

CHORD FORMULAS ©

by
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The basic premise of "Chord Formulas" is that there is, in certain terms, a *recipe* of how to construct a chord, any chord. This recipe is called the *chord formula*. With this formula you can unerringly construct that chord starting with any root note (tonic) you wish. Readers of *Film Score Rundowns* may find this technique useful when identifying chords on their own.

Using a keyboard or simply a picture of one, you can count the steps given in a formula. For example, the chord formula for the basic major triad is **5-4**. If you begin, say, with the C note as the root note, count up chromatically (half-steps or semi-tones) five steps *starting* with that root note as the "1" count or step. In this case, C to E equals five steps. To elaborate, C to C# [or Db enharmonically] are 2 steps. C to D are composed of three steps (C-C#-D or C-Db-D). C to D# [or Eb enharmonically] are composed of four steps (C-C#-D-D# or, if you prefer, C-Db-D-Eb). Then, starting with that E note where you ended up with in the first half ("5") of the 5-4 formula, you count up four steps to G (E-F-F#-G). Hence you get C-E-G or the simple root position triad in C major. A partial *Chord Formulas* List is given starting on page 9.

SCALES

The basis of chord formulas formation is scales (from the Latin, *scala*, meaning "ladder"). A scale represents a series of tones orderly arranged in succession within a certain contextual range (normally an octave in Western music).

The two basic ways of classifying scales is the Diatonic method and the Chromatic method. The Diatonic scale of eight notes consists of whole-steps and half-steps arranged in alphabetical order, normally ascending from the root position. The Chromatic scale of 13 semi-tones is simply the succession of half-steps only. Since Western or modern music is based on the Diatonic scale, we focus on that.

Major Scale - Formula: 3-3-2-3-3-3-2

C-D-E-F-G-A-B

C#-D#-E#-F#-G#-A#-B#-C#

Db-Eb-F-Gb-Ab-Bb-C-Db

D-E-F#-G-A-B-C#-D

Eb-F-G-Ab-Bb-C-D-Eb

E-F#-G#-A-B-C#-D#-E

F-G-A-Bb-C-D-E-F

F#-G#-A#-B-C#-D#-E#-F#

Gb-Ab-Bb-Cb-Db-Eb-F-Gb

Ab-Bb-C-Db-Eb-F-G-Ab

A-B-C#-D-E-F#-G#-A

Bb-C-D-Eb-F-G-A-Bb

B-C#-D#-E-F#-G#-A#-B

Minor Scale - Formula: 3-2-3-3-2-3-3

A-B-C-D-E-F-G-A
A#-B#-C#-D#-E#-F#-G#-A#
Bb-C-Db-Eb-F-Gb-Ab-Bb
B-C#-D-E-F#-G-A-B
C-D-Eb-F-G-Ab-Bb-C
C#-D#-E-F#-G#-A-B-C#
D-E-F-G-A-Bb-C-D
D#-E#-F#-G#-A#-B-C#-D#
Eb-F-Gb-Ab-Bb-Cb-Db-Eb
E-F#-G-A-B-C-D-E
F-G-Ab-Bb-C-Db-Eb-F
F#-G#-A-B-C#-D-E-F#
G-A-Bb-C-D-Eb-F-G
G#-A#-B-C#-D#-E-F#-G#

The above are the two kinds or modes of diatonic scales. The trait of the major scale is that the half steps occur between the third and the fourth notes (or degrees, often designated as Roman numerals, I thru VIII), and between the seventh and eight. See below:

Major (Ionian) Scale Mode:

I C Tonic
II D Supertonic
III E Mediant
IV F Subdominant
V G Dominant
VI A Submediant
VII B Leading Tone
VIII C Octave

Whole steps are between C-D, D-E. Half step is between E-F. Whole steps are between F-G, G-A, A-B. Half step is between B-C.

The trait of the minor scale is that the half steps occur between the second and third notes, and between the fifth and sixth notes.

Minor (Aeolian) Scale Mode:

I A Tonic
II B Supertonic
III C Mediant
IV D Subdominant
V E Dominant
VI F Submediant

- VII G Leading Tone
- VIII A Octave

Whole step are between A-B. Half step is between B-C. Etc.

As a shorthand convenience in musical compositions, instead of laboriously writing out each flat or sharp needed in a particular modal key, the KEY SIGNATURE was devised. Here the required accidentals are assembled in a standard pattern that is placed at the beginning of the music staff of each page immediately after the clef sign. A consistent pattern is devised by ascending fifths and descending fifths, as given below:

Major Keys

- C# 7 sharps F#-C#-G#-D#-A#-E#-B#
- F# 6 sharps F#-C#-G#-D#-A#-E#
- B 5 sharps F#-C#-G#-D#-A#
- E 4 sharps F#-C#-G#-D#
- A 3 sharps F#-C#-G#
- D 2 sharps F#-C#
- G 1 sharp F#

C

- F 1 flat Bb
- Bb 2 flats Bb-Eb
- Eb 3 flats Bb-Eb-Ab
- Ab 4 flats Bb-Eb-Ab-Db
- Db 5 flats Bb-Eb-Ab-Db-Gb
- Gb 6 flats Bb-Eb-Ab-Db-Gb-Cb
- Cb 7 flats Bb-Eb-Ab-Db-Gb-Cb-Fb

Minor keys

- A# 7 sharps F#-C#-G#-D#-A#-E#-B#
- D# 6 sharps F#-C#-G#-D#-A#-E#
- G# 5 sharps F#-C#-G#-D#-A#
- C# 4 sharps F#-C#-G#-D#
- F# 3 sharps F#-C#-G#
- B 2 sharps F#-C#
- E 1 sharp F#

A

- D 1 flat Bb
- G 2 flats Bb-Eb
- C 3 flats Bb-Eb-Ab
- F 4 flats Bb-Eb-Ab-Db

Bb 5 flats Bb-Eb-Ab-Db-Gb
 Eb 6 flats Bb-Eb-Ab-Db-Gb-Cb
 Ab 7 flats Bb-Eb-Ab-Db-Gb-C-Fb

INTERVALS

The distance between any two notes of a scale is called an interval. The smallest interval in western music is the half-step (semi-tone). A half step between two notes having different letter names (Ex., C to D-flat, E to F) is a diatonic half-step. A half-step between two notes having the same letter name (Ex., C to C-sharp) is a chromatic half-step.

