Fundamentals of Twelve-Tone Analysis

The Dodecaphonic System: The liberation of the western chromatic scale from the hierarchical qualities of the tonal system establishing twelve pitches of EQUAL importance: Twelve pitch-types, twelve pitch-classes, twelve interval-types and SIX interval-classes. A non-hierarchical and transposable system of pitch-organisation.

Useful for analysts, composers and musicologists, this document outlines a condensed introduction to the fundamentals of twelve-tone, atonal and pitch-class analysis through a series of written tutorials and practical worksheets growing progressively more advanced. The content is explained in an accessible vocabulary that can be followed by anyone with a basic understanding of music theory (and a little patience).

Twelve-tone composition is not inherently dissonant, this is a common misconception. The dodecaphonic system is a non-hierarchical and transposable system of pitch-organisation. Nothing more, nothing less. One can 'compose' the twelve-tone row as two overlapping keys and in doing so embed a precomposed sense of tonal or modal modulation, or one can adapt a short chord progression. The rules of twelve-tone composition state that no note can be repeated until all twelve have been played, they do not determine how one conceives (or composes) the initial row. Then there are the subcomponents of the row – the pitch-class sets. The musical possibilities remain endless …

Besides, who follows the rules anyway? Check out the modal stasis of Arvo Pärt and his post 1976 tintinnabulation style, you will find many elements of strict systemisation and precomposed elements of form and proportion comparable to the processes and concepts discussed in these sheets, even the presence of a primary row. However, Pärt chooses to work with modality and tonal stasis, repetition of notes (rhythm and time) is an essential element of his immediately recognisable style.

So … It is not 'what you know', but 'what you do with it' that counts here …

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Twelve Tone Analysis

Dr Ian Percy

Rosetta Stone One

The basic language of 21st century music analysis – the dodecaphonic system:
The liberation of the western chromatic scale from the hierarchical qualities of the tonal system: 12 pitches of EQUAL importance.

Twelve pitch-types, twelve pitch-classes and twelve interval-types:

C	0	Unison	0 s-tones
C$^{\#}$ / D^{b}	1	minor 2nd	1 s-tone
D	2	Major 2nd	2 s-tones
D$^{\#}$ / E^{b}	3	minor 3rd	3 s-tones
E	4	Major 3rd	4 s-tones
F	5	Perfect 4th	5 s-tones
F$^{\#}$ / G^{b}	6	Tritone	6 s-tones
G	7	Perfect 5th	7 s-tones
G$^{\#}$ / A^{b}	8	Aug 5/min 6	8 s-tones
A	9	Major 6th	9 s-tones
A$^{\#}$ / B^{b}	10 (T)	minor 7th	10 s-tones
B	11 (E)	Major 7th	11 s-tones
C	0	Octave	12 s-tones

Twelve pitch-types, twelve pitch-classes and twelve interval-types:
A non-hierarchical and transposable system of pitch-organisation.

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Worksheet One

1. Convert the following **pitch-types** into **pitch-classes**: (0-11)

A =	C =	E =
D =	B^b =	$G^\#$ =
B =	$F^\#$ =	F =
E^b =	$C^\#$ =	G =

2. Convert the following **interval-types** into <u>pairs of pitch-classes</u>

Perfect 5^{th} =	minor 3^{rd} =
Major 7^{th} =	Tritone =
minor 2^{nd} =	minor 7^{th} =
Augmented 5^{th} =	Major 2^{nd} =
Unison =	Perfect 4^{th} =
Major 6^{th} =	Major 3^{rd} =

3. Convert the following pitch-classes into pitch-types: (C – B)

11 =	1 =	6 =
7 =	5 =	4 =
2 =	3 =	0 =
9 =	10 =	8 =

4. Convert the following <u>pairs of pitch-classes</u> into interval-types:

0, 11 =	0, 1 =	0, 6 =
0, 7 =	0, 5 =	0, 4 =
0, 2 =	0, 3 =	0, 0 =
0, 9 =	0, 10 =	0, 8 =

5. Convert the following pitch-sequences into pitch-classes to identify the **pitch-class set** (PC Set):

C – F – G =	C – $C^{\#}$ – B =
C – D – B^{b} =	C – E^{b} – A =
C – E – $G^{\#}$ =	C – $F^{\#}$ – C =

6. Convert the following pitch-sequences into pitch-classes to identify the pitch-class set (PC Set). Do you recognise the pitch-sequences?

i. C – E – $G^{\#}$ – C =
ii. C – $D^{\#}$ – $F^{\#}$ – A – C =
iii. C – D – E – G – A – C =
iv. C – D – E – $F^{\#}$ – $G^{\#}$ – $A^{\#}$ – C =
v. C – D – E^{b} – F – G – A – B^{b} – C =
vi. C – D – E^{b} – F – $F^{\#}$ – $G^{\#}$ – A – B – C =
vii. C – D^{b} – E^{b} – E – $F^{\#}$ – G – A – B^{b} – C =

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Rosetta Stone Two

The octave plays a pivotal role in the fundamentals of tonality and functional harmony (harmonic inversions, voice-leading, cadences, progressions and modulations etc.). Octave displacement is how we cycle through the chord inversions of triadic tonal harmony. The harmonic inversion is essentially an octave displacement that produces alternate intervallic relationships between two identical notes: C to G is a Perfect Fifth, but if we raise the C by an octave, then G to C is a Perfect Fourth. This variable intervallic relationship between two identical notes of tonality needed to be neutralised.

