{\lambda_1}$ (or) $\frac{\lambda_1}{\lambda_2}$ is an integer (not float)

λ_1	λ_2		isHarmonic
33	66	$\frac{\lambda_2}{\lambda_1} = 2$	✓
33	65	$\frac{\lambda_1}{\lambda_2}, \frac{\lambda_2}{\lambda_1} \notin \mathbb{Z}$	✗
300	150	$\frac{\lambda_1}{\lambda_2} = 2$	✓

'ν' is measured in units 'Hertz' — which tells no. of waves per second.

In piano, as we move from $C_1 \to C_2 \to C_3 \to C_4 \to C_5 \ldots$ each time the frequency is doubling.

$\Rightarrow A_1 \to A_2 \to A_3 \to A_4 \to A_5 - A_6$

$f = 55 \quad 110 \quad 220 \quad 440 \quad 880 \quad 1760$ (Hz)

$55 \quad 55\times2 \quad 55\times4 \quad 55\times8 \quad 55\times16 \quad 55\times32$

$55\times2^2 \quad 55\times2^3 \quad 55\times2^4 \quad 55\times2^5$

$\rightarrow$ Fundamental frequency (main frequency) of an intrument

If C_2 is the fundamental frequency then the harmonics $2\times C_2 = C_3$; $4\times C_2 = C_4$; $8\times C_1 = C_5$;

But $3 \times C_2$, $5 \times C_2$, $7 \times C_2$ etc. won't be used for 'C'.

→ When we play 'C3' on different instruments, we hear them differently because they are also playing harmonics of 'C3' in different ways. That's called 'timbre' (pronounced 'tamber') of the instrument.

→ Starting from $C_3 = 130.8$ Hz (ν)

$C4 = 2 \times C3 = 261.6$ Hz

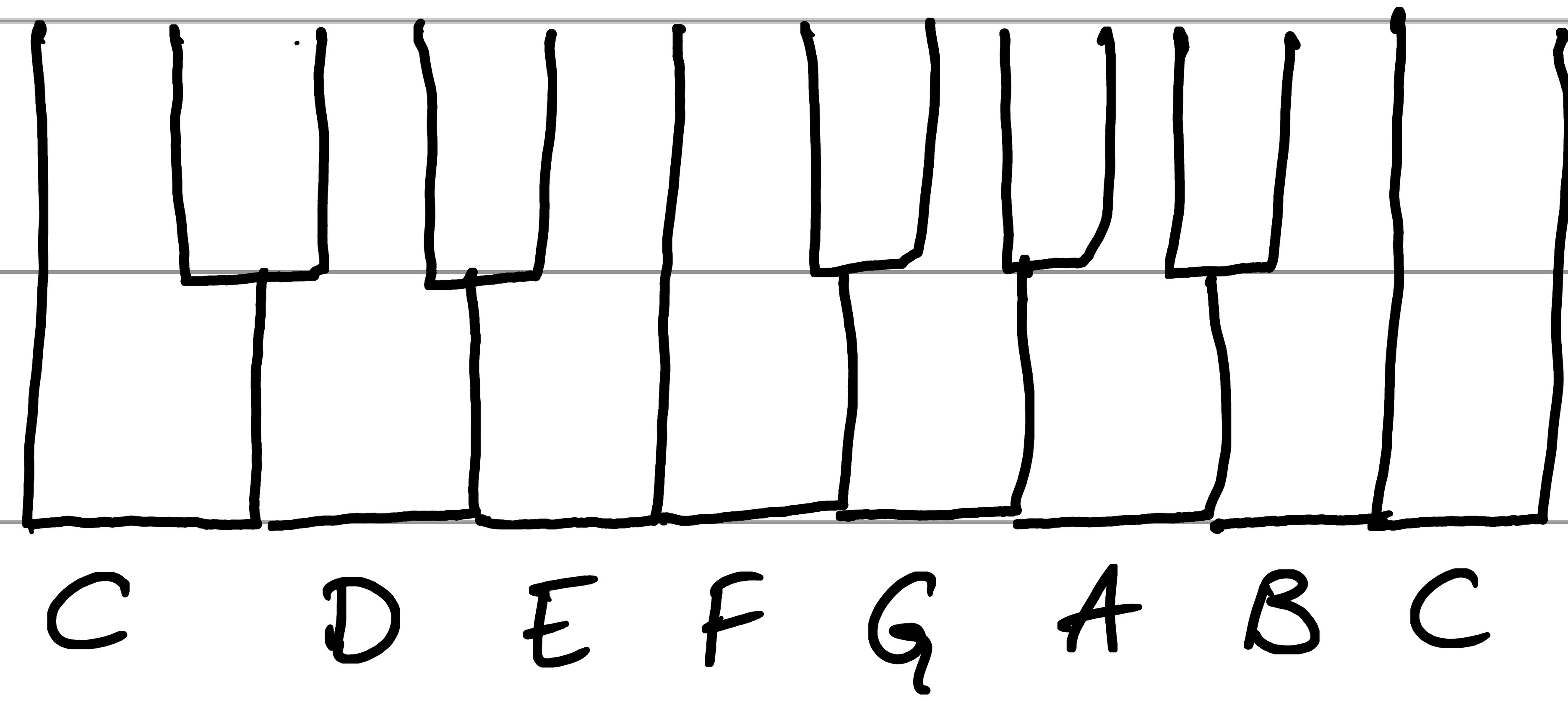
In between these two, we have all the other notes:

ν is increasing

$$
\begin{aligned}
C3 &= 130.8 \text{ Hz} &&= 130.8 \text{ Hz} \\
D3 &= 1.12 \times C3 &&= 146.496 \\
E3 &= 1.26 \times C_3 &&= 164.808 \\
F3 &= 1.33 \times C_3 &&= 173.964 \\
G3 &= 1.50 \times C_3 &&= 196.2 \\
A3 &= 1.68 \times C_3 &&= 219.744 \\
B3 &= 1.89 \times C_3 &&= 247.212 \\
C4 &= 2.00 \times C_3 &&= 261.6 \text{ Hz}
\end{aligned}
$$

Multiplication factors to get frequencies from C3's ν.

→ SY Bhajans practice :



In C-scale

$G_{}$ — /pa/

G# — /da1/

A — /da2/(or)/ni1/

A# — /da3/ (or) /ni2/

B — /ni3/

C_4 — /ṡa/

C_3 — /sa/

C# — /ri1/

D — /ri2/(or)/ga1/

D# — /ri3/(or)/ga2/

E — /ga3/

F — /ma1/

F# — /ma2/

→ (1) Aigiri nandini song swaras & scale

(2) Hasat Ali song swaras & scale

→ **HW:** Practice both songs whole