The size of an interval is determined diatonically by counting the letter name upward from the root note. Ex., C-D = 2nd; C-E = 3rd; C-F = 4th; C-G = 5th, etc.

The *quality* of an interval is perfect, major, minor, augmented or diminished. Unisons, 4ths, 5ths and octaves are called *perfect* intervals, but any half-tone alteration makes them diminished (if lowered a half-step) or augmented (if raised a half-step). 2nds, 3rds, 6ths, 7ths are a separate group of intervals that can be major, minor, diminished or augmented intervals. Examples of intervals of the A and C major and minor scales are as follows:

<u>A major</u>	<u>C major</u>	<u>Interval Name</u>	<u>Half-Steps</u>
A to B	C to D	major 2 nd	2
A to D	C to F	perfect 4 th	5
A to E	C to G	perfect 5 th	7
A to G#	C to B	major 7 th	11

<u>C minor</u>	<u>A minor</u>	<u>Interval Name</u>	<u>Half-Steps</u>
C to Eb	A to C	minor 3 rd	3
C to Bb	A to G	minor 7 th	10

To determine the number of half-steps from a chord formula number, simply subtract 1 from the chord formula number.

Half-Steps	Chord Formula Steps	Diatonic Interval name
1	2	minor 2nd
2	3	major 2nd
3	4	minor 3rd
4	5	major 3rd
5	6	perfect 5th
6	7	dim 5th/aug 4th
7	8	perfect 5th
8	9	minor 6th
9	10	major 6th
10	11	(Dom)7th
11	12	major 7th
12	13	octave

So, as examples, the interval between C to C (itself) is P1 or unison

C-C# = Aug 1

C-Db = min 2nd

C-D = maj 2nd

C-D# = Aug 2nd

C-Eb = min 3rd (though enharmonically the same sound)

C-E = maj 3rd

C-E# = Aug 3rd

C-Fb = dim 4th

C-F = P4 (Perfect 4th interval)

C-F# = Aug 4th (tritone)

C-Gb = dim 5th (tritone)

C-G = P5

C-G# = A5

C-Ab = m6

C-A = M6

C-A# = A6

C-Bb = m7

C-B = M7

C-B# = A7

C-Cb = d8

Other examples

Cb-C = A1

Cb- C# = AA1 (double augmented unison)

Cb-Db = m2

Cb- D# = AA2

E#-Fb = dd2double diminished

E#-F = d2 (*not* unison)

B-Cb = d2 (*not* unison)

B-C = m2

B-C# = M2

B-Db = d3

B-Bb = d8

CHORDS

While the combination of two notes is an interval, the combination of three or more notes is a chord. The basic chord is a triad, a three-tone sound consisting of two intervals of thirds, normally. The two kinds of thirds are major & minor, and there are four permutations:

Major-minor = major triad (Ex. C-E-G)

minor-Major = minor triad (Ex. C-Eb-G)

minor-minor = diminished triad (Ex. C-Eb-Gb)

Major-major = augmented triad (Ex. C-E-G#)

Both the major and minor triads have a perfect 5th between the root note and the 5th (Ex. C to G). The difference between them lies in the fact that, in the minor chord, the third is always lowered or flatted one half-step (Ex., Eb in the C minor triad). In the diminished triad, the 5th is also lowered one half-step # in the C aug triad). In certain terms, the diminished chord is a special kind of minor chord, while the augmented chord is a special kind of major chord--their 5ths either lowered or raised a half-step respectively.

In this analysis, the chord formula shows the diatonic intervals of a given chord. For example, the **5-4** formula for a basic major triad shows *two* intervals separated by a dash: the major third (the "5" in the formula) or C to E in the C maj triad, and the minor third (the "4" in the formula) or E to G. The **5-4-4** formula in the Dominant 7 (D 7) chord shows three intervals: using C as the root, we have a major third between C to E, a minor third between E to G, and another minor third between G to Bb.

The **5-4-5** formula in the Major 7 chord also has three intervals: major third from C-E, minor third from E-G, and a major third from G-B.

The chord formula approach also very importantly uses the proper letter/note sequence. The rule of standard music is that the correct name for a note a whole tone above a given letter/note must be the next letter. For example, a 6th note is a whole tone above a 5th, so in A major 6, the proper letter sequence is A-C#-E-F#, *not* A-C#-E-Gb (the 6th note must be identified as F#, *not* Gb).

The proper letter sequence (except for suspended and added 4th chords) is as follows:

C-E-G-B-D-F-A (Or, for better ease of memory, starting with F:)
F-A-C-E-G-B-D

Notice that the sequence is separated by thirds since most chords in traditional Western harmony are basically built upon third (tertian) intervals (*quartal* harmony, say, also exists of course). Even a perfect 5th is built upon two intervals of thirds (minor-Major or Major-minor). An example of an exception is the suspended chord (6-3 formula) in which the suspended note "suspends" or replaces the third note in relation to the root note.