The dodecaphonic (12-tone) system relies upon each note (pitch-class) maintaining a constant individual relationship with any and all of the other eleven notes in the system. Therefore the octave (octave displacement and compound intervals) had to be negated:

Twelve Pitch-Classes: 0123456789TE

0 = 12 = 0 (12 is never used)

Unison = Octave = Unison

The dodecaphonic system utilises mirror-inversions (symmetrical inversion or identical inversion) exclusively and negates the variability of harmonic inversions and the role of the octave through reducing the twelve interval-types to **SIX Interval-Classes** numbered Class 1 through to Class 6:

There are TWELVE Interval-Types:

Unison/Octave	0 semi-tones [0]
minor 2^{nd}	1 semi-tone [0,1]
Major 2^{nd}	2 semi-tones [0,2]
minor 3^{rd}	3 semi-tones [0,3]
Major 3^{rd}	4 semi-tones [0,4]
Perfect 4^{th}	5 semi-tones [0,5]
Tritone/diminished 5^{th}	6 semi-tones [0,6]
Perfect 5^{th}	7 semi-tones [0,7]
Augmented 5^{th}/minor 6^{th}	8 semi-tones [0,8]
Major 6^{th}	9 semi-tones [0,9]
minor 7^{th}	10 semi-tones [0,10]
Major 7^{th}	11 semi-tones [0,11]

There are SIX Interval-Classes: (Note: Prime = 0)

Class One: minor 2^{nd}/Major 7^{th} (1 semi-tone from prime) [01E]

Class Two: Major 2^{nd}/minor 7^{th} (2 semi-tones from prime) [02T]

Class Three: minor 3^{rd}/Major 6^{th} (3 semi-tones from prime) [039]

Class Four: Major 3^{rd}/minor 6^{th} (4 semi-tones from prime) [048]

Class Five: Perfect 4^{th}/Perfect 5^{th} (5 semi-tones from prime) [057]

Class Six: Tritone/diminished 5^{th} (6 semi-tones from prime) [0,6]

Summation:

Twelve pitch-types, twelve pitch-classes, twelve interval-types and **Six** Interval-classes: A transposable system of pitch-organisation.

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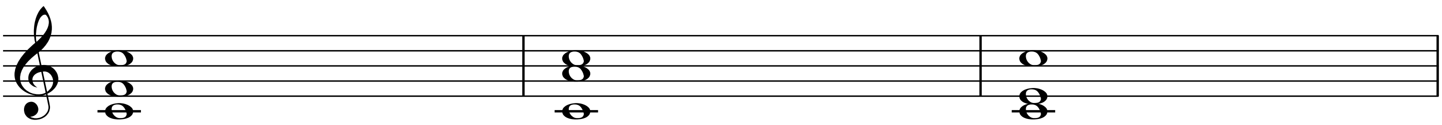
Twelve-tone Analysis

Worksheet Two

Question:

1. Name the **interval-class** shown in each of the following twelve examples:
2. List all of the **interval-types** found in each of the examples by **interval-name**:
3. List each of the **interval-types** using **pitch-classes** (numbers 0-11):

[a] **[b]** **[c]**



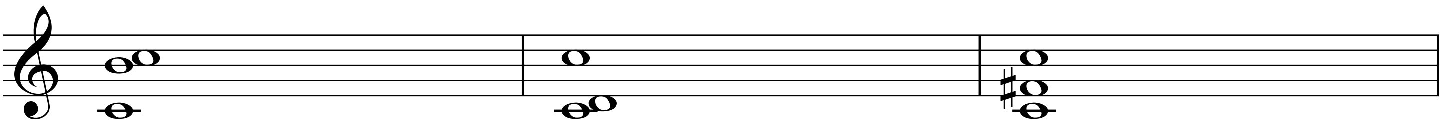
Answer:

1.
2.
3.

1.
2.
3.

1.
2.
3.

[d] **[e]** **[f]**



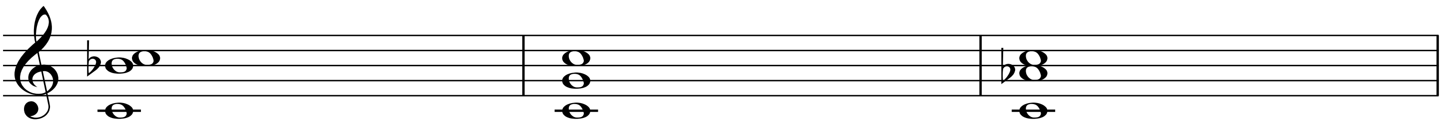
Answer:

1.
2.
3.

1.
2.
3.

1.
2.
3.

[g] **[h]** **[i]**



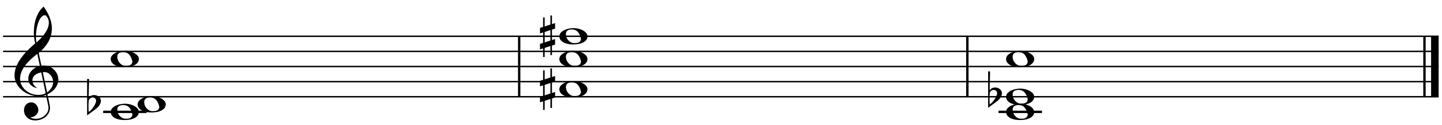
Answer:

1.
2.
3.

1.
2.
3.

1.
2.
3.

[j] **[k]** **[l]**



Answer:

1.
2.
3.

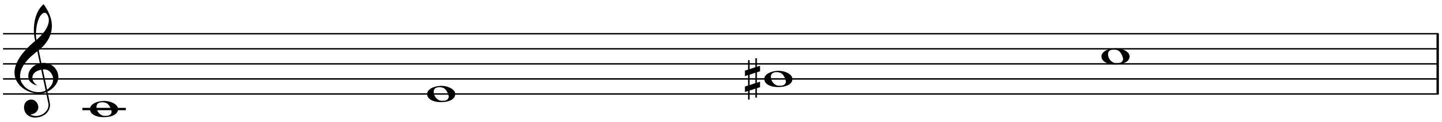
1.
2.
3.

1.
2.
3.

Question:

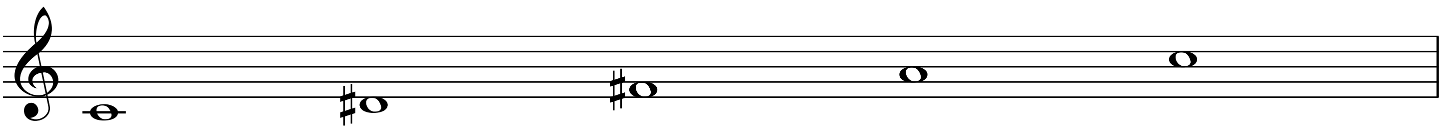
1. Write out the following three examples in **pitch-classes** (numbers 0-11):
2. Use Solomon or PitchsetCalc App to identify the **Forte Number** for each **PC set**.
3. Use Solomon Webpage, to find an alternate name for the **pitch-class set**:
4. Write a short descriptive analysis discussing each of the three examples:

[m]



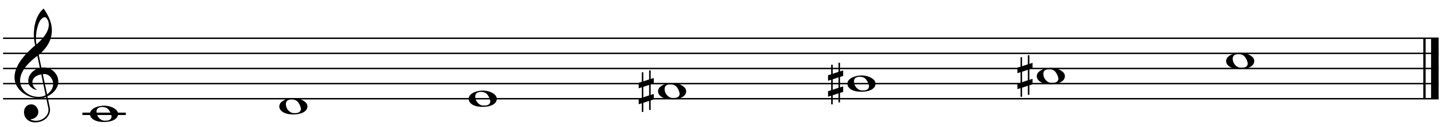
Answer:
1.
2.
3.
4.

