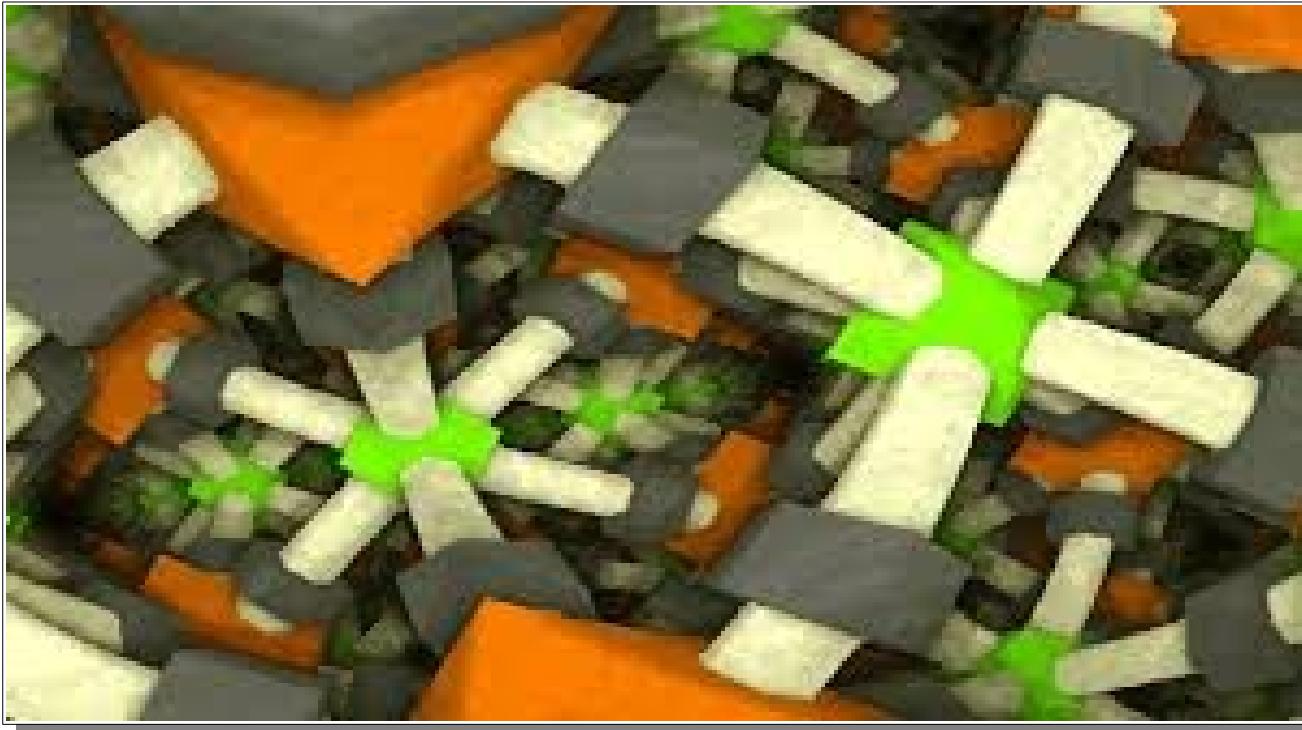


This page is intentionally left blank.

