

Final Project Report - Part III: Chord Calculator Implementation

Andres Antillon and Andres Aguilar
CS3361 Concepts of Programming Languages
Instructor: Dr. Arturo Camacho

Abstract—This report documents the third deliverable of the musical-grammar project: a chord calculator that outputs the pitch-class set for every chord in a valid song. Building on the parser from Part II, the program rebuilds an abstract syntax tree, applies the interval tables from the specification, renders the required histogram, and writes the grading files. We cover how the code handles suspensions, extensions, additions, omissions, inversions, and repeat bars, then show outputs for six test songs. The raw calculator outputs are embedded as plain text.

Index Terms—Chord calculator, pitch classes, recursive descent, Python

I. INTRODUCTION

Deliverable III requires computing the pitch classes for every chord in a song, producing the Fig. 3 histogram, and saving the output for chi-square grading against instructor data [1]. This stage interprets qualities, suspensions, extensions, additions, omissions, and inversions; repeated bars marked with % are skipped in the totals row. Because the grading formula penalizes squared error, each interval must be applied correctly. This report explains the implementation choices and shows evidence that the calculator matches the specification.

II. METHODOLOGY

A. Pipeline Overview

The calculator runs on Python 3.14.0 inside the repository virtual environment. For each song, `calculator.py` first calls the submitted grammar validator to ensure the input respects the project grammar. That validator owns the official recursive-descent parser from Deliverable II. After it signals success, the calculator performs a second pass with a slimmer `CalculatorParser` that is easier to mutate for note computation. This two-pass approach avoids modifying the graded parser yet still gives us a structured AST we control. The AST mirrors the grammar (`Song` \rightarrow `Bars` \rightarrow `Chords`) and stores the root pitch class, quality token, extension number and caret flag, alterations, omissions, and inversion bass. Bars tagged with % are marked as repeats so they can be skipped when computing totals.

B. Chord Evaluation Details

Pitch-class computation follows the project tables. Root letters map to pitch classes (C=0, D=2, E=4, F=5, G=7, A=9, B=11); accidentals shift by ± 1 semitone. The evaluator:

- 1) Adds quality intervals from Table I or suspension tones from Table II.
- 2) Drops thirds and/or fifths when `no3`, `no5`, or `no35` appears.
- 3) Applies extensions from Table III, raising the seventh on carets and omitting it when the number is parenthesized.
- 4) Applies additions and altered fifths; an altered fifth replaces the perfect-fifth family so the set stays consistent.
- 5) Adds the inversion bass when a slash chord is present.

All arithmetic is modulo 12 so enharmonic spellings collapse to the same pitch class, matching the project description [1].

C. Output and Tooling

The `format_table` routine renders the Fig. 3 grid, puts a star in each pitch-class column, and accumulates totals only for non-repeated bars. Rows are numbered with room for two digits, and the result is printed and saved to `calculator/out/<song_basename>_notes.txt`. A single call to `python calculator/calculator.py <song-file>` validates, evaluates, and writes the output; `pypdf` is only used to read the assignment text.

III. RESULTS

The calculator was run on six songs from the provided corpus: “Tick Tock,” “Don’t Stop Believin’,” “Edge of Desire,” “La Camisa Negra,” “Luka,” and “Sweet Child O’ Mine.” Each run produced the star grid and totals row; repeated bars were omitted from aggregation, and inversion basses were included in the pitch-class sets. The appendix embeds the exact outputs from `calculator/out`. Comparing the totals to the instructor reference files shows matching pitch-class distributions even when layout differs, which should keep the chi-square score near the maximum.

IV. CONCLUSION

The calculator validates songs, computes pitch classes per Tables I–III (including suspensions, caret sevenths, altered additions, omissions, inversions, and repeats), and produces the required histogram and output files. The outputs in the appendix demonstrate how the implementation handles diverse charts while honoring the grammar and interval rules. Potential follow-ups include clearer error messages for malformed chords and a batch script to compare against reference outputs.

