

# Near-Equal Temperament

## Project N-ET : Part 2 of 3

**Occupation:** Music and Math

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## Forward Stack

(Full Manual)

### Description

This is the full manual, step by step how to tune all 12 keys following the conception in first article, sub-chapter “Forward Stack” (read it first). It is recommended for beginners to understand this process and master the tuning techniques of just intervals.

This process requires to create **7 perfect fifths and 1 major third** as just intervals. Tuning order of the stack is a personal choice.

Images below are an example how I would do it from my perspective. They are for educational purpose to see the whole picture of this procedure. Choose any order that fits best for you. I’m recommending to use sticky notes on every key to track your progress. Otherwise, you might get lost what has been done and what has left.

The range of the referent and jump octave have been chosen on purpose. As already said in first article, the best hearing range for complex sounds is between 80Hz – 500Hz.

## Process

**Referent octave** is the kernel for all other keys. When you finish with referent octave, spread the tunes across all octaves. It is a standard, well-known technique which does not need further explanation. Remember to tune an octave exactly in ratio 2:1. DO NOT STRETCH THE OCTAVE!

**Jump octaves** is where a single stack is being created. They are called jump because will be constantly detuned.

Keys marked with numbers represent all required steps for a single stack.

**X** – Black and white “X” symbol have the meaning of already tempered tone. Do not touch this key!

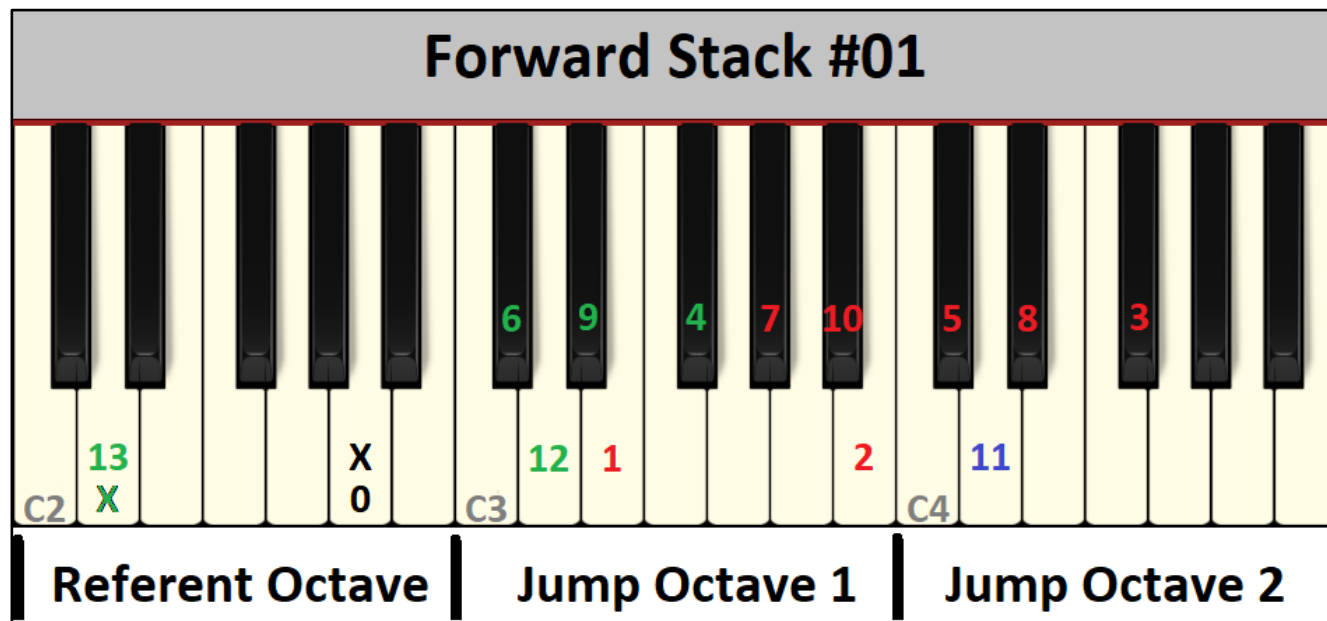
**X** – Green “X” mark. The tune of this key will be equally tempered within the current stack.

**0** – Black or white “0”. The kernel of every stack. This is the initial step. In first picture it’s tone A and assumes that already has the right tune of 440Hz, 432Hz... or whatever you like.