[n]



Answer:
1.
2.
3.
4.

[o]



Answer:
1.
2.
3.
4.

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Rosetta Stone Three

There are twelve pitch-types:

C – C$^{\#}$ – D – E^{b} – E – F – F$^{\#}$ – G – G$^{\#}$ – A – B^{b} – B

The enharmonic equivalent notes of tonality are treated as the same pitch-type (pitch-class) within the dodecaphonic system: C$^{\#}$ = D^{b} and D$^{\#}$ = E^{b} etc.

There are twelve pitch-classes numbered: 0123456789TE

There are twelve interval-types:

Unison [0], minor 2nd [0,1], Major 2nd [0,2], minor 3rd [0,3], Major 3rd [0,4], Perfect 4th [0,5], Tritone [0,6], Perfect 5th [0,7], minor 6th [0,8], Major 6th [0,9], minor 7th [0,10], Major 7th [0,11].

The dodecaphonic system treats the unison and octave as the same pitch-class, negating the pivotal roles octave displacement and harmonic inversions play within the functioning harmony of tonality. The 12-tone system exclusively uses mirror-inversion (identical inversion) and negates the variable relationships of harmonic inversions through reducing the twelve interval-types into SIX interval-classes:

There are SIX Interval-Classes: (Note: Prime = 0)

Class One: minor 2nd/Major 7th (1 semi-tone from prime) [01E]
Class Two: Major 2nd/minor 7th (2 semi-tones from prime) [02T]
Class Three: minor 3rd/Major 6th (3 semi-tones from prime) [039]
Class Four: Major 3rd/minor 6th (4 semi-tones from prime) [048]
Class Five: Perfect 4th/Perfect 5th (5 semi-tones from prime) [057]
Class Six: Tritone/diminished 5th (6 semi-tones from prime) [0,6]

Pitch-Class Sets:

Any interval or group of notes can be referred to as a **Pitch-Class Set**. A pitch-class set (**PC Set**) is a sequence of pitch-types written as a sequence of pitch-classes (numbers 0-11).

Forte Numbers:

Pitch-classes can be identified for further research using a system developed by American Analyst Allan Forte (Structure of Atonal Music). This system is referred to as the **Forte Number**. To identify the Forte Number one must first identify the PC Set (pitch-types written as pitch-classes):

C – $C^{\#}$ – B = 0, 1, 11 [01E]

Normal Order:

The **Normal Order** for any PC Set can be identified through rotating the sequences of pitch-classes (numbers 0-11) until the span between the first and last pitch-class is as short as it can be:

0, 1, 11 [01E] and 1, 11, 0 both span twelve semi-tones, but 11, 0, 1 only spans three semi-tones. Therefore, the **Normal Order** for **PC Set** 0, 1, 11 [01E] is 11, 0, 1 [E01].

Prime Order:

Once the Normal Order has been identified, if required, it is transposed back into **Prime Order** (sequence transposed/written from 0): 11, 0, 1 = 0, 1, 2

Therefore the **Prime Order** of 0, 1, 11 [01E] = 0, 1, 2 [012] = PC Set: 3-1

Additional Example: C – D – B^{b}

0, 2, 10 [02T] = span of 11 semi-tones

2, 10, 0 [2T0] = span of 11 semi-tones

10, 0, 2 [T02] = Shortest span of 5 semi-tones: 10, 0, 2 = Normal Order

10, 0, 2 [T02] Transposed to Prime Order = 0, 2, 4 = PC Set: 3-6*

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Twelve-tone Analysis

Worksheet Three

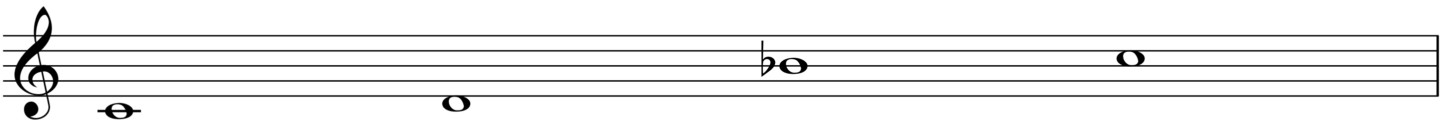
Pitch-Classes, Interval-Classes and Pitch-Class Sets

Question:

1. Write out each example in pitch-classes (numbers 0-11) to identify the **PC Set**:
2. Identify and list the PC Set in **Normal Order**: Shortest span between outer notes
3. If required transpose the PC Set into **Prime Order**: Normal Order transposed to 0
4. Use Solomon Webpage or PCSetCalc App to identify the PC Set (Forte) number:
5. List the **Interval Vector** for each example:
6. List all of the interval-classes (class 1-6) found in each example:
7. List all of the interval-types (interval-name) found in each example:
8. Use Solomon Webpage to help identify any alternate names for the PC Set:

Note: Each example results in a three-note (three number) pitch-class set.