REFERENCES

- [1] A. Camacho, “Extra credit project,” CS3361 Concepts of Programming Languages, project handout, 2024.

APPENDIX A CALCULATOR OUTPUTS

A. Tick Tock (Joji)

	0	1	2	3	4	5	6	7	8	9	A	B	
	—	—	—	—	—	—	—	—	—	—	—	—	
1.	*				*	*		*					C/F
2.			*		*			*				*	E-7
3.	*		*		*			*		*			C6 (9)
4.			*			*				*			D-
5.			*		*			*				*	E-7
6.	*				*	*		*					C/F
7.			*		*							*	E7no3
8.	*		*		*			*		*			C6 (9)
9.	*		*		*	*				*			D-9
10.			*		*							*	E7no3
11.			*		*							*	E7no3
12.			*		*							*	E7no3
13.	*		*		*			*		*			C6 (9)
14.	*		*		*			*				*	C^7/D
15.	*				*			*				*	C^7/E
16.	*				*	*		*					C/F
17.			*		*							*	E7no3
18.	*		*		*			*		*			C6 (9)
19.	*		*		*			*				*	C^7/D
20.	*				*			*				*	C^7/E
21.	*				*	*		*					C/F
22.			*		*			*				*	E-7
23.	*		*		*			*		*			C6 (9)
24.	*		*		*			*					C/D
25.			*		*			*				*	E-7
26.	*				*	*		*		*			F^9
27.			*		*			*				*	E-7
28.	*		*		*			*		*			C6 (9)
29.	*		*		*			*					C/D
30.			*		*			*				*	E-7
31.			*		*			*				*	E-7
32.			*		*							*	E7no3
33.	*		*		*			*		*			C6 (9)
34.	*		*		*			*				*	C^7/D
35.					*							*	E5
36.	*				*	*		*					C/F
37.			*		*							*	E7no3
38.	*		*		*			*		*			C6 (9)
39.	*		*		*			*					C/D
40.	*		*		*			*				*	C^9/E
41.	*				*	*		*					C/F
42.			*		*			*				*	E-7
43.	*		*		*			*		*			C6 (9)
44.	*		*		*			*				*	C^7/D
45.					*			*				*	E-
46.	*				*	*		*					C/F
47.			*		*							*	E7no3
48.	*		*		*			*		*			C6 (9)
49.	*		*		*			*				*	C^7/D
50.					*			*				*	E-
	—	—	—	—	—	—	—	—	—	—	—	—	
	30	0	37	0	49	10	0	39	0	13	0	27	

B. Don't Stop Believin' (Journey)

	0	1	2	3	4	5	6	7	8	9	A	B	
	—	—	—	—	—	—	—	—	—	—	—	—	
1.					*							*	E5
2.				*			*					*	B
3.		*			*				*			*	C#-7
4.		*			*					*			A
5.					*				*			*	E
6.				*			*					*	B
7.				*					*			*	G#-
8.		*			*					*			A
9.					*				*			*	E
10.							*					*	B5
11.		*			*				*			*	C#-7
12.		*			*					*		*	A(9)
13.					*				*			*	E
14.							*					*	B5
15.				*			*		*			*	G#-7
16.		*			*					*			A
17.					*				*			*	E
18.							*					*	B5
19.		*			*				*			*	C#-7
20.		*			*					*		*	A(9)
21.					*				*			*	E
22.				*			*					*	B
23.				*			*		*			*	G#-7
24.		*			*					*			A
25.					*				*			*	E
26.				*			*					*	B
27.		*			*				*			*	C#-7
28.		*			*					*			A
29.					*				*			*	E
30.				*			*					*	B
31.				*					*			*	G#-
32.		*			*					*			A
33.					*				*			*	E
34.							*					*	B5
35.		*			*				*			*	C#-7
36.		*			*					*		*	A(9)
37.					*				*			*	E
38.							*					*	B5
39.				*			*		*			*	G#-7
40.		*			*		*			*			A6
41.				*			*			*		*	B/A
42.		*			*					*			A
43.				*			*			*		*	B/A
44.					*				*	*		*	E/A
45.				*	*		*					*	B/E
46.					*				*			*	E
47.				*	*		*					*	B/E
48.					*				*			*	E
49.				*			*			*		*	B/A
50.		*			*					*			A
51.				*			*			*		*	B/A
52.					*				*	*		*	E/A
53.				*	*		*					*	B/E
54.					*				*			*	E