**Red numbers** – These are perfect fifths, ratio:  $\frac{3}{2}$

**Blue number** – This is a major third, ratio:  $\frac{5}{4}$

**Green numbers** – Shift 1 octave down, ratio:  $\frac{1}{2}$



## Forward Stack #02

Diagram illustrating the Forward Stack #02 on a piano keyboard. The keyboard is divided into three octaves: Referent Octave, Jump Octave 1, and Jump Octave 2. Fingerings are indicated by numbers 0-5 on black keys and X on white keys. Fingerings are color-coded: green for the Referent Octave, blue for the first octave of the Jump Octave 1, and red for the second octave of the Jump Octave 1.

Octave	White Key	Black Key	Fingering	
Referent Octave (C2-C3)	C2	C#2	X	
	D2	D#2	X	
	E2	F2	13	
	F2	F#2	X	
	G2	G#2	X	
	A2	B2	0	
	Jump Octave 1 (C3-C4)	C3	C#3	8
		D3	D#3	11
		E3	F3	6
		F3	F#3	9
		G3	A3	12
		A3	B3	1
Jump Octave 2 (C4-C5)	C4	C#4	4	
	D4	D#4	7	
	E4	F4	10	
	F4	F#4	2	
	G4	A4	5	
	A4	B4		

## Forward Stack #03

Diagram illustrating the Forward Stack #03 on a piano keyboard. The keyboard is divided into three octaves: Referent Octave, Jump Octave 1, and Jump Octave 2. Fingerings are indicated by numbers 0-5 on black keys and X on white keys. Fingerings are color-coded: green for the Referent Octave, blue for the first octave of the Jump Octave 1, and red for the second octave of the Jump Octave 1.

Octave	White Key	Black Key	Fingering	
Referent Octave (C2-C3)	C2	C#2	X	
	D2	D#2	X	
	E2	F2	13	
	F2	F#2	X	
	G2	G#2	X	
	A2	B2	0	
	Jump Octave 1 (C3-C4)	C3	C#3	9
		D3	D#3	12
		E3	F3	1
		F3	F#3	4
		G3	A3	7
		A3	B3	10
Jump Octave 2 (C4-C5)	C4	C#4	2	
	D4	D#4	5	
	E4	F4	8	
	F4	F#4	11	
	G4	A4	3	
	A4	B4	6	

## Forward Stack #04

Diagram of Forward Stack #04 on a piano keyboard. The keyboard is divided into three octaves: Referent Octave (C2-C3), Jump Octave 1 (C3-C4), and Jump Octave 2 (C4-C5). Fingerings are indicated by numbers 0-13. Black keys are marked with 'X'.

Octave	Key	Fingering
Referent Octave (C2-C3)	C2	X
	C#2	X
	D2	13
	D#2	X
	E2	X
	F2	X
Jump Octave 1 (C3-C4)	C3	0
	C#3	3
	D3	6
	D#3	12
	E3	9
	F3	1
	F#3	4
	G3	7
	G#3	
	A3	
	A#3	
	B3	
C4		
Jump Octave 2 (C4-C5)	C4	2
	C#4	5
	D4	11
	D#4	
	E4	
	F4	8

## Forward Stack #05

Diagram of Forward Stack #05 on a piano keyboard. The keyboard is divided into three octaves: Referent Octave (C2-C3), Jump Octave 1 (C3-C4), and Jump Octave 2 (C4-C5). Fingerings are indicated by numbers 0-12. Black keys are marked with 'X'.

Octave	Key	Fingering
Referent Octave (C2-C3)	C2	X
	C#2	X
	D2	X
	D#2	X
	E2	X
	F2	X
Jump Octave 1 (C3-C4)	C3	0
	C#3	1
	D3	4
	D#3	7
	E3	10
	F3	2
	F#3	5
	G3	8
	G#3	
	A3	
	A#3	
	B3	
C4		
Jump Octave 2 (C4-C5)	C4	3
	C#4	6
	D4	
	D#4	
	E4	
	F4	9

## Forward Stack #06

Diagram illustrating the Forward Stack #06 on a piano keyboard. The keyboard is divided into three octaves: Referent Octave, Jump Octave 1, and Jump Octave 2.

**Referent Octave (C2-C3):** Notes are marked with 'X' (C2, D2, E2, F2, G2) and '0' (A2). A green 'X' with '13' is above D2.