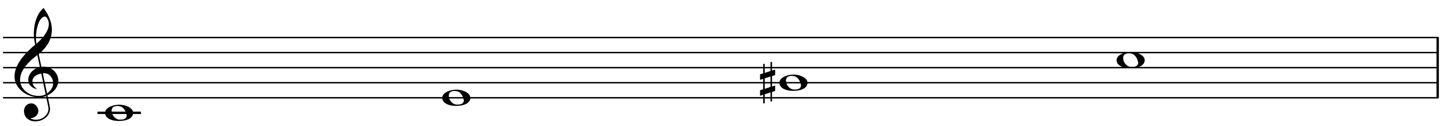
[a]



Answer:

1. PC Set:
2. Normal Order:
3. Prime Order:
4. PC Set (Forte) Number:
5. Vector:
6. Interval-Classes:
7. Interval-Types:
8. Alternate Names:

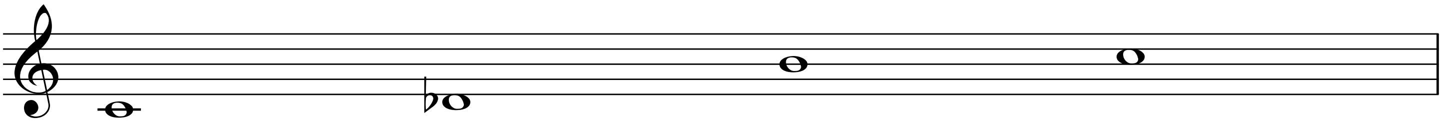
[b]



Answer:

1. PC Set:
2. Normal Order:
3. Prime Order:
4. PC Set (Forte) Number:
5. Vector:
6. Interval-Classes:
7. Interval-Types:
8. Alternate Names:

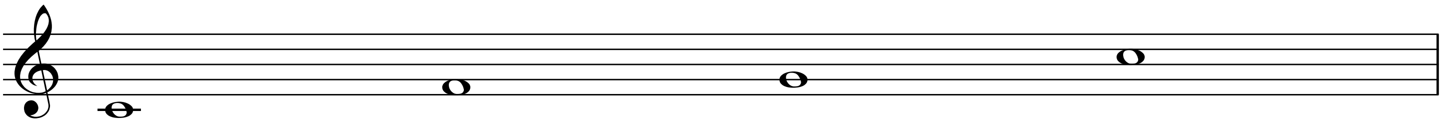
[c]



Answer:

1. PC Set:
2. Normal Order:
3. Prime Order:
4. PC Set (Forte) Number:
5. Vector:
6. Interval-Classes:
7. Interval-Types:
8. Alternate Names:

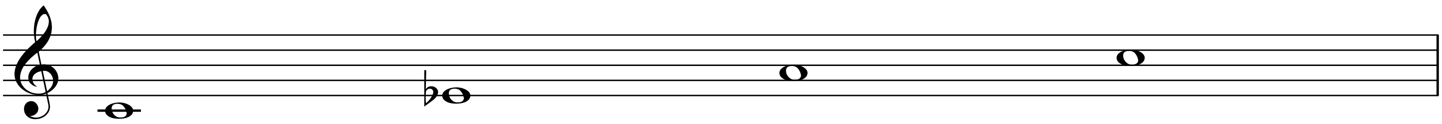
[d]



Answer:

1. PC Set:
2. Normal Order:
3. Prime Order:
4. PC Set (Forte) Number:
5. Vector:
6. Interval-Classes:
7. Interval-Types:
8. Alternate Names:

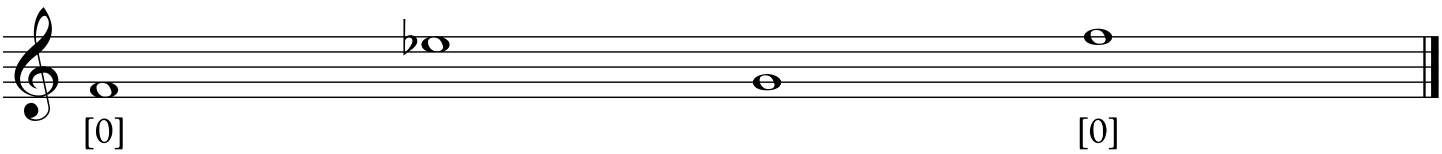
[e]



Answer:

1. PC Set:
2. Normal Order:
3. Prime Order:
4. PC Set (Forte) Number:
5. Vector:
6. Interval-Classes:
7. Interval-Types:
8. Alternate Names:

[f]



Answer:

1. PC Set:
2. Normal Order:
3. Prime Order:
4. PC Set (Forte) Number:
5. Vector:
6. Interval-Classes:
7. Interval-Types:
8. Alternate Names:

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Rosetta Stone Four

There are twelve pitch-types:

$C – C^{\#} – D – E^{b} – E – F – F^{\#} – G – G^{\#} – A – B^{b} – B$

Note: The enharmonic equivalents of tonality are treated as the same pitch-type (pitch-class) within the twelve-tone system: $C^{\#} = D^{b} = 1$, and $D^{\#} = E^{b} = 3$ etc.

There are twelve pitch-classes numbered: 0123456789TE

Note: Many analysts use commas in-between each integer of the sequence of pitch-classes and write pitch-class 10 and 11 as numbers. However, it is just as common to see twelve-tone rows written without commas and the numbers 10 and 11 written as T and E.

There are twelve interval-types:

Unison [0], minor 2^{nd} [0,1], Major 2^{nd} [0,2], minor 3^{rd} [0,3], Major 3^{rd} [0,4], Perfect 4^{th} [0,5], Tritone [0,6], Perfect 5^{th} [0,7], minor 6^{th} [0,8], Major 6^{th} [0,9], minor 7^{th} [0,10], Major 7^{th} [0,11].

There are **SIX** Interval-Classes: (Note: Prime = 0)

Class One: minor 2^{nd}/Major 7^{th} (1 semi-tone from prime) [01E]
Class Two: Major 2^{nd}/minor 7^{th} (2 semi-tones from prime) [02T]
Class Three: minor 3^{rd}/Major 6^{th} (3 semi-tones from prime) [039]
Class Four: Major 3^{rd}/minor 6^{th} (4 semi-tones from prime) [048]
Class Five: Perfect 4^{th}/Perfect 5^{th} (5 semi-tones from prime) [057]
Class Six: Tritone/diminished 5^{th} (6 semi-tones from prime) [0,6]

Note: Paired Interval-classes negates the role of the octave in classical harmony and the variable intervallic relationships produced through harmonic inversions.

Pitch-Class Sets:

Many composers found the repetitive cyclic use of strict order twelve-tone rows restrictive and so dissected the twelve-tone row into smaller more flexible units. These subsets became known as **Pitch-Class Sets**. Any interval or group of notes can be referred to as a pitch-class set. A **PC Set** is a sequence of pitches written as a sequence of pitch-classes.