256-byte demoscene: extremly strong competition

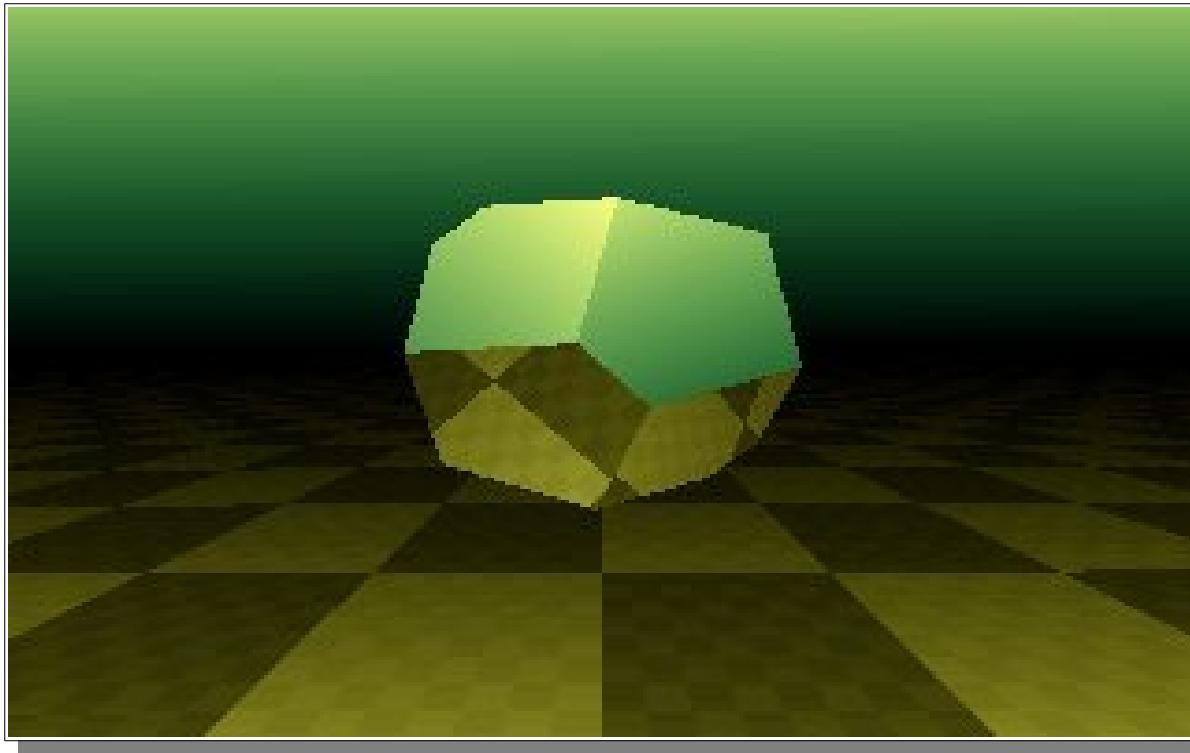


256-byte demoscene: extremly strong competition



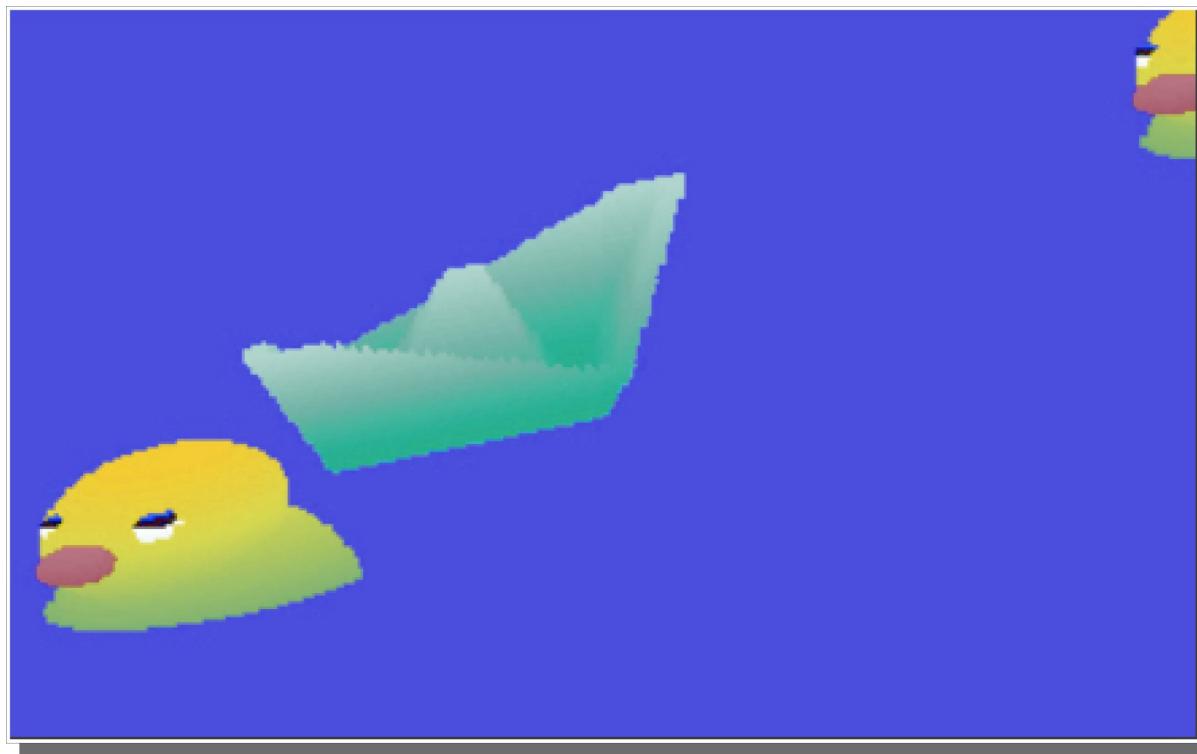
Řrřola: Puls

256-byte demoscene: extremly strong competition



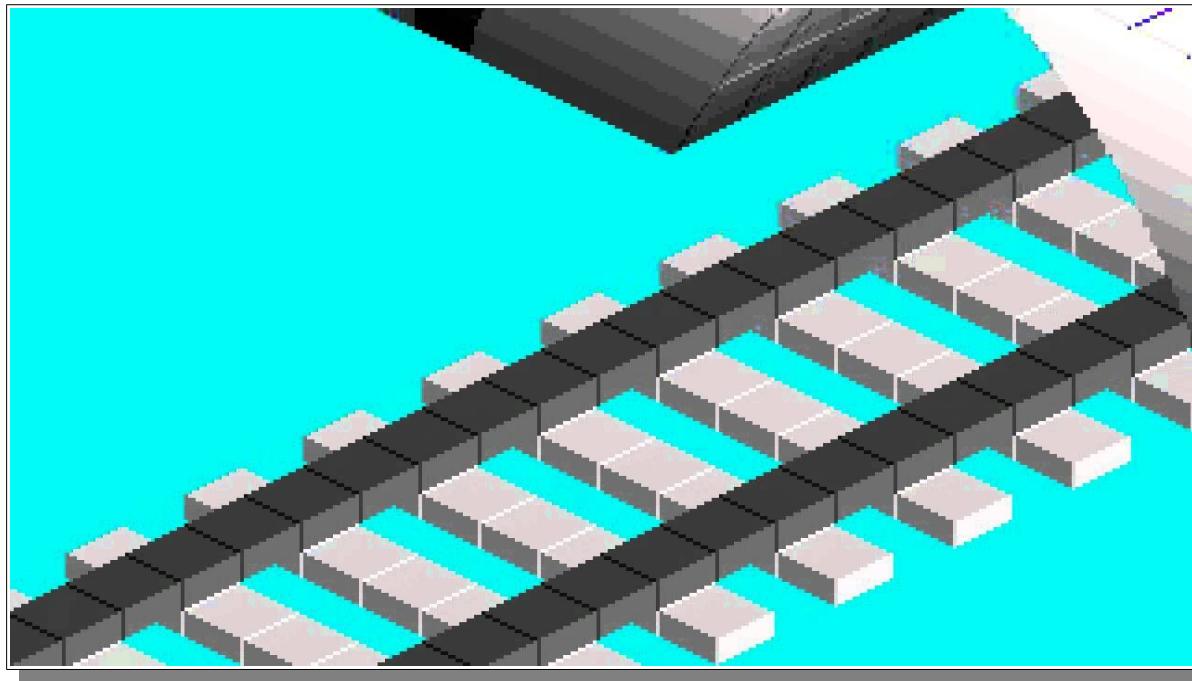
Řrřola: Pyrit

256-byte demoscene: extremly strong competition



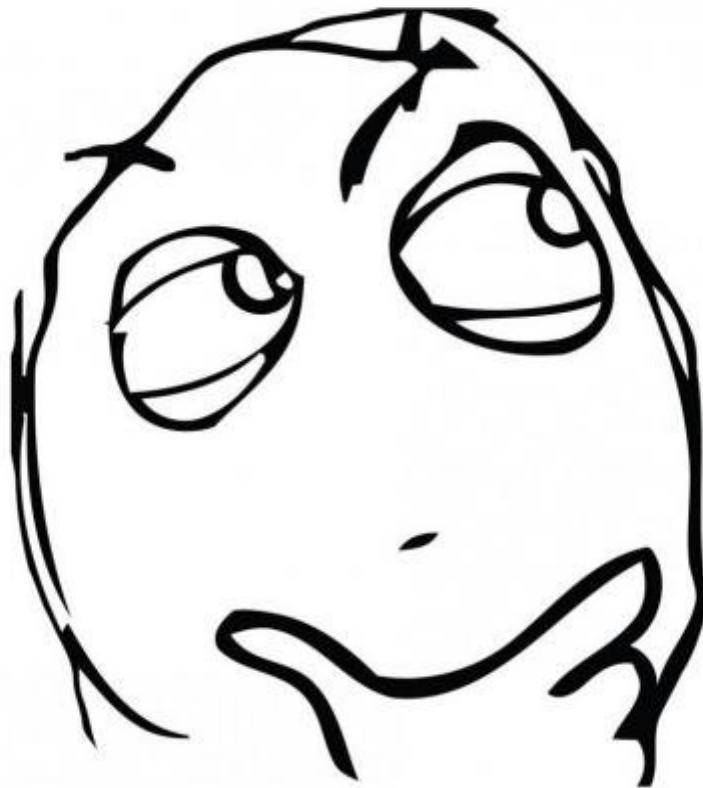
Digimind: Pool Patrol

256-byte demoscene: extremly strong competition



Digimind: Immediate Railways

256-byte demoscene: extremly strong competition

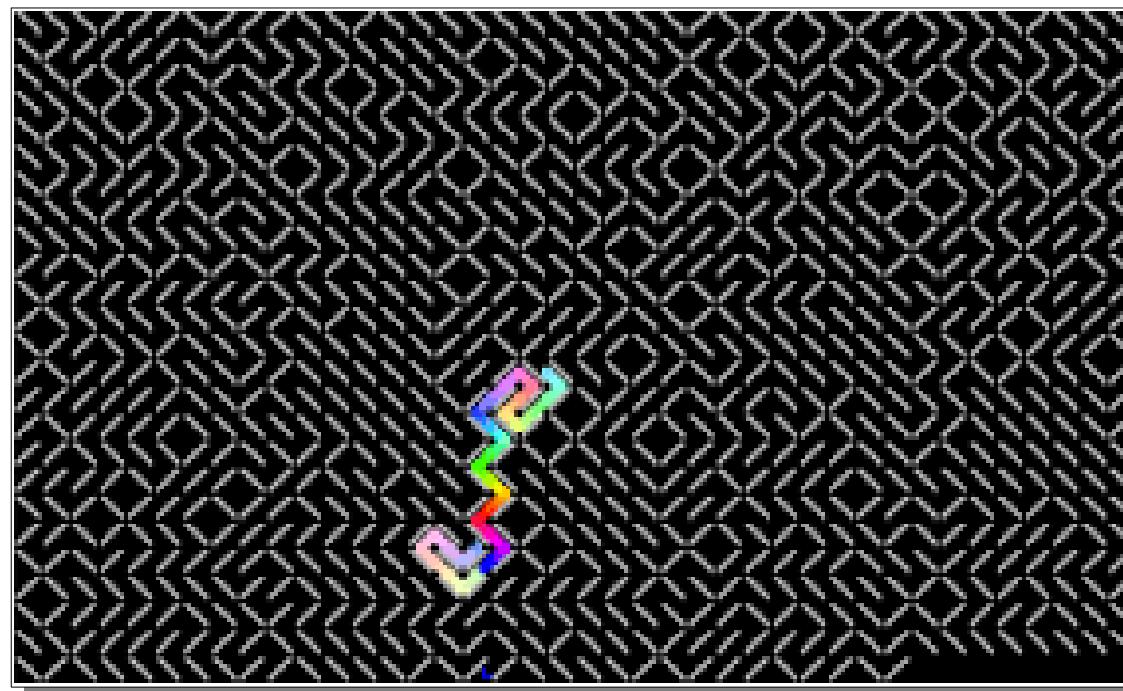


How to shine out of crowd?