In terms of proper letter sequencing of chords, a further example is the major b (flat) 5th (**5-3** formula) or major chord flat the 5th. You may think that (using the F as the tonic, say) the letter sequence is F-A-B. However, that is incorrect because the nature of the chord is a major with a flatted *fifth*. The fifth of the F root note is C, *not* B. Hence the proper letter pattern is F-A-Cb. Cb and B are enharmonic notes, sounding the same in isolation but bearing different letter names, depending on the chord context. For example, D# and Eb in relation to C are enharmonically the same, but the former is an augmented second interval, while the latter is a major third.

As given, the basic chord is a *triad* (three tones). A chord with an added third to a triad is called a *seventh*. In the table below are five of the most common 7th chords:

Dom 7	7	Major-minor 7th	maj-min-min
Maj 7	M7	Major-Major 7th	maj-min-maj
min 7	m7	minor-minor 7th	min-maj-min
minMaj 7	m +7	minor-Major 7th	min-maj-maj
min 7 b 5	dm7	half-diminished 7th	min-min-maj
dim 7	dd7	diminished 7th	min-min-min

Adding a third (Ex. a minor 3rd to Maj 7; a major 3rd to Dom 7) to a seventh chord creates the ninth chord. Adding a minor 3rd to a 9th creates an 11th chord. And adding a major 3rd to an 11th creates a 13th. Some of these compound chords are called poly-chords. For example, the A Dom 11th (5-4-4-5-4 formula) can be seen as the A major triad with a G major triad on top of it. The D min 11th (4-5-4-5-4) can be seen as the D min triad with the C maj triad on top.

Keeping to tradition, the 11th note in a 13th chord is omitted. Even so, a 13th chord with its six notes (Ex. C-E-G-B-D-A) will look very imposing. In performed music, all the notes of such a chord would usually not be played together. Otherwise the chord would sound too muddled, too close together. Proper voicing means rearranging the placement of some of the notes from their root position and omitting others. In an 11th chord, the 9th and even the 5th are omitted. In a 9th chord, the 7th is left out many times, with the 9th sounding below the root note. Even the basic maj 7th in its root position is often better voiced (sounds more interesting) by bringing down the 7th below the root while leaving all the other notes the same.

INVERSIONS

Most music, in fact, is not played in the basic chord placement of the root note as the lowest or bottom note. Instead, chords are often "inverted." Inversions are the rearrangement of the intervals of a chord. A triad with the tonic as the lowest note is the root position. A triad with the third as the lowest note is the first inversion (ex. E-G-C in the C maj triad). The 5th as the bottom note is the second inversion (ex. G-C-E).

Using the D min 7 as another example:

D/F/A/C = Root position

F/A/C/D = 1st inversion

A/C/D/F = 2nd inv

C/D/F/A = 3rd inv

Some chords, when inverted, become entirely different chords in isolation. Ex., if the A in the C maj 6 chord (C/E/G/A) is placed below the root C note (C maj 6 third inv), the chord structurally becomes an A minor 7th (A/C/E/G) in its root position. The maj 6 and minor 7th are "equivalent" in that sense. Normally, however, the nature of a chord is determined (in most or many cases) by the low note of a bass instrument in a composition.

SHARED CHORD NOTES

While chord formulas are unerringly accurate in *constructing* chords, it is not necessarily easy to *identify* chords intended by a composer in a complex composition. Harmony is a moving, ever-changing or modulating experience dependent on the context of adjacent chords and shared notes of a previous chord. Besides *Circle of Fifths* modulation, parallel (chromatic) triads and sevenths, and other devices, chords can modulate into other chords with shared notes.

In major triads:

C : C maj (C/E/G), Ab maj (Ab/C/Eb), F maj (F/A/C)
D : D maj (D/F#/A), G maj (G/B/D), Bb maj (Bb/D/F)
E : E maj (E/G#/B), A maj (A/C#/E), C maj (C/E/G)
F : F maj (F/A/C), Db maj (Db/F/Ab), Bb maj (Bb/D/F)
G : G maj (G/B/D), C maj (C/E/G), Eb maj (Eb/G/Bb)
A : A maj (A/C#/E), D maj (D/F#/A), F maj (F/A/C)
B : B maj (B/D#/F#), E maj (E/G#/B), G maj (G/B/D)

C# : C# maj (C#/E#/G#), F# maj (F#/A#/C#), A maj (A/C#/E)
D# : D# maj (D#/F#/A#), B maj (B/D#/F#)
F# : F# maj, D maj, B maj
G# : G# maj (G#/B#/D#), C# maj (C#/E#/G#), E maj (E/G#/B)
A# : A# maj (A#/C#/E#), F# maj (F#/A#/C#)

Db : Db maj (Db/F/Ab), Gb maj (Gb/Bb/Db)
Eb : Eb maj (Eb/G/Bb), Ab maj (Ab/C/Eb), Cb maj (Cb/Eb/Gb)
Gb : Gb maj, Cb maj
Ab : Ab maj, Db maj
Bb : Bb maj, Eb maj, Gb maj

In minor triads:

C : C min (C/Eb/G), F min (F/Ab/C), A min (A/C/E)
D : D min (D/F/A), G min (G/Bb/D), B min (B/D/F#)
E : E min (E/G/B), C# min (C#/E/G#), A min (A/C/E)
F : F min (F/Ab/C), Bb min (Bb/Db/F), D min (D/F/A)
G : G min, C min, E min
A : A min (A/C/E), D min (D/F/A), F# min (F#/A/C#)
B : B min (B/D/F#), E min (E/G/B), G# min (G#/B/D#)