Forte Numbers:

PC sets can be identified for further research using a system developed by American analyst Allan Forte (Structure of Atonal Music). This system is referred to as the **Forte Number**. To identify the Forte Number one must first identify the PC Set (pitch-types written as pitch-classes):

C – C# – B = 0, 1, 11

Normal Order:

The **Normal Order** for any PC Set can be identified through rotating the sequence of pitch-classes until the span between the first and last pitch-class is as short as it can be:

0, 1, 11 and
1, 11, 0 both span twelve semi-tones, but,
11, 0, 1 only spans three semi-tones: The **Normal Order** is 11, 0, 1.

Prime Order:

Once the Normal Order has been identified, if required, it is transposed back into **Prime Order** (sequence transposed to/written from 0): 11, 0, 1 = 0, 1, 2

Therefore the **Prime Order** of 0, 1, 11 = 0, 1, 2 = PC Set: 3-1

Additional Example: C – D – Bb = 0, 2, 10
0, 2, 10 = span of 11 semi-tones
2, 10, 0 = span of 11 semi-tones
10, 0, 2 = span of 5 semi-tones = Shortest Span = Normal Order
10, 0, 2 transposed to Prime Order = 0, 2, 4 = PC Set: 3-6*

Complement:

The **complement** to any PC set is all of the notes that are NOT in the PC Set. If the original PC Set has four notes, then the complement will have eight notes (totalling the twelve notes of the chromatic scale). If the PC Set has seven notes, then the complement will have five notes. Complements play an important role in the analysis of pitch-class sets and dodecaphonic theory.

Strict Order and Unordered Sets:

Whilst twelve-tone rows are regularly transposed (often many times within the same piece), and rotate through Prime, Prime Inversion, Retrograde and Retrograde Inversions, they are almost always employed in **Strict Order** (the sequence they were conceived in). However, composers often vary the sequence of pitches within the smaller subsets of the row (PC sets) and it is just as common to see PC Sets treated as **Unordered Sets** (pitches used as a collective group appearing in any order) as it is to see **Strict Order Sets** (each note appearing in strict consecutive order).

Dodecaphonic Chord-types: PC Sets (and their Forte numbers) are often referred to as chord-types that identify how many pitch-classes they contain:

Diad (Dyad): Two-note Interval (complement is a ten-note <u>Decachord</u>)
Trichord: Three-note PC Set (complement is a nine-note <u>Nonachord</u>)
Tetrachord: Four-note PC Set (complement is an eight-note <u>Octachord</u>)
Pentachord: Five-note PC Set (complement is an seven-note <u>Heptachord</u>)
Hexachord: Six-note PC Set (complement is a six-note <u>Hexachord</u>)
Heptachord: Seven-note PC Set (complement is a five-note <u>Pentachord</u>)
Octachord: Eight-note PC Set (complement is a four-note <u>Tetrachord</u>)
Nonachord: Nine-note PC Set (complement is a three-note <u>Trichord</u>)
Decachord: Ten-note PC Set (complement is a two-note <u>Interval</u>)
Eleven-note Scales: (Incomplete Chromatic Scale)
Twelve-Tone Rows: Prime – Inversion – Retrograde – Retrograde Inversion – Transposition: Each note in strict order always follows/precedes the same note in the row.

Dr Ian Percy

Twelve-tone Analysis

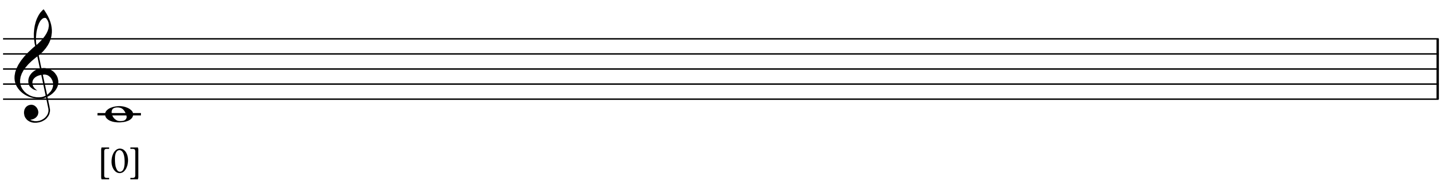
Worksheet Four

Interval-Types, Pitch-Class Sets and Equidistant Cycles

Question:

1. Notate an equidistant (equal step) cycle from C to C for the following examples:
2. List the sequence in pitch-classes (numbers 0-11) to identify the PC Set:
3. List the PC Set in **Normal Order**: Shortest span between outer notes
4. If required transpose the PC Set into **Prime Order**: Normal Order transposed to 0
5. Use Solomon Webpage or PCSetCalc App to identify the PC Set (Forte) number:
6. List the **Interval Vector** for each example:
7. List the **Complement** for each example: (PC Set - Normal - Prime - Forte Number)
8. List any alternate names and/or analytical oservations:

[a] Major 2nd: Equal interval steps from C to C

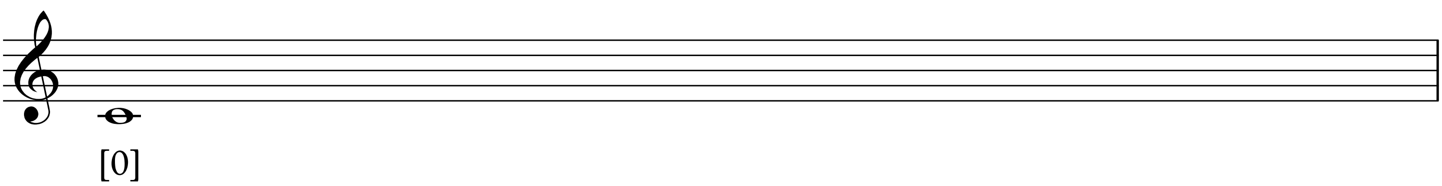


Answer:

1. Notate equidistant cycle (above):
2. PC Set:
3. Normal Order:
4. Prime Order:
5. Forte Number:
6. Vector:
7. Complement:

8. Alternate Name:

[b] Major 3rd: Equal interval steps from C to C

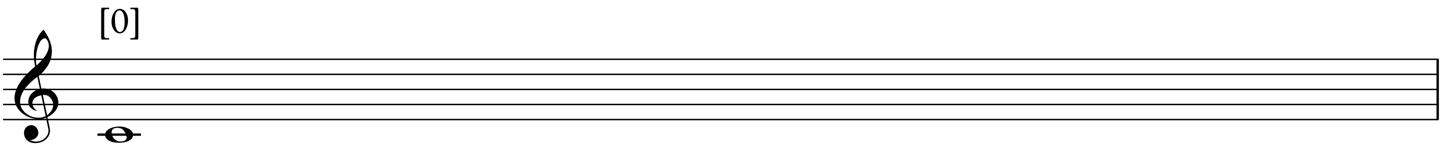


Answer:

1. Notate equidistant cycle (above):
2. PC Set:
3. Normal Order:
4. Prime Order:
5. Forte Number:
6. Vector:
7. Complement:

8. Alternate Name:

[c] Perfect 4th: Equal interval steps from C to C

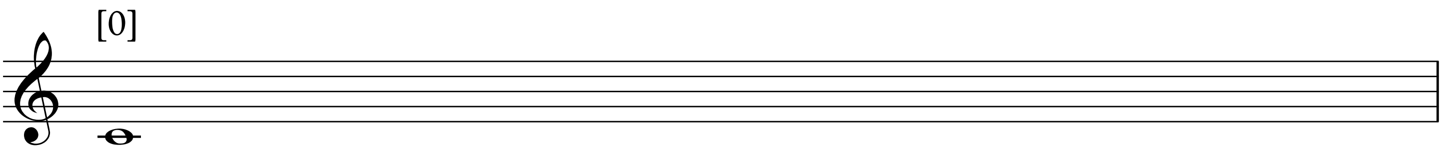


Answer:

1. Notate equidistant cycle (above):
2. PC Set:
3. Normal Order:
4. Prime Order:
5. Forte Number:
6. Vector:
7. Complement:

8. Alternate Name:

[d] minor 3rd: Equal interval steps from C to C

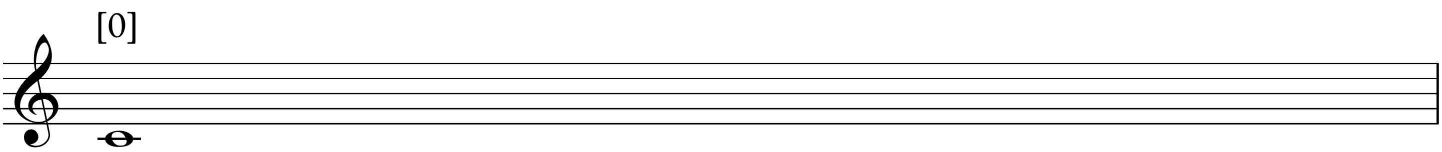


Answer:

1. Notate equidistant cycle (above):
2. PC Set:
3. Normal Order:
4. Prime Order:
5. Forte Number:
6. Vector:
7. Complement:

8. Alternate Name:

[e] minor 2nd: Equal interval steps from C to C

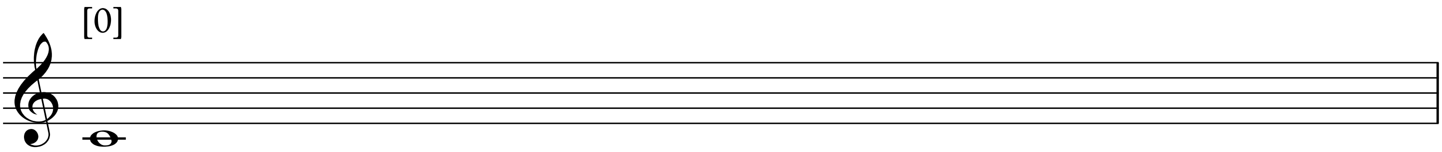


Answer:

1. Notate equidistant cycle (above):
2. PC Set:
3. Normal Order:
4. Prime Order:
5. Forte Number:
6. Vector:
7. Complement:

8. Alternate Name:

[f] Tritone: Equal interval steps from C to C

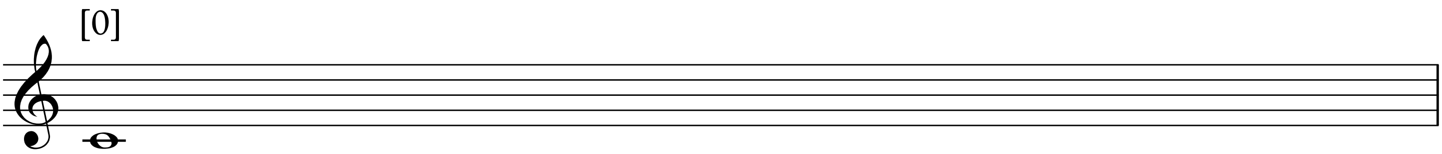


Answer:

1. Notate equidistant cycle (above):
2. PC Set:
3. Normal Order:
4. Prime Order:
5. Forte Number:
6. Vector:
7. Complement:

8. Alternate Name:

[g] minor 7th: Equal interval steps from C to C

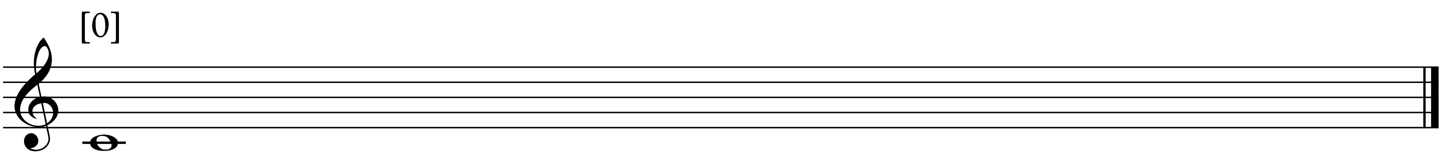


Answer:

1. Notate equidistant cycle (above):
2. PC Set:
3. Normal Order:
4. Prime Order:
5. Forte Number:
6. Vector:
7. Complement:

8. Alternate Name:

[h] minor 6th (augmented 5th): Equal interval steps from C to C



Answer:

1. Notate equidistant cycle (above):
2. PC Set:
3. Normal Order:
4. Prime Order:
5. Forte Number:
6. Vector:
7. Complement:

8. Alternate Name:

Twelve-Tone Analysis – Dr Ian Percy – Rosetta Stone Five

12-Tone Rows and Pitch-Matrices

Arnold Schoenberg (1874-1951) formally unveiled his system of twelve-tone pitch organisation in 1923. It dismantled the hierarchical relationships of the tonal system and liberated the twelve 'equal' tones of the chromatic scale: Twelve tones ALL of EQUAL importance.