256-byte demoscene: how to beat competition?

Fun

(if you are not a hardcore sizecoder)



ern0: Maze Solver

256-byte demoscene: how to beat competition?

Image processing



TomCat: She – Weak Signal

256-byte demoscene: how to beat competition?

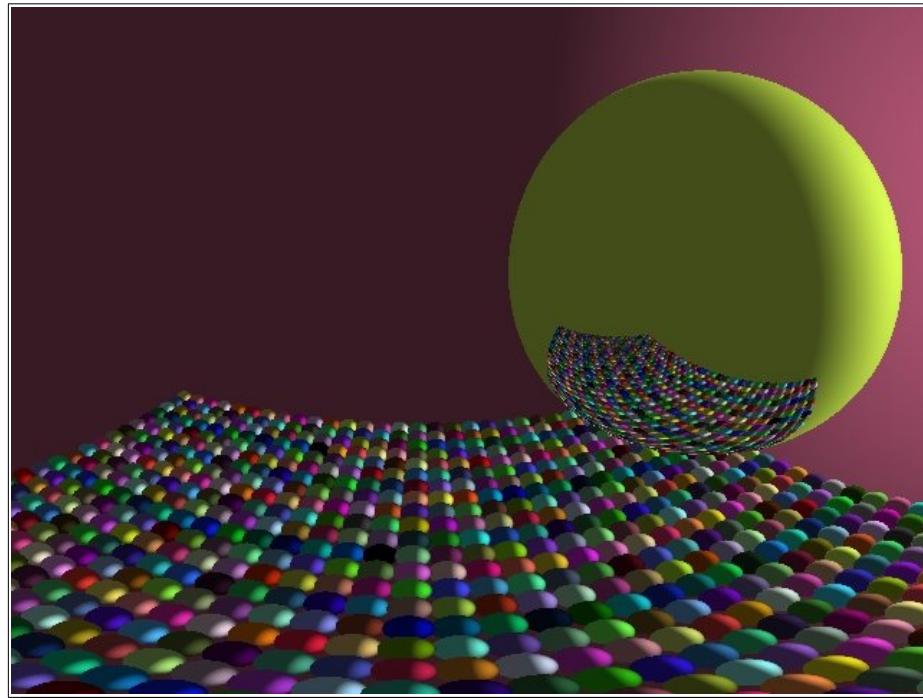
Image processing + fun



TomCat: Be Happy!

256-byte demoscene: how to beat competition?

Raytracing



TomCat: Colorful

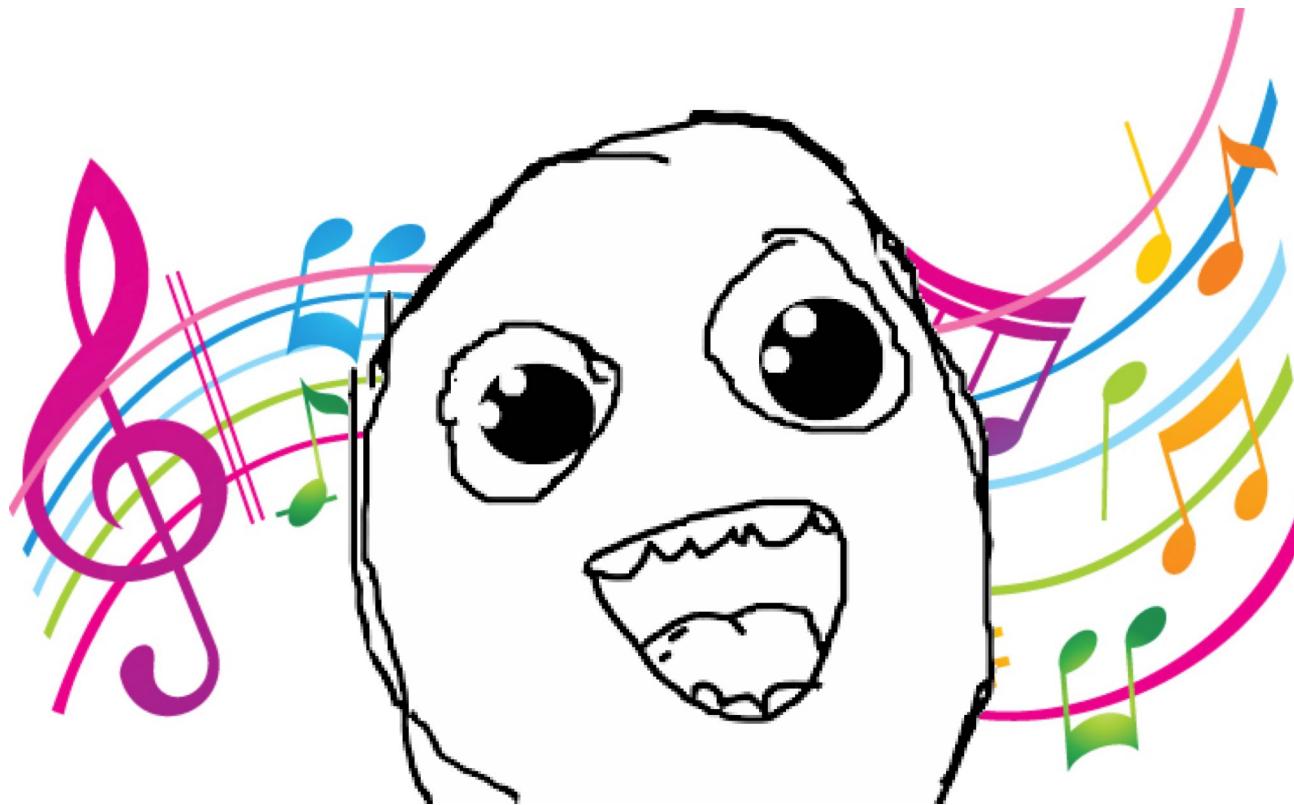
256-byte demoscene: how to beat competition?