C# : C# min (C#/E/G#), F# min (F#/A/C#), A# min (A#/C#/E#)
D# : D# min, G# min
F# : F# min, B min, D# min
G# : G# min, C# min
A# : A# min, D# min

Db : Db min, Bb min
Eb : Eb min, C min, Ab min

Gb : Gb min, Bb min
 Ab: Ab min, F min
 Bb : Bb min, Eb min, G min

Common Sevenths (examples):

C : C min Maj 7 (C/Eb/G/B), C maj 7, C Dom 7, C min 7, C 7, C dim 7, C half-dim 7, Db maj7 (Db/F/Ab/C), D min 7 (D/F/A/C), D Dom7 (D/F#/A/C), D# dim 7, D half-dim 7 (D/F/Ab/C), F minMaj 7, F maj 7, F min 7, F Dom7 (F/A/C/Eb), F# dim 7, F# half-dim 7, A minMaj 7 (A/C/E/G#), Ab maj 7 (Ab/C/Eb/G), A min 7 (A/C/E/G), Ab Dom7, A dim7 (A/C/Eb/Gb), A half -dim 7 (A/C/Eb/G).

Etc etc.

-Diminished chords were often used or favored in the "Romantic" period of music history. I discuss the half-diminished 7th chords at length (tied to Herrmann works) in my online paper, "Half-Diminished 7th: The Herrmann Chord." Half-diminished 7ths are often also used in jazz compositions as alternate chords to standard minor chords. Often such chords are used to convey foreboding, tragic, dangerous, melodramatic situations, darkness and dread, as well as deep emotional yearnings. Herrmann often used these chords with the minor chords to convey poignant, sad, introspective, inner qualities.

-Augmented chords are often used as variations of the 7th chord, found in gospel music, say, or used to convey feelings of solitude, isolation or *spaciness*..

-The slash (/) symbol within a chord name shows that the slash is *added* to the chord. It does not replace any note as the "Sus" does when it replaces the third degree of a particular chord. If the interval degree after the slash is lower than the nature of the chord, the added note goes within the chord structure (Ex. see maj 7/6). If the interval degree after the slash is higher, the added note is placed above the chord structure (Ex., see maj/9 in which the 9th note is added without any intermediary 7th note).

Chord Formulas List (partial)

<u>Name</u>	<u>Formula</u>
#1) major (maj)	= 5-4
#2) maj 6	= 5-4-3
#3) maj 7	= 5-4-5
#4) maj 9	= 5-4-5-4
#5) maj 11	= 5-4-5-4-4
#6) maj 13	= 5-4-5-4-8
#7) maj b5	= 5-3
#8) maj 7b5	= 5-3-6
#9) maj 9b5	= 5-3-6-4
#10) maj 11b5	= 5-3-6-4-4
#11) maj 13 b5	= 5-3-6-4-8
#12) Augmented (aug)	= 5-5
#13) maj 7#5	= 5-5-4

#14) maj 9 #5 = 5-5-4-4
 #15) maj 11 #5 = 5-5-4-4-4
 #16) maj 13 #5 = 5-5-4-4-8
 #17) maj/9 = 5-4-8
 #18) maj 6/9 = 5-4-3-6
 #19) maj 7/6 = 5-4-3-3
 #20) maj 7/11 = 5-4-5-7
 #21) maj 11/13 = 5-4-5-4-4-5
 #22) maj 7b9 = 5-4-5-3
 #23) maj 11b9 = 5-4-5-3-5
 #24) maj 7#9 = 5-4-5-5
 #26) maj 11 #9 = 5-4-5-5-3
 #28) maj 9#11 = 5-4-5-4-5
 #30) maj 7b5#9 = 5-3-6-5

#40) minor (min) = 4-5
 #41) min6 = 4-5-3
 #42) min7 = 4-5-4
 #43) min9 = 4-5-4-5
 #44) min 11 = 4-5-4-5-4
 #45) min 13 = 4-5-4-5-8
 #46) diminished (dim) = 4-4
 #47) dim 6 = 4-4-4
 #48) dim 7 = 4-4-4
 #49) minor Major 7 = 4-5-5
 #50) min Maj 9 = 4-5-5-4
 #51) min Maj 11 = 4-5-5-4-4
 #52) min 7 b5 (half-dim) = 4-4-5
 #54) min9 b5 = 4-4-5-5
 #55) min 11b5 = 4-4-5-5-4
 #56) min 13 b 5 = 4-4-5-5-8
 #57) min 7#5 = 4-6-3
 #58) min 9#5 = 4-6-3-5
 #59) min 11#5 = 4-6-3-5-4
 #61) min/9 = 4-5-8
 #62) min 6/9 = 4-5-3-6
 #63) min 7/6 = 4-5-3-2
 #64) min 7/11 = 4-5-4-8
 #66) min 7b 9 = 4-5-4-4
 #69) min 7#9 = 4-5-4-6

#84) Dominant 7 = 5-4-4
 #85) Dom 9 = 5-4-4-5
 #86) Dom 11 = 5-4-4-5-4
 #87) Dom 13 = 5-4-4-5-8
 #88) Dom 7b5 = 5-3-5

#89) Dom 9b5 = 5-3-5-5
 #90) Dom 11b5 = 5-3-5-5-4
 #92) Dom 7#5 = 5-5-3
 #93) Dom 9#5 = 5-5-3-5
 #96) Dom 7/6 = 5-4-3-2
 #97) Dom 7/11 = 5-4-4-8
 #99) Dom 7b9 = 5-4-4-4
 #102) Dom 7#9 = 5-4-4-6