55.		*	*	*		*	B/E
56.			*		*	*	E
57.		*		*	*	*	B/A
58.	*		*		*		A
59.		*		*	*	*	B/A
60.			*		*	*	E/A
61.		*	*	*		*	B/E
62.			*		*	*	E
63.		*	*	*		*	B/E
64.			*		*	*	E
65.		*		*	*	*	B/A
66.	*		*		*		A
67.		*		*	*	*	B/A
68.			*		*	*	E/A
69.		*		*		*	B
70.			*	*		*	Esus2
71.		*		*		*	B
72.			*	*		*	Esus2
73.	*		*		*	*	A(9)
74.			*		*	*	E
75.		*		*		*	B
76.	*				*	*	C#7no3
77.	*		*		*	*	A(9)
78.			*		*	*	E
79.		*		*		*	B
80.	*		*		*	*	C#-7
81.	*		*		*	*	A(9)
82.			*		*	*	E
83.		*		*		*	B
84.		*		*	*	*	G#-7
85.	*		*		*	*	A(9)
86.			*		*	*	E
87.		*		*		*	B
88.	*		*		*	*	C#-7
89.	*		*		*	*	A(9)
90.			*		*	*	E
91.		*		*		*	B
92.		*		*	*	*	G#-7
93.	*		*	*	*	*	A6
94.		*		*	*	*	B/A
95.	*		*		*	*	A
96.		*		*	*	*	B/A
97.			*		*	*	E/A
98.		*	*	*		*	B/E
99.			*		*	*	E
100.		*	*	*		*	B/E
101.			*		*	*	E
102.		*		*	*	*	B/A
103.	*		*		*	*	A
104.		*		*	*	*	B/A
105.			*		*	*	E/A
106.		*	*	*		*	B/E
107.			*		*	*	E
108.		*	*	*		*	B/E
109.			*			*	E5
110.		*		*	*	*	B/A
111.			*		*	*	A5
112.		*		*	*	*	B/A

113.				*				*	*	*	E/A
114.			*	*		*				*	B/E
115.				*				*		*	E
116.			*	*		*				*	B/E
117.				*				*		*	E
118.			*			*			*	*	B/A
119.	*			*					*		A
120.			*			*			*	*	B/A
121.				*				*	*	*	E/A
122.			*			*				*	B
123.				*		*				*	Esus2
124.			*			*				*	B
125.				*		*				*	Esus2
126.	*			*		*			*	*	A6(9)
127.				*				*		*	E
128.			*			*		*		*	B6
129.	*			*				*			C#-
130.	*			*					*		A
131.				*				*		*	E
132.						*				*	B5
133.			*					*		*	G#-
134.				*					*		A5
135.				*				*		*	E
136.			*			*				*	B
137.	*							*			C#5
138.	*			*					*		A
139.				*				*		*	E
140.						*				*	B5
141.			*					*		*	G#-
142.				*					*	*	Asus2
143.				*				*		*	E
144.						*				*	B5
145.	*							*			C#5
146.				*					*	*	Asus2
147.				*				*		*	E
148.						*				*	B5
149.			*					*		*	G#-
150.				*					*	*	Asus2
151.				*				*		*	E
152.						*				*	B5
153.	*							*		*	C#7no3
154.	*			*					*	*	A
155.				*				*		*	E
156.						*				*	B5
157.			*					*		*	G#-
158.									*	*	A1
	-	-	-	-	-	-	-	-	-	-	-
	0	39	0	55	99	0	67	0	65	57	0 134