Raytracing + fun



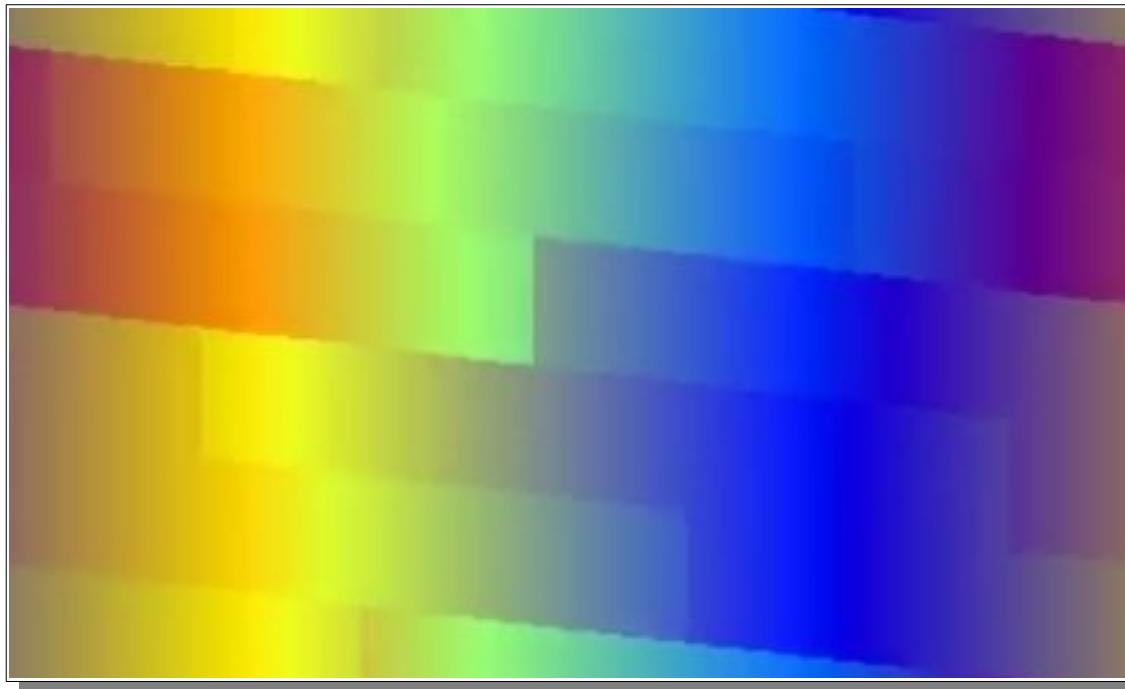
TomCat: Pokeball

256-byte demoscene: how to beat competition?



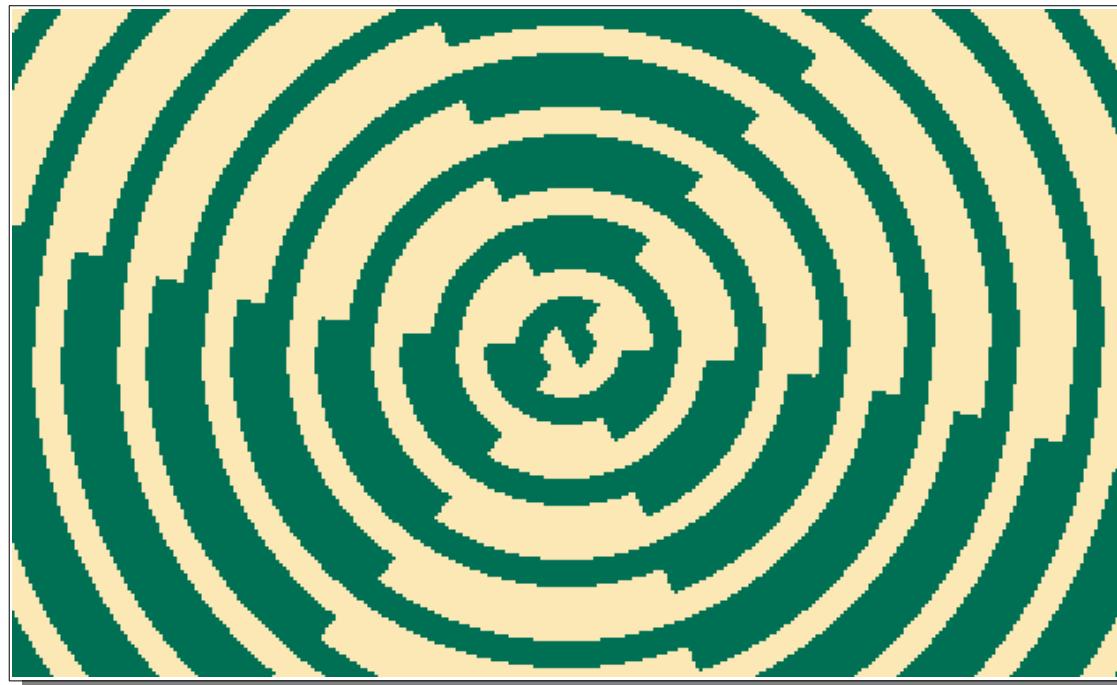
Music! Add music in 256-byte intros!

256 byte intro with music



*TomCat: 2(56)unlimited
(bytebeat music by ern0)*

256 byte intro with music



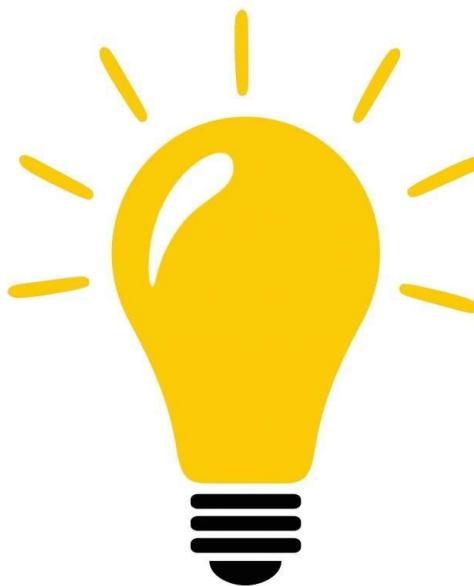
TomCat: No Sleep!
(buzzer music by ern0)

256 byte intro with music

Everyone loves it!



Create universal bytebeat tool



Create universal bytebeat tool

- Bytebeat player & editor

TomCat



Create universal bytebeat tool

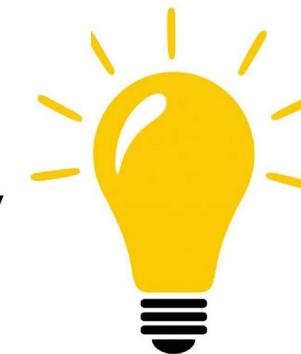
- Bytebeat player & editor

TomCat



- Formula compiler for assembly

ern0



Create universal bytebeat tool

- Bytebeat player & editor
TomCat
- Formula compiler for assembly
ern0



Create universal bytebeat tool

- Bytebeat player & editor

TomCat



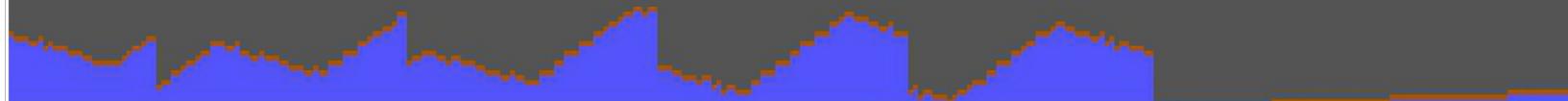
- Formula compiler for assembly

ern0



Bytebeat Editor (TomCat)

```
BYTEBEAT by TomCat/Abaddon 7 24632
freq:18939 zoom:1 out:7 vol:11173
Kick drum no:CMP1Z skip:TSTONZ
rate:16383 len:24576 vol:64
Hihat no:CMP3B skip:TST96NZ
rate:63 ien:22 rnd:99 vol:64 fade:1
Instrument1 no:CMP1B wave:sawtooth
idx:0 mask:15 len:8 tune:4 fade:1
Instrument2 no:CMP5B wave:triangle
idx:16 mask:31 len:4 tune:16 fade:1
Arpeggio no:CMP4B
idx:48 mask:7 rate:4 len:4 vol:31
```



```
9405450574B445B425B4744525059474
4 405A405743474 4 405A405743474
0525352535052505 4 405A405743474
042474 4043474 4 3 3 3 3 3 3 3 3 3
```

Bytebeat Editor (TomCat)

Features:

- realtime feedback

The screenshot shows the Bytebeat Editor interface. At the top, there is a text area containing the configuration for a bytebeat piece. Below this is a waveform visualization consisting of several blue triangles on a grey background. At the bottom, there is a hex dump of the bytebeat data.