#115) Suspended 4 = 6-3
 #116) Sus 6 = 6-3-3
 #117) Sus 7 = 6-3-5
 #118) Sus 9 = 6-3-5-4
 #120) Sus 7b5 = 6-2-6
 #123) Sus 7#5 = 6-4-4
 #126) Sus/9 = 6-3-8
 #127) Sus 6/9 = 6-3-3-6

#145) Maj/4 = 5-2-3
 #146) maj 6/4 = 5-2-3-3
 #147) maj 7/4 = 5-2-3-5
 #156) maj/9/4 = 5-2-3-8

#175) min/4 = 4-3-3
 #176) min 6/4 = 4-3-3-3
 #177) min 7/4 = 4-3-3-4

#209) dim Sus = 6-2
 #210) dim 6 Sus = 6-2-4
 #211) dim 7 Sus = 6-2-4
 #212) aug Sus = 6-4
 #213) Dom 7 Sus = 6-3-4

#238) Dom 7/4 = 5-2-3-5
 #244) Aug/4 = 5-2-4

Illustration examples:

Chord No. 1: **Major**
 Chord Formula: 5-4

C-E-G
 C#-E#-G#
 Db-F-Ab
 D-F#-A
 Eb-G-Bb

E-G#-B
F-A-C
F#-A#-C#
Gb-Bb-Db
G-B-D
Ab-C-Eb
A-C#-E
Bb-D-F
B-D#-F#
Cb-Eb-Gb

Chord No. 2 : **maj 6**
Chord Formula : 5-4-3

C-E-G-A
C#-E#-G#-A#
Db-F-Ab-Bb
D-F#-A-B
Eb-G-Bb-C
E-G#-B-C#
F-A-C-D
F#-A#-C#-D#
Gb-Bb-Db-Eb
G-B-D-E
Ab-C#-E-F#
Bb-D-F-G
B-D#-F#-G#
Cb-Eb-Gb-Ab

Chord No. 3: **maj 7**
Chord Formula: 5-4-5

C-E-G-B
C#-E#-G#-B#
Db-F-Ab-C
D-F#-A-C#
Eb-G-Bb-D
F-A-C-E
F#-A#-C#-E#
Gb-Bb-Db-F
G-B-D-F#
Ab-C-Eb-G
A-C#-E-G#
Bb-D-F-A
B-D#-F#-A#
Cb-Eb-Gb-Bb

Chord No. 4 : **maj 9**
Chord Formula: 5-4-5-4

C-E-G-B-D
C#-E#-G#-B#-D#
Db-F-Ab-C-Eb
D-F#-Ab-C#-E
Eb-G-Bb-D-F
E-G#-B-D#-F#
F-A-C-E-G
F#-A#-C#-E#-G#
Gb-Bb-Db-F-Ab
G-B-D-F#-A
Ab-C#-E-G#-B
Bb-D-F-A-C
B-D#-F#-A#-C#
Cb-Eb-Gb-Bb-Db

Chord No. 12: **augmented (aug)**
Chord Formula: 5-5

C-E-G#
C#-E#-Gx
Db-F-A
D-F#-A#
Eb-G-B
E-G#-B#
F-A-C#
F#-A#-Cx
Gb-Bb-D
G-B-D#
Ab-C-E
A-C#-E#
Bb-D-F#
B-D#-Fx
Cb-Eb-G

Chord No. 17 : **maj/9**
Chord Formula: 5-4-8

C-E-G-D
C#-E#-G#-D#
Db-F-Ab-Eb
D-F#-A-E
Eb-G-Bb-F

E-G#-B-F#
F-A-C-G
F#-A#-C#-G#
Gb-Bb-Db-Ab
G-B-D-A
Ab-C-Eb-Bb
A-C#-E-B
Bb-D-F-C
B-D#-F#-C#
Cb-Eb-Gb-Db

Chord No. 20 : **maj 7/11**
Chord Formula : 5-4-5-7

C-E-G-B-F
C#-E#-G#-B#-F#
Db-F-Ab-C-Gb
D-F#-A-C#-G
Eb-G-Bb-D-Ab
E-G#-B-D#-A
F-A-C-E-Bb
F#-A#-C#-E#-B
Gb-Bb-Db-F-Cb
G-B-D-F#-C
Ab-C-Eb-G-Db
A-C#-E-G#-D
Bb-D-F-A-Eb
B-D#-F#-A#-E
Cb-Eb-Gb-Bb-Fb

Chord No. 40: **minor**
Chord Formula: 4-5

C-Eb-G
C#-E-G#
D-F-A
D#-F#-A#
Eb-Gb-Bb
E-G-B
F-Ab-C
F#-A-C#
G-Bb-D
G#-B-D#
Ab-Cb-Eb
A-C-E
A#-C#-E#

Bb-Db-F
B-D-F#

Chord No. 42: **min 7**
Chord Formula: 4-5-4

C-Eb-G-Bb
C#-#-G#-B
D-F-A-C
D#-F#-A#-C#
Eb-Gb-Bb-Db
E-G-B-D
F-Ab-C-Eb
F#-A-C#-E
G-Bb-D-F
G#-B-D#-F#
Ab-Cb-Eb-Gb
A-C-E-G
A#-C#-E#-G#
Bb-Db-F-Ab
B-D-F#-A

Chord No. 45 : **min 13**
Chord Formula : 4-5-4-5-8

C-Eb-G-Bb-D-A
C#-E-G#-B-D#-A#
D-F-A-C-E-B
D#-F#-A#-C#-E#-B#
Eb-Gb-Bb-Db-F-C
E-G-B-D-F#-C#
F-Ab-C-Eb-G-D
F#-A-C#-E-G#-D#
G-Bb-D-F-A-E
G#-B-D#-F#-A#-E#
Ab-Cb-Eb-Gb-Bb-F
A-C-E-G-B-F#
A#-C#-E#-G#-B#-Fx
Bb-Db-F-Ab-C-G
B-D-F#-A-C#-G#