C. Edge of Desire (Jonas Blue & Malive)

	0	1	2	3	4	5	6	7	8	9	A	B
	-	-	-	-	-	-	-	-	-	-	-	-
1.	*				*					*		A-
2.	*		*			*				*		D-7
3.			*					*			*	G
4.	*				*			*		*		A-7
5.	*		*			*				*		D-7

6.		*		*	*		*	G7
7.			*			*		A5
8.		*						D1
9.		*			*			G5
10.			*			*		A5
11.		*						D1
12.		*			*		*	G
13.	*		*		*	*		A-7
14.	*	*		*		*		D-7
15.		*			*		*	G
16.	*		*		*	*		A-7
17.	*	*		*		*		D-7
18.		*			*		*	G
19.	*		*		*	*		A-7
20.	*	*		*		*		D-7
21.		*			*		*	G
22.	*		*		*	*		A-7
23.	*	*		*		*		D-7
24.		*			*		*	G
25.	*		*		*	*		A-7
26.	*	*		*		*		D-7
27.		*			*		*	G
28.	*		*		*	*		A-7
29.	*	*		*		*		D-7
30.		*			*		*	G
31.	*		*		*	*		A-7
32.	*	*		*		*		D-7
33.		*			*		*	G
34.	*		*		*	*		A-7
35.	*	*		*		*		D-7
36.		*			*		*	G
37.	*		*		*	*		A-7
38.	*	*		*		*		D-7
39.		*			*		*	G
40.	*		*			*		A-
41.	*	*		*		*		D-7
42.		*			*		*	G
43.	*		*		*	*		A-7
44.	*	*		*		*		D-7
45.		*			*		*	G
46.			*			*		A5
47.		*		*		*		D-
48.		*			*		*	G
49.	*		*		*	*		A-7
50.		*		*		*		D-
51.		*			*		*	G
52.	*		*			*		A-
53.	*	*		*		*		D-7
54.		*			*		*	G
55.	*		*			*		A-
56.	*	*		*		*		D-7
57.		*			*		*	G
58.	*		*		*	*		A-7
59.	*			*		*		F
60.		*			*		*	G
61.	*		*		*	*		A-7
62.	*			*		*		F
63.		*			*		*	G

64.	*		*	*	*	A-7
65.	*			*	*	F
66.		*		*	*	G
67.	*		*	*	*	A-7
68.	*		*	*	*	F
69.		*		*	*	G
70.	*		*		*	A-
71.	*		*	*	*	F
72.		*	*	*	*	G7
73.	*		*	*	*	A-7
74.	*	*	*	*	*	D-7
75.		*		*	*	G
76.	*		*	*	*	A-7
77.	*		*	*	*	F
78.		*	*	*	*	G7
79.	*		*	*	*	A-7
80.	*		*	*	*	F
81.		*		*	*	G
82.	*		*	*	*	A-7
83.	*		*	*	*	F
84.		*		*	*	G
85.	*		*	*	*	A-7
86.	*		*	*	*	F
87.		*		*	*	G
88.	*		*	*	*	A-7
89.	*		*	*	*	F
90.		*		*	*	G
91.	*		*	*	*	A-7
92.	*		*	*	*	F
93.		*		*	*	G
94.	*		*	*	*	A-7
95.	*	*	*	*	*	D-7
96.		*		*	*	G
97.	*		*	*	*	A-
98.	*	*	*	*	*	D-7
99.		*		*	*	G
100.	*		*	*	*	A-7
101.	*	*	*	*	*	D-7
102.		*		*	*	G
103.	*		*	*	*	A-7
104.	*	*	*	*	*	D-7
105.		*		*	*	G
106.	*		*	*	*	A-7
107.	*	*	*	*	*	D-7
108.		*		*	*	G
109.	*		*	*	*	A-7
110.	*	*	*	*	*	D-7
111.		*		*	*	G
112.	*		*	*	*	A-
113.		*	*	*	*	D-
114.		*		*	*	G
115.	*		*	*	*	A-7
116.	*	*	*	*	*	D-7
117.		*		*	*	G
118.	*		*	*	*	A-7
119.		*	*	*	*	D-
120.		*		*	*	G
121.	*		*	*	*	A-7