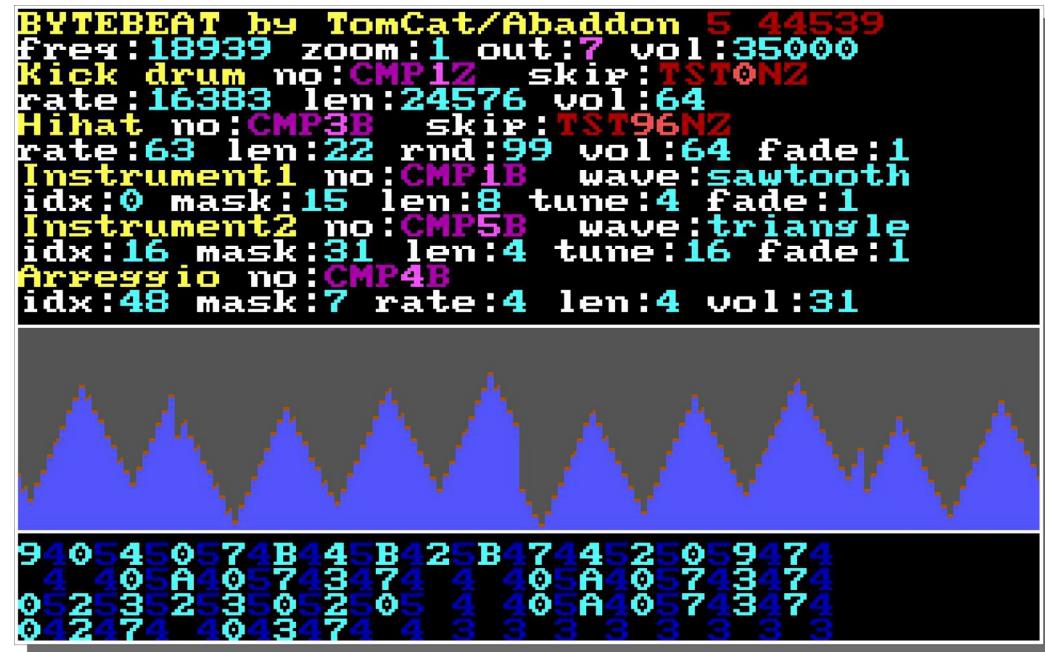
```
BYTEBEAT by TomCat/Abaddon 2 12981
freq:18939 zoom:1 out:7 vol:35000
Kick drum no:CMP1Z skip:TSTONZ
rate:16383 len:24576 vol:64
Hihat no:CMP3B skip:TST96NZ
rate:63 len:22 rnd:99 vol:64 fade:1
Instrument1 no:CMP1B wave:sawtooth
idx:0 mask:15 len:8 tune:4 fade:1
Instrument2 no:CMP5B wave:triangle
idx:16 mask:31 len:4 tune:16 fade:1
Arpeggio no:CMP4B
idx:48 mask:7 rate:4 len:4 vol:31
```

```
9405450574B445B425B4744525059474
4 405A405743474 4 405A405743474
0525352535052505 4 405A405743474
042474 4043474 4 3 3 3 3 3 3 3 3
```

Bytebeat Editor (TomCat)

Features:

- realtime feedback
- graphical sound wave



Bytebeat Editor (TomCat)

Features:

- realtime feedback
- graphical sound wave
- save/restore modified code

The screenshot shows the Bytebeat Editor interface. At the top, there is a text-based configuration section with various parameters for different instruments. Below this is a graphical sound wave visualization showing a repeating pattern of blue and grey triangles. At the bottom, there is a hex dump of the modified code.

```
BYTEBEAT by TomCat/Abaddon 2 12981
freq:18939 zoom:1 out:7 vol:35000
Kick drum no:CMP1Z skip:TSTONZ
rate:16383 len:24576 vol:64
Hihat no:CMP3B skip:TST96NZ
rate:63 len:22 rnd:99 vol:64 fade:1
Instrument1 no:CMP1B wave:sawtooth
idx:0 mask:15 len:8 tune:4 fade:1
Instrument2 no:CMP5B wave:triangle
idx:16 mask:31 len:4 tune:16 fade:1
Arpeggio no:CMP4B
idx:48 mask:7 rate:4 len:4 vol:31
```

```
9405450574B445B425B4744525059474
4 405A405743474 4 405A405743474
0525352535052505 4 405A405743474
042474 4043474 4 3 3 3 3 3 3 3 3
```

Bytebeat Editor (TomCat)

Features:

- realtime feedback
- graphical sound wave
- save/restore modified code

Issues:

- more than 70 hotkeys

The screenshot shows the Bytebeat Editor interface. At the top, there is a text area containing assembly-like code for a 'BYTEBEAT' track. Below this is a waveform visualization showing blue peaks on a black background. At the bottom, there is a hex dump of the raw byte data.

```
BYTEBEAT by TomCat/Abaddon 5 44539
freq:18939 zoom:1 out:7 vol:35000
Kick drum no:CMP1Z skip:TSTONZ
rate:16383 len:24576 vol:64
Hihat no:CMP3B skip:TST96NZ
rate:63 len:22 rnd:99 vol:64 fade:1
Instrument1 no:CMP1B wave:sawtooth
idx:0 mask:15 len:8 tune:4 fade:1
Instrument2 no:CMP5B wave:triangle
idx:16 mask:31 len:4 tune:16 fade:1
Arpeggio no:CMP4B
idx:48 mask:7 rate:4 len:4 vol:31
```

```
9405450574B445B425B4744525059474
4 405A405743474 4 405A405743474
0525352535052505 4 405A405743474
042474 4043474 4 3 3 3 3 3 3 3 3
```

Bytebeat Editor (TomCat)

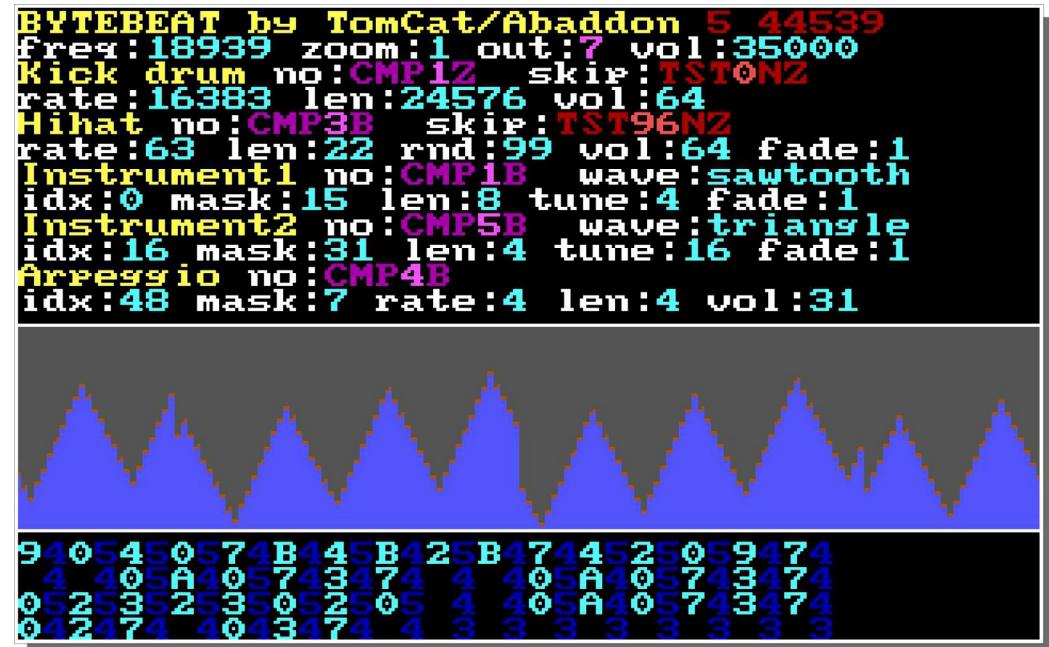
Features:

- realtime feedback
- graphical sound wave
- save/restore modified code



Issues:

- more than 70 hotkeys



Bytebeat Editor (TomCat)

Features:

- realtime feedback
- graphical sound wave
- save/restore modified code

Issues:

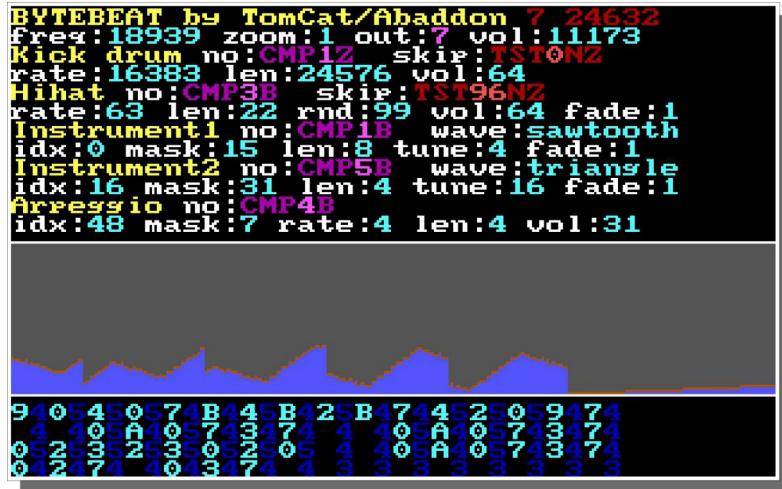
- more than 70 hotkeys
- needs some x86 coder knowledge
e.g. you can set any flag for a conditional jump

The screenshot shows the Bytebeat Editor interface. At the top, there is assembly-like code for a song titled 'BYTEBEAT by TomCat/Abaddon 2 12981'. The code includes parameters for various instruments like Kick, Drum, Hihat, and Arpeggio. Below the code is a waveform visualization consisting of several blue triangles on a grey background. At the bottom, there is a memory dump showing a sequence of bytes.

```
BYTEBEAT by TomCat/Abaddon 2 12981
freq:18939 zoom:1 out:7 vol:35000
Kick drum no:CMP1Z skip:TSTONZ
rate:16383 len:24576 vol:64
Hihat no:CMP3B skip:TST96NZ
rate:63 len:22 rnd:99 vol:64 fade:1
Instrument1 no:CMP1B wave:sawtooth
idx:0 mask:15 len:8 tune:4 fade:1
Instrument2 no:CMP5B wave:triangle
idx:16 mask:31 len:4 tune:16 fade:1
Arpeggio no:CMP4B
idx:48 mask:7 rate:4 len:4 vol:31
```

```
9405450574B445B425B4744525059474
4405A4057434744405A405743474
05253525350525054405A405743474
042474404347443333333333333333
```

Bytebeat Editor (TomCat)



Verdict:

- too complex, especially for musicians #UX

Bytebeat Editor (TomCat)



Verdict:

- too complex, especially for musicians #UX
- does not provide enough freedom

Bytebeat Editor (TomCat)



A screenshot of the Bytebeat Editor interface. On the left, there is a text editor window displaying assembly-like code for a Bytebeat track. The code includes parameters like freq, zoom, out, vol, kick drum, hihat, instrument definitions, and arpeggio settings. Below the code is a waveform visualization showing amplitude over time. At the bottom, there is a hex dump of the raw byte data.

```
BYTEBEAT by TomCat/Abaddon 7 24632
freq:18939 zoom:1 out:7 vol:11173
Kick drum no:CMP1Z skip:TST0NZ
rate:16383 len:24576 vol:64
Hihat no:CMP3B skip:TST96NZ
rate:63 len:22 rnd:99 vol:64 fade:1
Instrument1 no:CMP1B wave:sawtooth
idx:0 mask:15 len:8 tune:4 fade:1
Instrument2 no:CMP5B wave:triangle
idx:16 mask:31 len:4 tune:16 fade:1
Arpeggio no:CMP4B
idx:48 mask:7 rate:4 len:4 vol:31

9405450574B445B425B474452:0
4405A4057434744405A40574405A40574
062935293506350540405A40574405A40574
04217440134744340405A40574405A40574
```

Verdict:

- Too Complex, especially for music fans
- UX does not provide enough freedom



Assemblyzator (ern0)

Transform bytebeat formula to assembly code...

Assemblyzator (ern0)

Transform bytebeat formula to assembly code
using a modern C compiler!

Assemblyzator (ern0)

Transform bytebeat formula to assembly code using a modern C compiler!

```
int main() {  
    int result = 0;  
  
    for (int i = 0; i < 100; i++) {  
        for (int j = 0; j < 100; j++) {  
            result += i * j;  
        }  
    }  
  
    return result;  
}
```

```
b8 e4 e0 75 01  
5c3
```

```
main:  
    mov     eax,0x175e0e4  
    ret
```

Assemblyzator (ern0)

Transform bytebeat formula to assembly code using a modern C compiler!

```
int main() {  
    int result = 0;  
  
    for (int i = 0; i < 100; i++) {  
        for (int j = 0; j < 100; j++) {  
            result += i * j;  
        }  
    }  
  
    return result;  
}
```

```
b8 e4 e0 75 01  
5c3
```

```
main:  
    mov     eax, 0x175e0e4  
    ret
```

Very optimized!
Such compiler!



Assemblyzator (ern0)

Transform bytebeat formula to assembly code using a modern C compiler!

int main() {
 int result = 0;

 for (int i = 0; i < 100; i++) {
 for (int j = 0; j < 100; j++) {
 result += i * j;
 }
 }

 return result;
}

b8 00 00 00 01
5c3
ret

~~Vc, optimized!
such compiler!~~



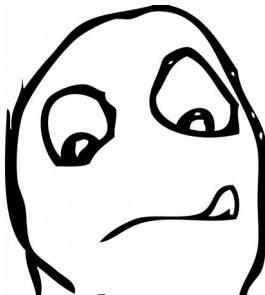
No modern compiler exists for **16-bit** target.

Assemblyzator (ern0)

Let's write a compiler thing!

Assemblylyzator (ern0)

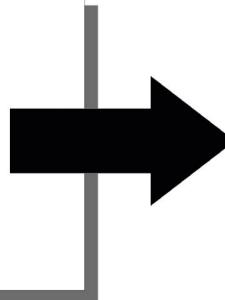
Let's write a compiler thing!