To establish this equality, Schoenberg's system states that once the initial twelve-tone sequence has been composed, each note in the twelve-tone row should be placed in strict consecutive order and no note can repeat until the cycle has rotated through all twelve tones of the chromatic scale.

The twelve-tone row is NEVER converted to Normal Order/Prime Order (as when organising PC Sets), as this would make every twelve-tone row a consecutive row of semi-tones. However the original row is often referred to as the **Prime Row** or **Prime Form**. Schoenberg's system is completely transposable and through adopting exclusive use of mirror inversion (not harmonic inversion), negated the variable intervallic relationships of functioning harmony and the role of the octave and through pitch-matrices established a way to organise the internal symmetries and proportional relationships of the Prime Row. Pitch-matrices show all 48 possible permutations of the 12-tone row within a 12 x 12 grid:

	I0	**I2**	**I3**	**I7**	**I10**	**I5**	**I11**	**I4**	**I1**	**I9**	**I8**	**I6**	
P0	0	2	3	7	10	5	11	4	1	9	8	6	**R0**
P10	10	0	1	5	8	3	9	2	11	7	6	4	**R10**
P9	9	11	0	4	7	2	8	1	10	6	5	3	**R9**
P5	5	7	8	0	3	10	4	9	6	2	1	11	**R5**
P2	2	4	5	9	0	7	1	6	3	11	10	8	**R2**
P7	7	9	10	2	5	0	6	11	8	4	3	1	**R7**
P1	1	3	4	8	11	6	0	5	2	10	9	7	**R1**
P8	8	10	11	3	6	1	7	0	9	5	4	2	**R8**
P11	11	1	2	6	9	4	10	3	0	8	7	5	**R11**
P3	3	5	6	10	1	8	2	7	4	0	11	9	**R3**
P4	4	6	7	11	2	9	3	8	5	1	0	10	**R4**
P6	6	8	9	1	4	11	5	10	7	3	2	0	**R6**
	RI0	**RI2**	**RI3**	**RI7**	**RI10**	**RI5**	**RI11**	**RI4**	**RI1**	**RI9**	**RI8**	**RI6**	

The top row of the matrix when reading from <u>Left to Right</u>, lists the **Prime Row** or **Prime Form** [P0], which is the original twelve-tone row written in the exact order it was composed (conceived).

The top row of the matrix when reading from <u>Right to Left</u>, lists the **Retrograde Row** [R0], which is the Prime Row [P0], played backwards.

The far left column of the grid reading downwards from <u>Top to Bottom</u> lists the **Inversion** [I0], which is the <u>mirror-inversion</u> of the Prime Row [P0].

The far left column of the grid reading upwards from <u>Bottom to Top</u>, lists the **Retrograde Inversion** [RI0], which is the Inversion [I0], played backwards.

The consecutive descending rows of the matrix, when reading from <u>Left to Right</u>, list all twelve possible transpositions of the Prime Row (P0 – P11).
When reading from <u>Right to Left</u>, the descending rows of the matrix list all twelve possible transpositions of the Retrograde Row (R0 – R11).

Note: For clarity of reference, the following matrix has taken the pitch-class 0 from the matrix above to equal the pitch-type of C, but 0 can be any of the twelve tones of the chromatic system. Twelve-tone theory is completely transposable.

	I0	**I2**	**I3**	**I7**	**I10**	**I5**	**I11**	**I4**	**I1**	**I9**	**I8**	**I6**	
P0	C	D	E^b	G	B^b	F	B	E	$C^{\#}$	A	$G^{\#}$	$F^{\#}$	**R0**
P10	B^b	C	D^b	F	A^b	E^b	A	D	B	G	$F^{\#}$	E	**R10**
P9	A	B	C	E	G	D	A^b	D^b	B^b	G^b	F	E^b	**R9**
P5	F	G	A^b	C	E^b	B^b	E	A	$F^{\#}$	D	$C^{\#}$	B	**R5**
P2	D	E	F	A	C	G	$C^{\#}$	$F^{\#}$	$D^{\#}$	B	B^b	A^b	**R2**
P7	G	A	B^b	D	F	C	$F^{\#}$	B	$G^{\#}$	E	$D^{\#}$	$C^{\#}$	**R7**
P1	$C^{\#}$	$D^{\#}$	E	$G^{\#}$	B	$F^{\#}$	C	F	D	B^b	A	G	**R1**
P8	$G^{\#}$	$A^{\#}$	B	$D^{\#}$	$F^{\#}$	$C^{\#}$	G	C	A	F	E	D	**R8**
P11	B	$C^{\#}$	D	$F^{\#}$	A	E	B^b	E^b	C	A^b	G	F	**R11**
P3	E^b	F	G^b	B^b	D^b	A^b	D	G	E	C	B	A	**R3**
P4	E	$F^{\#}$	G	B	D	A	E^b	A^b	F	D^b	C	B^b	**R4**
P6	$F^{\#}$	$G^{\#}$	A	$C^{\#}$	E	B	F	B^b	G	E^b	D	C	**R6**
	RI0	**RI2**	**RI3**	**RI7**	**RI10**	**RI5**	**RI11**	**RI4**	**RI1**	**RI9**	**RI8**	**RI6**	

Twelve-Tone Analysis – Dr Ian Percy

Worksheet Five

Vocabulary and Glossary

Question:

Taking one definition from the Solomon Webpage Glossary and one from a trusted alternate resource, copy and paste <u>two definitions</u> of the following words/terms. Please format the document in Tahoma Font 14 1.15 line spacing with a UK spell check throughout and include clear references for all resources used:

1. Combinatorial (Combinatoriality):
2. Complement:
3. Inversion:
4. Mirror or Mirror Set:
5. Normal Order:
6. Ordered Set:
7. Prime Order (Prime Form):
8. Retrograde:
9. Retrograde Inversion:
10. Unordered Set:

Dr Ian Percy

Twelve-tone Analysis

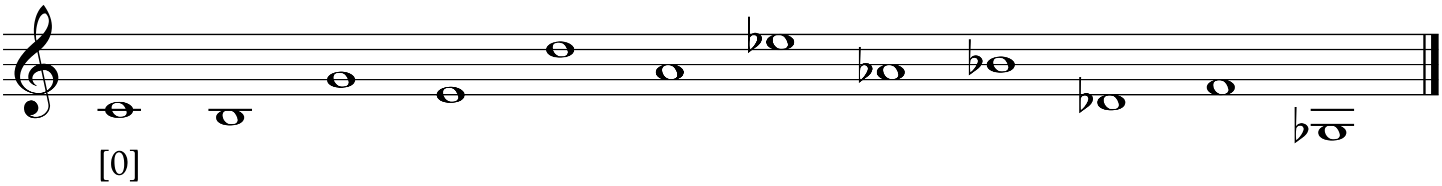
Worksheet Six

Twelve-Tone Rows and Pitch-Matrices

Question:

1. Write out the following **twelve-tone rows** as pitch-classes (numbers 0-11):
2. On the attached sheet, complete the three **pitch-matrices** for each example:
3. Is there anything worth noting about the examples?