Chord No. 48: **diminished 7**
Chord Formula: 4-4-4

C-Eb-Gb-Bbb
C#-E-G-Bb

D-F-Ab-Cb
D#-F#-A-C
Eb-Gb-Bbb-Dbb
E-G-Bb-Db
F-Ab-Cb-Ebb
F#-A-C-Eb
G-Bb-Db-Fb
G#-B-D-F
Ab-Cb-Ebb-Gbb
A-C-Eb-Gb
A#-C#-E-G
Bb-Db-Fb-Abb
B-D-F-Ab

Chord No. 49: **min Maj 7**

Chord Formula: 4-5-5

C-Eb-G-B
C#-E-G#-B#
D-F-A-C#
D#-F#-A#-Cx
Eb-Gb-Bb-D
E-G-B-D#
F-Ab-C-E
F#-A-C#-E#
G-Bb-D-F#
G#-B-D#-Fx
Ab-Cb-Eb-G
A-C-E-G#
Bb-Db-F-A
B-D-F#-A#

Chord No. 53: **min 7 b 5 (half-diminished 7th)**

Chord Formula: 4-4-5

C-Eb-Gb-Bb
C#-E-G-B
D-F-Ab-C
D#-F#-A-C#
Eb-Gb-Bbb-Db
E-G-Bb-D
F-Ab-Cb-Eb
F#-A-C-E
G-Bb-Db-F
G#-B-D-F#

Ab-Cb-Ebb-Gb
A-C-Eb-G
A#-C#-E-G#
Bb-Db-Fb-Ab
B-D-F-A

Chord No. 61 : **min/9**
Chord Formula : 4-5-8

C-Eb-G-D
C#-E-G#-D#
D-F-A-E
D#-F#-A#-E#
Eb-Gb-Bb-F
E-G-B-F#
F-Ab-C-G
F#-A-C#-G#
G-Bb-D-A
G#-B-D#-A#
Ab-Cb-Eb-Bb
A-C-E-B
A#-C#-E#-B#
Bb-Db-F-C
B-D-F#-C#

Chord No. 84: **Dominant 7**
Chord Formula: 5-4-4

C-E-G-Bb
C#-E#-G#-B
Db-F-Ab-Cb
D-F#-A-C
D#-F#-A#-C#
Eb-G-Bb-Db
E-G#-B-D
F-A-C-Eb
F#-A#-C#-E
Gb-Bb-Db-Fb
G-B-D-F
G#-B#-D#-F#
Ab-C-Eb-Gb
A-C#-E-G
A#-Cx-E#-G#
Bb-D-F-Ab
B-D#-F#-A

Chord No. 97 : **Dom 7/11**
Chord Formula : 5-4-4-8

C-E-G-Bb-F
C#-E#-G#-B-F#
Db-F-Ab-Cb-Gb
D-F#-A-C-G
D#-Fx-A#-C#-G#
Eb-G-Bb-Db-Ab
E-G#-B-D-A
F-A-C-Eb-Bb
F#-A#-C#-E-B
Gb-Bb-Db-Fb-Cb
G-B-D-F-C
G#-B#-D#-F#-C#
Ab-C-Eb-Gb-Db
A-C#-E-G-D
A#-Cx-E#-G#-D#
Bb-D-F-Ab-Eb
B-D#-F#-A-E

Chord No. 117: **Suspended 7**
Chord Formula: 6-3-5

C-F-G-B
C#-F#-G#-B#
Db-Gb-Ab-C
D-G-A-C#
D#-G#-A#-Cx
Eb-Ab-Bb-D
E-A-B-D#
F-Bb-C-E
F#-B-C#-E#
Gb-Cb-Db-F
G-C-D-F#
G#-C#-D#-Fx
Ab-Db-Eb-G
A-D-E-G#
A#-D#-E#-Gx
Bb-Eb-F-A
B-E-F#-A#
Cb-Fb-Gb-Bb

Chord No. 147: **maj 7/4**
Chord Formula: 5-2-3-5

C-E-F-G-B
D-F#-G-A-C#
Eb-G-Ab-Bb-D
E-G#-A-B-D#
F-A-Bb-C-E
F#-A#-B-C#-E#
Gb-Bb-Cb-Db-F
G-B-C-D-F#
Ab-C-Db-Eb-G
A-C#-D-E-G#
Bb-D-Eb-F-A
B-D#-E-F#-A#

Chord No. 211: **dim Sus 7**
Chord Formula 6-2-4

C-F-Gb-Bbb
C#-F#-G-Bb
D-G-Ab-Cb
D#-G#-A-C
Eb-Ab-Bbb-Dbb
E-A-Bb-Db
F-Bb-Cb-Ebb
F#-B-C-Eb
G-C-Db-Fb
G#-C#-D-F
A-D-Eb-Gb
A#-D#-E-G
Bb-Eb-Fb-Abb
B-E-F-Ab

Chord No. 175: **min/4**
Chord Formula: 4-3-3

C-Eb-F-G
C#-E-F#-G#
D-F-G-A
D#-F#-G#-A#
Eb-Gb-Ab-Bb
E-G-A-B
F-Ab-Bb-C
F#-A-B-C#
G-Bb-C-D
A-C-D-E
B-D-E-F#

Chord No. 238: **Dom 7/4**
 Chord Formula: 5-2-3-4

C-E-F-G-Bb
 C#-E#-F#-G#-B
 Db-F-Gb-Ab-Cb
 D-F#-G-A-C etc etc

Chord/Note Equivalences

Ex.:
 #2 maj 6 = #42 min 7
 To illustrate, C maj 6(C-E-G-A) = A min 7(1st inversion)
 Also: C min 7(C-Eb-G-Bb) = Eb maj 6(3rd inversion)

Ex. :
 #41 min 6 = #53 (half-dim 7th).
 To illustrate, E-G-B-C# (E min 6) = C#-E-G-B (C# half-dim 7th).