122.	*		*			*			*			D-7
123.			*					*			*	G
124.	*			*				*		*		A-7
125.			*			*				*		D-
126.			*					*			*	G
127.	*			*						*		A-
128.			*			*				*		D-
129.			*					*			*	G
130.	*			*				*		*		A-7
131.	*		*			*				*		D-7
132.			*					*			*	G
133.	*			*				*		*		A-7
134.	*		*			*				*		D-7
135.			*					*			*	G
136.	*			*				*		*		A-7
137.	*		*			*				*		D-7
138.			*					*			*	G
139.	*			*				*		*		A-7
140.	*		*			*				*		D-7
141.			*					*			*	G
	-	-	-	-	-	-	-	-	-	-	-	-
	83	0	83	0	47	48	0	83	0	92	0	46

D. La Camisa Negra (Juanes)

	0	1	2	3	4	5	6	7	8	9	A	B	
	-	-	-	-	-	-	-	-	-	-	-	-	
1.		*					*			*			F#-
2.		*				*			*			*	C#7
3.		*					*			*			F#-
4.			*				*					*	B-
5.		*				*			*			*	C#7
6.		*					*			*			F#-
7.		*				*			*			*	C#7
8.		*					*			*			F#-
9.			*				*					*	B-
10.		*				*			*			*	C#7
11.		*					*			*			F#-
12.		*					*			*			F#-
13.		*				*			*			*	C#7
14.		*					*			*			F#-
15.			*				*					*	B-
16.		*				*			*				C#
17.		*					*			*			F#-
18.		*				*			*			*	C#7
19.		*					*			*			F#-
20.			*				*					*	B-
21.		*				*			*			*	C#7
22.		*					*			*			F#-
23.		*				*			*			*	C#7
24.		*					*			*			F#-
25.			*				*					*	B-
26.		*				*			*			*	C#7
27.		*					*				*		F#
28.				*					*			*	G#-
29.		*				*					*		A#-
30.				*			*					*	B
31.		*					*				*		F#

32.		*		*		*	G#-
33.	*		*		*		A#-
34.		*		*		*	B
35.	*			*		*	F#
36.		*			*	*	G#-
37.	*		*			*	A#-
38.		*		*		*	B
39.	*			*		*	F#
40.		*			*	*	G#-
41.	*		*			*	A#-
42.		*		*		*	B
43.	*			*	*		F#-
44.	*		*		*	*	C#7
45.	*			*		*	F#-
46.		*		*		*	B-
47.	*		*		*	*	C#7
48.	*			*	*		F#-
49.	*		*		*	*	C#7
50.	*			*		*	F#-
51.		*		*		*	B-
52.	*		*		*	*	C#7
53.	*			*	*		F#-
54.	*		*		*	*	C#7
55.	*			*		*	F#-
56.		*		*		*	B-
57.	*		*		*	*	C#7
58.	*			*	*		F#-
59.	*		*		*	*	C#7
60.	*			*		*	F#-
61.		*		*		*	B-
62.	*		*		*	*	C#7
63.	*			*	*		F#-
64.	*			*	*		F#-
65.	*		*		*	*	C#7
66.	*			*		*	F#-
67.		*		*		*	B-
68.	*		*		*	*	C#7
69.	*			*	*		F#-
70.	*		*		*	*	C#7
71.	*			*	*		F#-
72.		*		*		*	B-
73.	*		*		*		C#
74.	*			*	*		F#-
75.	*		*		*	*	C#7
76.	*			*	*		F#-
77.		*		*		*	B-
78.	*		*		*	*	C#7
79.	*			*	*		F#
80.		*			*	*	G#-
81.	*		*		*	*	A#-
82.		*		*		*	B
83.	*			*		*	F#
84.		*			*	*	G#-
85.	*		*		*	*	A#-
86.		*		*		*	B
87.	*			*	*		F#
88.		*			*	*	G#-
89.	*		*		*	*	A#-

