**Ladder of Fifths**

The two four note halves of an octave in Western music are called tetrachords, each conforming to the pattern of note – tone interval – note - tone interval – note - semitone interval - note often visualised as T, T, S. The two four note halves are separated by a tone giving us the pattern for a whole octave of T, T, S, (T), T, T, S. The tone in brackets is the tone that separates the two tetrachords.

The table which follows show how the tetrachords make up the sequence of the 12 major keys often called the Circle of Fifths but, this time, presented in ladder format. The description “Circle of Fifths” is used because of the way intervals are counted. Taking the first row (which is the 1st tetrachord in the key of C major) we count C to D = a (major) second, C to E a (major) third, C to F a (perfect) fourth and C to G a (perfect) fifth. If you repeat the count for all the rows, starting with the letter in the first column (which is the key note, tonic or root), you will see that all the tetrachords, and the keys they belong to, are a perfect fifth apart.

The table which follows shows how the tetrachords would be presented if we only used sharps and no flats. It demonstrates how unwieldy writing music would be as the number of sharps rapidly increases until we get to a total of 11 for the key of E sharp major.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pitch Letter** | **Tone Interval** | **Pitch Letter** | **Tone Interval** | **Pitch Letter** | **Semitone Interval** | **Pitch Letter** | **Key #/b** | **Key #/b** |
| C |  | D |  | E |  | F | C  0 |  |
| G |  | A |  | B |  | C | G  1 # |
| D |  | E |  | F# |  | G | D  2 # |
| A |  | B |  | C# |  | D | A  3 # |
| E |  | F# |  | G# |  | A | E  4 # |
| B |  | C# |  | D# |  | E | B  5 # |
| F# |  | G# |  | A# |  | B | F#  6 # |
| C# |  | D# |  | E#(F) |  | F# | C#  7 # |
| G# |  | A# |  | B#(C) |  | C# | G#  8 # |
| D# |  | E#(F) |  | F##(G) |  | G# | D#  9 # |
| A# |  | B#(C) |  | C##(D) |  | D# | A#  10 # |
| E#(F) |  | F##(G) |  | G## (A) |  | A# | E#  11# |
| B#(C) |  | C##(D) |  | D##(E) |  | E#(F) |  |

This table shows how the tetrachords are presented using sharps and flats. (By convention sharps or flats are used alternately for F# major or Gb major followed by only flats. Typically, earlier keys in the circle (from 12 o’clock to 6 o’clock) or ladder use only sharps.) Note that E sharp major which needs a total of 11 sharps, needs only a single flat when written as F major. A big improvement in music writing convenience.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Pitch Letter** | **Tone Interval** | **Pitch Letter** | **Tone Interval** | **Pitch Letter** | **Semitone Interval** | **Pitch Letter** | **Key #/b** | **Key #/b** |
| C |  | D |  | E |  | F | C  0 |  |
| G |  | A |  | B |  | C | G  1 # |
| D |  | E |  | F# |  | G | D  2 # |
| A |  | B |  | C# |  | D | A  3 # |
| E |  | F# |  | G# |  | A | E  4 # |
| B |  | C# |  | D# |  | E | B  5 # |
| Gb/F# |  | Ab/G# |  | Bb/A# |  | Cb/B | Gb/F#  6b 6# |
| Db/C# |  | Eb/D# |  | F/E# |  | Gb/F# | Db  5b |
| Ab |  | Bb |  | C |  | Db | Ab  4b |
| Eb |  | F |  | G |  | Ab | Eb  3b |
| Bb |  | C |  | D |  | Eb | Bb  2b |
| F |  | G |  | A |  | Bb | F  1b |
| C |  | D |  | E |  | F |  |

Where two notes describe the same pitch, they are said to be enharmonic. Examples you can see in the ladders include B# and C, F## which is also G and E# which is F. The same applies to keys, G# major and Ab major are enharmonic.

The first ladder shows the need for double sharps; very awkward when writing out musical notation. Depending on the choice of key, double flats may be required instead.

Double sharps and double flats are used when a note is already sharp or flat according to the key signature, but the composer or arranger wants to sharpen or flatten (raise or lower) the note by another semitone and needs to obey the rule that a note letter can only be used once when writing music notation.

Note that as the musical fragment below shows, double sharps are written as x.

It is considered wrong – by convention it has to be said, using the same letter twice would work perfectly well musically – to write music where both E and E# occur with no F. The “right” thing to do would be to write E and F. If you remember every diatonic scale includes 7 letters, each used only once with no omissions, you will see why double sharps and double flats are sometimes necessary.

One last thing, when writing notes (or keys) using letter names, G, A etc, the sharp or flat sign # or b (called accidentals) are written following the letter; eg C#, Ab etc. In musical notation they precede the note they apply to and are written as in the diagram below.