**Jump Octave 1 (C3-C4):** Notes are marked with numbers: 6 (C3), 9 (D3), 1 (E3), 4 (F3), 7 (G3), 10 (A3).

**Jump Octave 2 (C4-C5):** Notes are marked with numbers: 2 (C4), 5 (D4), 8 (E4), 3 (F4).

## Forward Stack #07

Diagram illustrating the Forward Stack #07 on a piano keyboard. The keyboard is divided into three octaves: Referent Octave, Jump Octave 1, and Jump Octave 2.

**Referent Octave (C2-C3):** Notes are marked with 'X' (C2, D2, E2, F2, G2) and '0' (A2). A green 'X' with '14' is above E2.

**Jump Octave 1 (C3-C4):** Notes are marked with numbers: 5 (C3), 9 (D3), 12 (E3), 3 (F3), 7 (G3), 10 (A3).

**Jump Octave 2 (C4-C5):** Notes are marked with numbers: 4 (C4), 8 (D4), 11 (E4), 2 (F4).

## Forward Stack #08

Diagram illustrating the Forward Stack #08 on a piano keyboard. The keyboard is divided into three sections: Referent Octave, Jump Octave 1, and Jump Octave 2.

**Referent Octave (C2-C3):** Notes C2 (X), C#2 (X), D2 (X), D#2 (0), E2 (X), F2 (X).

**Jump Octave 1 (C3-C4):** Notes C3 (6), C#3 (9), D3 (4), D#3 (7), E3 (10), F3 (2).

**Jump Octave 2 (C4-C5):** Notes C4 (5), C#4 (8), D4 (11), D#4 (3), E4 (8), F4 (3).

## Forward Stack #09

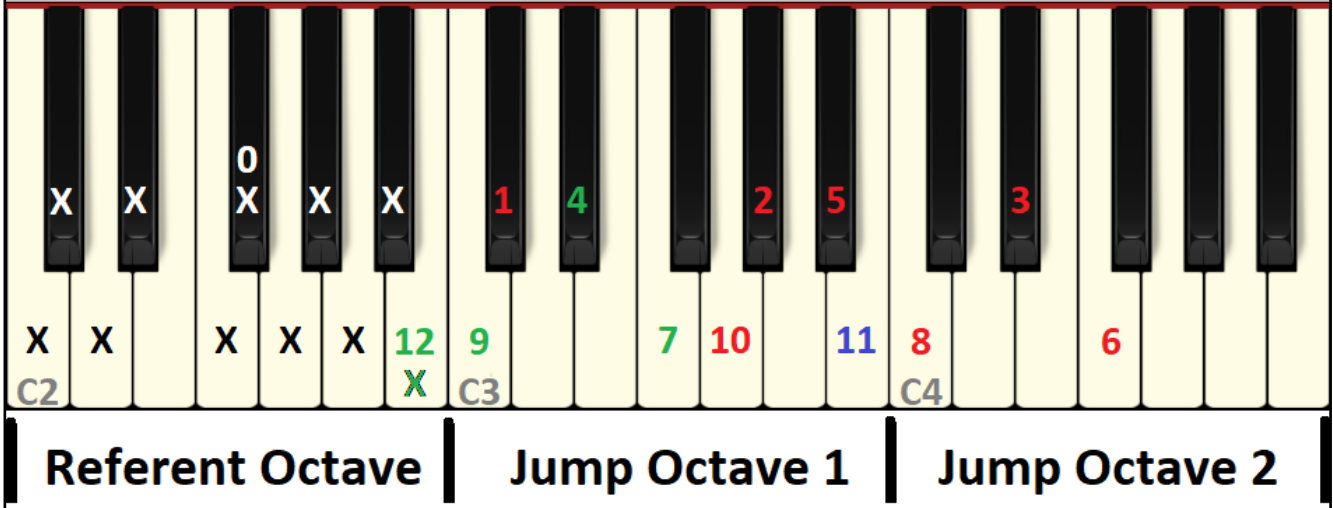
Diagram illustrating the Forward Stack #09 on a piano keyboard. The keyboard is divided into three sections: Referent Octave, Jump Octave 1, and Jump Octave 2.

**Referent Octave (C2-C3):** Notes C2 (X), C#2 (X), D2 (X), D#2 (13), E2 (X), F2 (X).

**Jump Octave 1 (C3-C4):** Notes C3 (8), C#3 (11), D3 (6), D#3 (9), E3 (12), F3 (1).

**Jump Octave 2 (C4-C5):** Notes C4 (7), C#4 (10), D4 (2), D#4 (4), E4 (2), F4 (5).

## Forward Stack #10



## Forward Stack #11