90.			*			*					*	B
91.	*					*				*		F#
92.			*					*			*	G#-
93.	*				*					*		A#-
94.			*			*					*	B
95.	*					*			*			F#-
96.	*				*			*			*	C#7
97.	*					*			*			F#-
98.		*				*					*	B-
99.	*				*			*			*	C#7
100.	*					*			*			F#-
101.	*				*			*			*	C#7
102.	*					*			*			F#-
103.		*				*					*	B-
104.	*				*			*			*	C#7
105.	*					*			*			F#-
106.	*				*			*			*	C#7
107.	*					*			*			F#-
108.		*				*					*	B-
109.	*				*			*				C#
110.	*					*			*			F#-
111.	*				*			*			*	C#7
112.	*					*			*			F#-
113.		*				*					*	B-
114.	*				*			*			*	C#7
115.	*					*			*			F#-
	-	-	-	-	-	-	-	-	-	-	-	-
	0	83	16	16	0	40	67	0	40	35	16	61

E. Luka (Violent Vira)

	0	1	2	3	4	5	6	7	8	9	A	B	
	-	-	-	-	-	-	-	-	-	-	-	-	
1.			*					*		*			Gsus2
2.		*					*					*	Bsus2
3.			*					*		*			Gsus2
4.		*					*					*	Bsus2
5.			*					*		*			Gsus2
6.		*					*					*	Bsus2
7.			*					*		*			Gsus2
8.		*					*					*	Bsus2
9.					*		*	*				*	E- (9)
10.			*				*	*				*	G^7
11.		*	*				*					*	B- (9)
12.			*				*	*				*	G^7
13.					*			*				*	E-
14.			*				*	*				*	G^7
15.			*				*					*	B-
16.		*			*		*	*		*			A13
17.			*				*	*				*	G^7
18.		*					*					*	Bsus2
19.			*					*		*			Gsus2
20.		*					*					*	Bsus2
21.			*					*		*			Gsus2
22.		*					*					*	Bsus2
23.			*					*					G5
24.		*	*				*					*	B- (9)
25.			*					*					G5

26.							*				*	B5
27.		*						*				G5
28.							*				*	B5
29.				*			*				*	Esus2
30.	*	*					*				*	B- (9)
31.		*		*			*	*			*	E-9
32.							*				*	B5
33.		*						*			*	G
34.				*			*	*			*	E- (9)
35.		*					*	*			*	G^7
36.	*	*					*				*	B- (9)
37.	*	*					*	*		*	*	G^9#11
38.				*			*	*			*	E- (9)
39.		*					*	*			*	G^7
40.		*					*				*	B-
41.	*			*			*	*		*		A13
42.		*					*	*			*	G^7
43.	*						*				*	Bsus2
44.		*						*		*		Gsus2
45.	*						*				*	Bsus2
46.	*	*						*			*	G (#11)
47.	*						*				*	Bsus2
48.		*						*				G5
49.	*						*				*	Bsus2
50.		*					*	*			*	G^7
51.	*						*				*	Bsus2
52.		*						*		*		Gsus2
53.							*				*	B5
54.				*			*				*	Esus2
55.							*				*	B5
56.				*			*				*	Esus2
57.							*				*	B5
58.	*	*					*	*			*	G^7#11
59.	*						*				*	Bsus2
60.		*						*		*		Gsus2
61.	*						*				*	Bsus2
62.		*						*		*		Gsus2
63.	*						*				*	Bsus2
64.		*						*		*		Gsus2
	-	-	-	-	-	-	-	-	-	-	-	
	0	24	34	0	10	0	46	34	0	14	0	47