Split complex bytebeat formula
to series of simple formulas,
which is close to assembly

Assemblyzator (ern0)

```
((t<<1) ^ ((t<<1) +  
(t>>7) &t>>12)) |  
t>>(4- (1^7&(t>>19)))  
| t>>7
```



```
var3 = t << 1  
var7 = t >> 7  
var5 = var3 + var7  
var6 = t >> 12  
var4 = var5 & var6  
var1 = var3 ^ var4  
var12 = t >> 19  
var11 = 7 & var12  
var10 = 1 ^ var11  
var9 = -var10  
var9 = var9 + 4  
var8 = t >> var9  
var2 = var8 | var7  
result = var1 | var2
```

Assemblyzator (ern0)

Features:

- split formula

Assemblyzator (ern0)

Features:

- split formula
- handle num arrays

Assemblyzator (ern0)

Features:

- split formula
- handle num arrays
- handle string arrays

Assemblyzator (ern0)

Features:

- split formula
- handle num arrays
- handle string arrays
- remove duplications

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- split formula
- handle num arrays
- handle string arrays
- remove duplications

Design Flaws:

- 3-op ($A = B \text{ op } C$)
8086 assembly instructions are 2-operand

Assemblyzator (ern0)

Features:

- split formula
- handle num arrays
- handle string arrays
- remove duplications

Design Flaws:

- 3-op ($A = B \text{ op } C$)
8086 assembly instructions are 2-operand
- can't handle cond. op.
 $A = (B \text{ op } C ? D : E)$
improperly designed Abstract Syntax Tree

Assemblyzator (ern0)

Features:

- split formula
- handle num arrays
- handle string arrays
- remove duplications

Design Flaws:

- 3-op ($A = B \text{ op } C$)
8086 assembly instructions are 2-operand
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 $A = (B \text{ op } C ? D : E)$
improperly designed Abstract Syntax Tree

Verdict:

- nice try, but does not help much

Assemblyzator (ern0)

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- split formula
- handle num arrays
- handle string arrays
- remove duplications

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- 3-op ($A = B \text{ op } C$)
8086 assembly instructions are 2-operand
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 $A = (B \text{ op } C ? D : E)$
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Verdict:

- nice try, but does not help much
- writing a compiler is not as easy as it looks first

Assemblyzator (ern0)

Features:

- split formula
- handle num arrays
- handle string arrays
- remove duplications

Verdict:

- nice try, but it does not help much
- writing a compiler is not as easy as it looks first

Design Flaws:

- 3-op ($A = B \text{ op } C$)
8086 assembly instructions are 2-operand
can't handle cond. op.
(A op, B ? C : D)
improperly designed Abstract Syntax Tree



[TomCat] *Instead of creating universal tools,
we should choose one song and
optimize for it*

[ern0] *Right, I'll pick a song*



Some hours later...

[ern0] *I got the perfect one.*

Making of **549NOTES.COM**

the 256-byte intro for PC-DOS which plays 549 notes

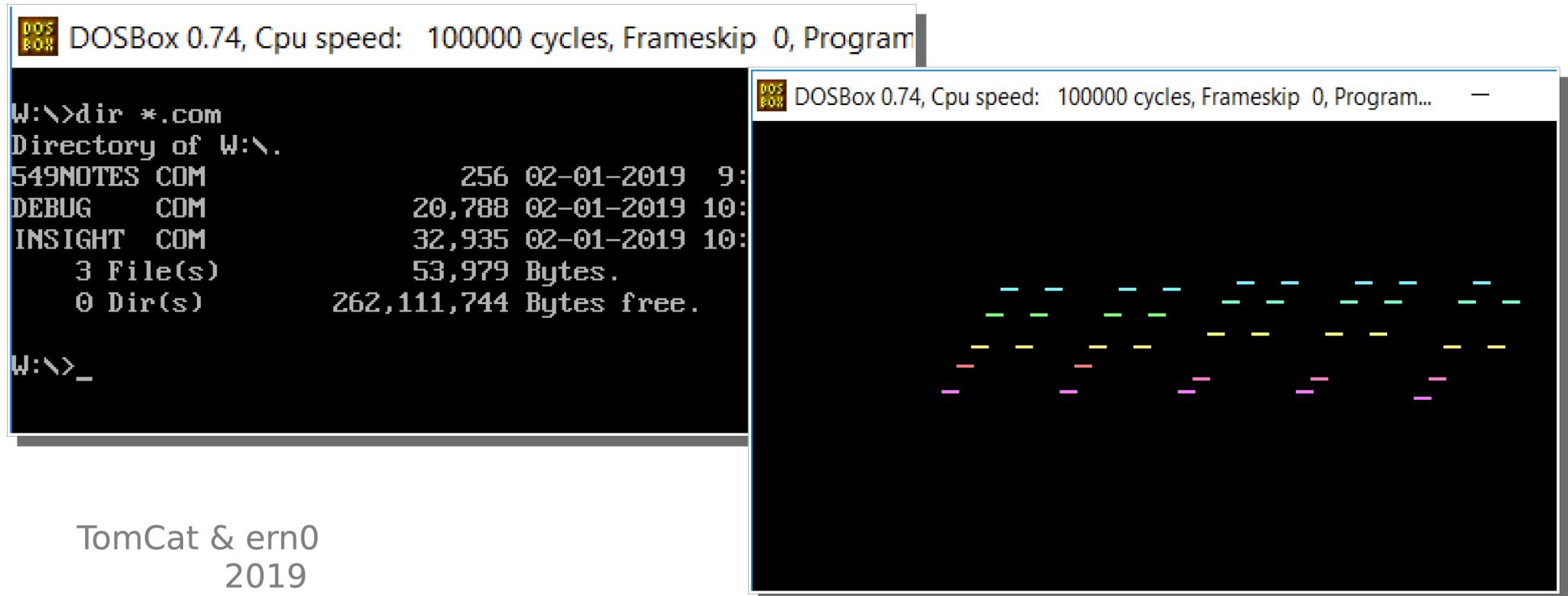


Table Of Contents

I. Song ★★★★☆

II. Data ★★★★★☆

III. Code ★★★★★★

I. Song

Prelude I

In C major

BWV 846

Johann Sebastian Bach (1685 - 1750)

Piano

This system shows the beginning of the prelude. The treble staff consists of eighth-note pairs followed by a rest. The bass staff consists of quarter notes with fermatas. The key signature is C major.

This system continues the pattern established in the first system. The treble staff has eighth-note pairs followed by rests. The bass staff has quarter notes with fermatas. A sharp sign appears in the key signature, indicating a temporary change to G major.

J. S. Bach: Prelude I. in C Major (BWV 846)

1. Popular, well-known piece

J. S. Bach: Prelude I. in C Major (BWV 846)

1. Popular, well-known piece
2. Written for piano: optimal for MIDI...

J. S. Bach: Prelude I. in C Major (BWV 846)

- Piano (patch 1) is the default instrument on all channels for all General MIDI instruments

J. S. Bach: Prelude I. in C Major (BWV 846)

- Piano (patch 1) is the default instrument on all channels for all General MIDI instruments

*Switch sound card
to MIDI mode:*

```
mov    al,3fH
mov    dx,331H
out    dx,al
```

J. S. Bach: Prelude I. in C Major (BWV 846)

- Piano (patch 1) is the default instrument on all channels for all General MIDI instruments
- Chord breaks: no „key up” message needed

*Switch sound card
to MIDI mode:*

```
mov    al,3fH
mov    dx,331H
out    dx,al
```

J. S. Bach: Prelude I. in C Major (BWV 846)

- Piano (patch 1) is the default instrument on all channels for all General MIDI instruments
- Chord breaks: no „key up” message needed

Switch sound card to MIDI mode:

```
mov    al,3fH  
mov    dx,331H  
out    dx,al
```

Play a note:

```
dec    dx  
mov    al,90H ; key down, ch=1  
out    dx,al  
lodsb          ; pitch  
out    dx,al  
mov    al,7fH ; velocity=127  
out    dx,al
```

J. S. Bach: Prelude I. in C Major (BWV 846)

- Piano (patch 1) is the default instrument on all channels for all General MIDI instruments
- Chord breaks: “key up” message needed

Switch sound card to MIDI mode:

```
mov al,3fH  
mov dx,331H  
out dx,al
```



```
90H ; key down, ch=1  
al  
; pitch  
al  
al  
al  
mov al,7fH ; velocity=127  
out dx,al
```

J. S. Bach: Prelude I. in C Major (BWV 846)

1. Popular, well-known piece
2. Written for piano: optimal for MIDI
3. Simple rhythm, only a few tempo changes...

J. S. Bach: Prelude I. in C Major (BWV 846)

Tempo changes:

- slow down around the end

J. S. Bach: Prelude I. in C Major (BWV 846)

Tempo changes:

- slow down around the end
- set minimal pause for the last 5-note chord

J. S. Bach: Prelude I. in C Major (BWV 846)

1. Popular, well-known piece
2. Written for piano: optimal for MIDI
3. Simple rhythm, only a few tempo changes
4. Contains repeating patterns...