Ex.:
 #4 maj 9 = #146 maj 6/4
 So, for example, C maj 9(C-E-G-B-D) = G maj 6/4(G-B-C-D-E)

INTERVAL TABLE

Symbols: A = Augmented; AA = double augmented; d = diminished;
 dd = double diminished; M = Major; m = minor; P = Perfect
 1 = unison; 2 = second; 3 = third.....8 = octave

UPPER NOTE[Left Margin notes are Root Notes]

	Cb	C	C#	Db	D	D#	Eb	E	E#	Fb	F	F#
Cb	P1	A1	AA2	M2	A2	AA2	M3	A3	AA3	P4	A4	AA4
C	d8	P1	A1	m2	M2	A2	m3	M3	A3	d4	P4	A4
C#	dd8	d8	P1	d2	m2	M2	d3	m3	M3	dd4	d4	P4
Db	m7	M7	A7	P1	A1	AA1	M2	A2	AA2	m3	M3	A3
D	d7	m7	M7	d8	P1	A1	m2	M2	A2	d3	m3	M3
D#	dd7	d7	m7	dd8	d8	P1	d2	m2	M2	dd3	d3	m3
Eb	m6	M6	A6	m7	M7	A7	P1	A1	AA1	m2	M2	A2
E	d6	m6	M6	d7	m7	M7	d8	P1	A1	d2	m2	M2
E#	dd6	d6	m6	dd7	d7	m7	dd8	d8	P1	dd2	d2	m2
Fb	P5	A5	AA5	M6	A6	AA6	M7	A7	AA7	P1	A1	AA1
F	d5	P5	A5	m6	M6	A6	m7	M7	A7	d8	P1	A1
F#	dd5	d5	P5	d6	m6	M6	d7	m7	M7	dd8	d8	P1
Gb	P4	A4	AA4	P5	A5	AA5	M6	A6	AA6	m7	M7	A7

G	d4	P4	A4	d5	P5	A5	m6	M6	A6	d7	m7	M7
G#	dd4	d4	P4	dd5	d5	P5	d6	m6	M6	dd7	d7	m7
Ab	m3	M3	A3	P4	A4	AA4	P5	A5	AA5	m6	M6	A6
A	d3	m3	M3	d4	P4	A4	d5	P5	A5	d6	m6	M6
A#	dd3	d3	m3	dd4	d4	P4	dd5	d5	P5	dd6	d6	m6
Bb	m2	M2	A2	m3	M3	A3	P4	A4	AA4	d5	P5	A5
B	d2	m2	M2	d3	m3	M3	d4	P4	A4	dd5	d5	P5

UPPER NOTE.....[Left margin notes are Root Notes].....

	Gb	G	G#	Ab	A	A#	Bb	B	B#
Cb	P5	A5	AA5	M6	A6	AA6	M7	A7	AA7
C	d5	P5	A5	m6	M6	A6	m7	M7	A7
C#	dd5	d5	P5	d6	m6	M6	d7	m7	M7
Db	P4	A4	AA4	P5	A5	AA5	M6	A6	AA6
D	d4	P4	A4	d5	P5	A5	m6	M6	A6
D#	dd4	d4	P4	dd5	d5	P5	d6	m6	M6
Eb	m3	M3	A3	P4	A4	AA4	P5	A5	AA5
E	d3	m3	M3	d4	P4	A4	d5	P5	A5
E#	dd3	d3	m3	dd4	d4	P4	dd5	d5	P5
Fb	M2	A2	AA2	M3	A3	AA3	A4	AA4	AAA4
F	m2	M2	A2	m3	M3	A3	P4	A4	AA4
F#	d2	m2	M2	d3	m3	M3	d4	P4	A4
Gb	P1	A1	AA1	M2	A2	AA2	M3	A3	AA3
G	d8	P1	A1	m2	M2	A2	m3	M3	A3
G#	dd8	d8	P1	d2	m2	M2	d3	m3	M3
Ab	M7	A7	AA7	P1	A1	AA1	M2	A2	AA2
A	d7	m7	M7	d8	P1	A1	m2	M2	A2
A#	dd7	d7	m7	dd8	d8	P1	d2	m2	M2
Bb	m6	M6	A6	m7	M7	A7	P1	A1	AA1
B	d6	m6	M6	d7	m7	M7	d8	P1	A1

TRANSPOSITION

For those readers unfamiliar with the technique of transposing, let's briefly discuss the practical aspects in case any reader wishes to easily convert a "C" concert note/tone as it sounds to the written equivalent in a transposing instrument (such as the Bb clarinet and trumpet, horn in "F," etc) *or* to convert the written or transposed notes of a transposing instrument to "C" concert pitch.