[a] Lyrische Suite (1926) - Alban Berg 1885-1935 (Transposed to C)



Answer:

1. 12-tone row in pitch-classes:
2. Three pitch-matrices:
3. Brief comments:

[b] String Quartet Op.28 (1938) - Anton Webern 1883-1945 (Transposed to C)

Answer:

1. 12-tone row in pitch-classes:
2. Three pitch-matrices:
3. Brief comments:

Ai. Example A in pitch-classes (0-11):

0											
	0										
		0									
			0								
				0							
					0						
						0					
							0				
								0			
									0		
										0	
											0

Aii: Example A in pitch-types **0 = C**:

C											
	C										
		C									
			C								
				C							
					C						
						C					
							C				
								C			
									C		
										C	
											C

Aiii: Example A in pitch-types (transposed) **0 = F**:

F											
	F										
		F									
			F								
				F							
					F						
						F					
							F				
								F			
									F		
										F	
											F

Bi. Example B in pitch-classes (0-11):

0											
	0										
		0									
			0								
				0							
					0						
						0					
							0				
								0			
									0		
										0	
											0

Bii: Example B in pitch-types **0 = C**:

C											
	C										
		C									
			C								
				C							
					C						
						C					
							C				
								C			
									C		
										C	
											C

Biii: Example B in pitch-types (transposed) **0 = B^b**:

B^b											
	B^b										
		B^b									
			B^b								
				B^b							
					B^b						
						B^b					
							B^b				
								B^b			
									B^b		
										B^b	
											B^b

Dr Ian Percy

Twelve-tone Analysis

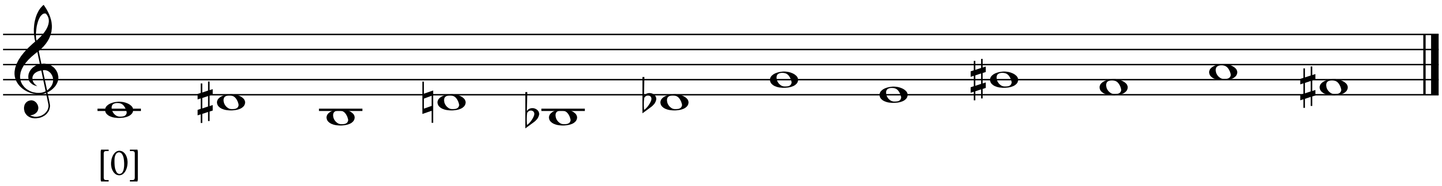
Worksheet Seven

Twelve-Tone Rows and Pitch-Matrices

Question:

1. Write out the following **twelve-tone rows** as pitch-classes (numbers 0-11):
2. On the attached sheet, complete the three **pitch-matrices** for each example:
3. Is there anything worth noting about the examples?

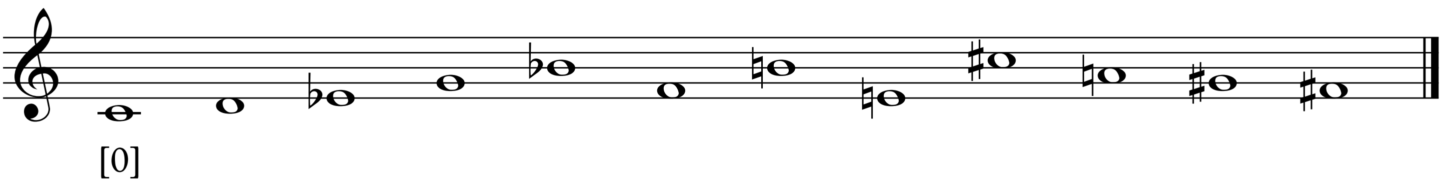
[a] Composition for 4 Instruments (1948)
Milton Babbitt 1916-2011 (Transposed to C)



Answer:

1. 12-tone row in pitch-classes:
2. Three pitch-matrices:
3. Brief comments:

[b] Elliott Carter (1908-2012)
Symmetrically Inverted All-Interval Twelve-Note (SI AITN) Chord 60:



Answer:

1. 12-tone row in pitch-classes:
2. Three pitch-matrices:
3. Brief comments:

Ai. Example A in pitch-classes (0-11):

0											
	0										
		0									
			0								
				0							
					0						
						0					
							0				
								0			
									0		
										0	
											0

Aii: Example A in pitch-types **0 = C**:

C											
	C										
		C									
			C								
				C							
					C						
						C					
							C				
								C			
									C		
										C	
											C

Aiii: Example A in pitch-types (transposed) **0 = F$^{\#}$**:

F$^{\#}$											
	F$^{\#}$										
		F$^{\#}$									
			F$^{\#}$								
				F$^{\#}$							
					F$^{\#}$						
						F$^{\#}$					
							F$^{\#}$				
								F$^{\#}$			
									F$^{\#}$		
										F$^{\#}$	
											F$^{\#}$

Bi. Example B in pitch-classes (0-11):

0											
	0										
		0									
			0								
				0							
					0						
						0					
							0				
								0			
									0		
										0	
											0

Bii: Example B in pitch-types **0 = C**:

C											
	C										
		C									
			C								
				C							
					C						
						C					
							C				
								C			
									C		
										C	
											C

Biii: Example B in pitch-types (transposed) **0 = E**:

E											
	E										
		E									
			E								
				E							
					E						
						E					
							E				
								E			
									E		
										E	
											E