F. Sweet Child O' Mine (Guns N' Roses)

	0	1	2	3	4	5	6	7	8	9	A	B	
	-	-	-	-	-	-	-	-	-	-	-	-	
1.			*					*		*			Dsus4
2.			*		*			*		*			A7sus4 / E
3.			*					*		*			Gsus2
4.			*					*		*			Dsus4
5.			*				*			*			D
6.	*				*			*					C
7.			*					*		*			Gsus2
8.			*				*			*			D
9.			*				*			*			D
10.	*				*			*					C
11.			*					*			*		G
12.			*				*			*			D

13.			*		*		*	D
14.	*			*		*		C
15.			*			*	*	G
16.			*		*		*	D
17.			*		*		*	D
18.	*			*		*		C
19.			*			*	*	G
20.			*		*		*	D
21.		*		*			*	A
22.	*			*		*		C
23.			*		*		*	D
24.		*		*			*	A
25.	*			*		*		C
26.			*				*	D5
27.			*		*		*	D
28.	*			*		*		C
29.			*			*	*	G
30.			*		*		*	D
31.			*		*		*	D
32.	*			*		*		C
33.			*			*	*	G
34.			*		*		*	D
35.			*		*		*	D
36.	*			*		*		C
37.			*			*	*	G
38.			*		*		*	D
39.		*		*			*	A
40.	*			*		*		C
41.			*				*	D5
42.		*		*			*	A
43.	*			*		*		C
44.			*			*	*	Gsus2
45.			*		*		*	D
46.	*			*		*		C
47.			*			*		G5
48.			*		*		*	D
49.			*		*		*	D
50.	*			*		*		C
51.			*			*	*	G
52.			*		*		*	D
53.		*		*			*	A
54.	*			*		*		C
55.			*		*		*	D
56.		*		*			*	A
57.	*			*		*		C
58.			*		*		*	D
59.		*		*			*	A
60.	*			*		*		C
61.			*		*		*	D
62.		*		*			*	A
63.	*			*		*		C
64.			*		*		*	D
65.				*			*	E5
66.	*			*		*		C
67.			*		*		*	B
68.				*			*	A5
69.				*		*	*	E-
70.	*					*		C5

71.			*		*		*	B
72.				*		*		A5
73.				*		*	*	E-
74.	*			*		*		C
75.			*		*		*	B
76.	*			*		*		A-
77.				*			*	E5
78.	*			*		*		C
79.			*		*		*	B
80.				*		*		A5
81.				*				E1
82.			*			*	*	G
83.				*		*		A5
84.	*			*		*		C
85.			*		*		*	D
86.				*				E1
87.			*			*	*	G
88.				*		*		A5
89.	*			*		*		C
90.			*		*		*	D
91.				*		*	*	E-
92.			*			*	*	G
93.				*		*		A5
94.	*			*		*		C
95.			*		*		*	D
96.				*			*	E5
97.			*			*	*	G
98.		*		*		*		A
99.	*			*		*		C
100.			*		*		*	D
101.				*		*	*	E-
102.			*			*	*	G
103.		*		*		*		A
104.	*			*		*		C
105.			*		*		*	D
106.				*		*	*	E-
107.			*			*	*	G
108.		*		*		*		A
109.	*			*		*		C
110.			*		*		*	D
111.				*		*	*	E-
112.			*			*	*	G
113.		*		*		*		A
114.	*			*		*		C
115.			*		*		*	D
116.				*		*	*	E-
117.			*			*	*	G
118.		*		*		*		A
119.	*			*		*		C
120.			*		*		*	D
121.				*		*	*	E-
122.			*			*	*	G
123.		*		*		*		A
124.	*			*		*		C
125.			*		*		*	D
126.				*		*	*	E-
127.			*			*	*	G
128.		*		*		*		A

129.	*				*			*					C
130.			*				*			*			D
131.					*			*			*		E-
132.			*					*			*		G
133.		*			*					*			A
134.					*			*			*		E-
135.			*					*			*		G
136.					*					*			A5
137.	*				*			*					C
138.			*				*			*			D
139.					*			*			*		E-
	-	-	-	-	-	-	-	-	-	-	-	-	
	33	16	62	4	73	0	38	70	0	66	0	38	