To begin this transposing guide, let's start with familiar Bb transposing instruments such as the Bb clarinet, bass clarinet, contra bass clarinet, soprano sax (major 2nd lower), tenor sax (maj 9th lower), and trumpet. The reason the Bb clarinet or trumpet is called a "Bb" instrument is because the *written* C of the clarinet transposed on paper is *heard* as Bb in concert pitch. Unless a written score specifically states it is a "C" score or a "Concert" score (meaning it is written as it sounds), then you'll need to transpose the written notes of transposing instruments back to concert pitch if you wish to make sense of the discrepancy of notes compared to, say, the violins. A trained musician does this automatically, but most people with some knowledge of reading music need to *catch* or *remind* themselves of the difference of notes *as written* for the transposing instruments. When studying any Herrmann score, you certainly must understand that he wrote a transposed score. So if he wrote a middle C (Line 1 or c') note, he did not mean a concert pitch "C" (what you hear) but Bb a major 2nd interval below.

Using the *Chord Formula* technique of counting steps, a major 2nd interval is 3 steps. To convert the written note of the Bb instrument to concert pitch, you *descend* or go down three steps; to convert a concert pitch to the Bb clarinet (Bb trumpet, etc), you *ascend* three steps. So when you see the written D of the Bb clarinet in, say, a Herrmann score, you go down three steps starting with D (D-Db-C) and you end up with C (what you actually hear in concert pitch).

The bass saxophone in Bb sounds two octaves and a major 2nd lower than written. The bass clarinet in Bb sounds an octave and a major 2nd lower.

The following is a list of transposed Bb instrument notes converted to concert pitch :

Written =Concert Pitch

C	=	Bb
C#	=	B
Db	=	Cb
D	=	C
D#	=	C#
Eb	=	Db
E	=	D
E#	=	D#
F	=	Eb
F#	=	E
Gb	=	Fb (enharmonic to E). Relatively rarely used (Fb maj 7th, etc)
G	=	F
G#	=	F#
Ab	=	Gb
A	=	G

A# = G#
 Bb = Ab
 B = A
 Cb = Bbb (enharmonic to A). Rarely encountered.

Next we will focus on the “F” transposing instruments, horns and English horns (Fr., *cor anglais*). The reason they are called “F” instruments is because the *written* C for the horns, say, is *heard* as the “F” note/tone in concert pitch (8 steps or P5 interval below). Conversely, to convert a concert pitch note to horns written, you need to *go up* 8 steps (again, starting with the note in question). So, to convert the written C note of the horn to concert pitch, descend 8 steps: C-B-Bb-A-Ab-G-Gb-F. You end up with the F tone actually heard.

The following is a list of F instrument notes as written converted to concert pitch:

<u>Written Horn</u>	=	<u>Concert Pitch</u>
Cb	=	Fb
C	=	F
C#	=	F#
Db	=	Gb
D	=	G
D#	=	G#
Eb	=	Ab
E	=	A
E#	=	A#
F	=	Bb
F#	=	B
Gb	=	Cb
G	=	C
G#	=	C#
Ab	=	Db
A	=	D
A#	=	D#
Bb	=	Eb
B	=	E

Next we will focus on Eb transposing instruments such as the contra alto Eb clarinet and Eb (alto) saxophone, and Eb baritone Sax (sounding an octave and major 6th lower). The reason they are called Eb instruments is because the written C on such instruments *sounds* as the Eb tone/note a major 6th interval lower. To convert alto Sax written to concert, *descend* 10 steps; to convert a concert pitch tone to alto sax written, *ascend* 10 steps. So to properly ascertain the concert pitch equivalence of the written C note, *go down* 10 steps: C-B-Bb-A-Ab-G-Gb-F-E-Eb. You end up with the Eb tone. The same applies in practical usage for the baritone Sax, however it sounds another octave lower (just, in similar principle, as the bass clarinet middle C written note would actually sound an octave and major 2nd lower—a Bb tone a register lower than a clarinet).

There is also the soprano Eb clarinet that sounds a minor 3rd *higher* than written so that the written C *sounds* a minor third or 4 steps higher (Eb).

The following is a list of Eb instrument (common usage now for the alto sax) written notes converted to concert pitch:

<u>Written Alto Sax</u>	= <u>Concert Pitch</u>
C	= Eb
C#	= E
Db	= Fb
D	= F
D#	= F#
Eb	= Gb
E	= G
E#	= G#
Fb	= Abb
F	= Ab
F#	= A
Gb	= Bbb
G	= Bb
G#	= B
Ab	= Cb
A	= C
A#	= C#
Bb	= Db
B	= D

Next we focus on the “G” alto flute that Herrmann used several times. The reason it is called a “G” instrument is because the written C for the alto flute *sounds* as the G tone a perfect 4th interval below (6 steps below). Conversely, to convert a concert pitch note to written alto flute, *ascend* 6 steps. So written C is converted 6 steps: C-B-Bb-A-Ab-G, ending in the proper note sounded (G).

The following is a list of conversions:

<u>Written Alto Flute</u>	= <u>Concert Pitch</u>
Cb	= Gb
C	= G
C#	= G#
Db	= Ab
D	= A
D#	= A#
Eb	= Bb
E	= B
E#	= B#
Fb	= Cb
F	= C
F#	= C#
Gb	= Db
G	= D
G#	= D#
Ab	= Eb
A	= E

A#	= E#
Bb	= F
B	= F#

There is also the oboe d'amore in A. The reason it is called an "A" instrument is because the written C for that instrument *sounds* a minor 3rd (4 steps) lower as note/tone A. I do not believe Herrmann ever used this instrument, but I will check. The principal transposing instruments that you need to consider are the common usage Bb instruments such as the Bb clarinet/bass clarinet/C.B/ clarinet/trumpet, and the horns "in F" (the "F" here does *not* mean shorthand for "French" horns!). Only in a few rare cases did Herrmann *not* transpose, usually in his Early Works period (I believe one case was in *Citizen Kane* but I need to recheck).

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