J. S. Bach: *Prelude I. in C Major (BWV 846)*

Repeating patterns 1/2:

Piano

The musical score displays two staves for a piano. The top staff uses a treble clef and a common time signature (indicated by a '4'). The bottom staff uses a bass clef and a common time signature. Both staves feature a key signature of one sharp (F#). The music consists of repeating eighth-note patterns. In the treble clef staff, the pattern is a rest followed by a sixteenth note, then a sixteenth note followed by a sixteenth note. In the bass clef staff, the pattern is a sixteenth note followed by a sixteenth note, then a sixteenth note followed by a sixteenth note. The patterns are identical in both staves.

J. S. Bach: Prelude I. in C Major (BWV 846)

Repeating patterns 1/2:

Piano

4

J. S. Bach: *Prelude I. in C Major (BWV 846)*

Repeating patterns 1/2:

Piano

16 → 8 notes

J. S. Bach: *Prelude I. in C Major (BWV 846)*

Repeating patterns 2/2:

Piano

The musical score consists of two staves for piano. The top staff is in common time (4/4) and the bottom staff is also in common time (4/4). Both staves feature a repeating pattern of eighth-note pairs followed by a sixteenth-note pair, with a bass note on the first beat of each measure. The pattern repeats four times in the top staff and five times in the bottom staff.

J. S. Bach: *Prelude I. in C Major (BWV 846)*

Repeating patterns 2/2:

Piano

The image displays two staves of a musical score for piano, labeled "Piano" on the left. The top staff is in common time (indicated by a "4") and the bottom staff is in common time (indicated by a "4"). Both staves begin with a bass clef and a treble clef. The music consists of eighth-note patterns. In the first measure, the right hand has a pattern of eighth notes (purple shading) and the left hand has a sustained note followed by a bass note. This pattern repeats three times. In the fourth measure, there is a change in the right-hand pattern, which is highlighted with green shading. The left hand continues its sustained note and bass note pattern. The bottom staff follows the same pattern as the top staff, starting with a bass note and a sustained note. The right-hand patterns are shaded in purple, yellow, and red across the measures.

J. S. Bach: *Prelude I. in C Major (BWV 846)*

Repeating patterns 2/2:

Piano

The image shows a musical score for the piano. The top staff is in common time (indicated by '4') and the bottom staff is in common time (indicated by '4'). The music consists of eighth-note patterns. The first four measures are highlighted with purple shading, and the last three measures are highlighted with green shading. The bassoon part is also visible at the bottom of the page.

8 → 5 notes

The image shows a musical score for the piano. The top staff is in common time (indicated by '4') and the bottom staff is in common time (indicated by '4'). The music consists of eighth-note patterns. The first four measures are highlighted with blue shading, and the last three measures are highlighted with red shading. The bassoon part is also visible at the bottom of the page.

Raw Data

<i>part</i>	<i>effective notes</i>	<i>raw data</i>
<i>repeating</i>	512	160
<i>non-repeating</i>	32	32
<i>final chord</i>	5	5
<i>total</i>	549	197

II. Data

Data analysis

```
"c-3","e-3","g-3","c-4","e-4",
"c-3","d-3","a-3","d-4","f-4",
"h-2","d-3","g-3","d-4","f-4",
"c-3","e-3","g-3","c-4","e-4",
"c-3","e-3","a-3","e-4","a-4",
"c-3","d-3","f#3","a-3","d-4",
"h-2","d-3","g-3","d-4","g-4",
"h-2","c-3","e-3","g-3","c-4",
"a-2","c-3","e-3","g-3","c-4",
"d-2","a-2","d-3","f#3","c-4",
"g-2","h-2","d-3","g-3","h-3",
"g-2","a#2","e-3","g-3","c#4",
"f-2","a-2","d-3","a-3","d-4",
"f-2","g#2","d-3","f-3","h-3",
"e-2","g-2","c-3","g-3","c-4",
"e-2","f-2","a-2","c-3","f-3",
"d-2","f-2","a-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-2","e-2","g-2","c-3","e-3",
"c-2","g-2","a#2","c-3","e-3",
"f-1","f-2","a-2","c-3","e-3",
"f#1","c-2","a-2","c-3","e-3",
"g#1","f-2","h-2","c-3","d-3",
"g-1","f-2","g-2","h-2","d-3",
"g-1","e-2","g-2","c-3","e-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"g-1","d#2","a-2","c-3","f#3",
"g-1","e-2","g-2","c-3","g-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-1","c-2","g-2","a#2","e-3"
```

Part 1:

Data analysis

```
"c-3","e-3","g-3","c-4","e-4",
"c-3","d-3","a-3","d-4","f-4",
"h-2","d-3","g-3","d-4","f-4",
"c-3","e-3","g-3","c-4","e-4",
"c-3","e-3","a-3","e-4","a-4",
"c-3","d-3","f#3","a-3","d-4",
"h-2","d-3","g-3","d-4","g-4",
"h-2","c-3","e-3","g-3","c-4",
"a-2","c-3","e-3","g-3","c-4",
"d-2","a-2","d-3","f#3","c-4",
"g-2","h-2","d-3","g-3","h-3",
"g-2","a#2","e-3","g-3","c#4",
"f-2","a-2","d-3","a-3","d-4",
"f-2","g#2","d-3","f-3","h-3",
"e-2","g-2","c-3","g-3","c-4",
"e-2","f-2","a-2","c-3","f-3",
"d-2","f-2","a-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-2","e-2","g-2","c-3","e-3",
"c-2","g-2","a#2","c-3","e-3",
"f-1","f-2","a-2","c-3","e-3",
"f#1","c-2","a-2","c-3","e-3",
"g#1","f-2","h-2","c-3","d-3",
"g-1","f-2","g-2","h-2","d-3",
"g-1","e-2","g-2","c-3","e-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"g-1","d#2","a-2","c-3","f#3",
"g-1","e-2","g-2","c-3","g-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-1","c-2","g-2","a#2","e-3"
```

Part 1:

- 32 lines x 5 notes

Data analysis

```
"c-3","e-3","g-3","c-4","e-4",
"c-3","d-3","a-3","d-4","f-4",
"h-2","d-3","g-3","d-4","f-4",
"c-3","e-3","g-3","c-4","e-4",
"c-3","e-3","a-3","e-4","a-4",
"c-3","d-3","f#3","a-3","d-4",
"h-2","d-3","g-3","d-4","g-4",
"h-2","c-3","e-3","g-3","c-4",
"a-2","c-3","e-3","g-3","c-4",
"d-2","a-2","d-3","f#3","c-4",
"g-2","h-2","d-3","g-3","h-3",
"g-2","a#2","e-3","g-3","c#4",
"f-2","a-2","d-3","a-3","d-4",
"f-2","g#2","d-3","f-3","h-3",
"e-2","g-2","c-3","g-3","c-4",
"e-2","f-2","a-2","c-3","f-3",
"d-2","f-2","a-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-2","e-2","g-2","c-3","e-3",
"c-2","g-2","a#2","c-3","e-3",
"f-1","f-2","a-2","c-3","e-3",
"f#1","c-2","a-2","c-3","e-3",
"g#1","f-2","h-2","c-3","d-3",
"g-1","f-2","g-2","h-2","d-3",
"g-1","e-2","g-2","c-3","e-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"g-1","d#2","a-2","c-3","f#3",
"g-1","e-2","g-2","c-3","g-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-1","c-2","g-2","a#2","e-3"
```

Part 1:

- 32 lines x 5 notes
- last 3 notes are repeated

Data analysis

```
"c-3","e-3","g-3","c-4","e-4",
"c-3","d-3","a-3","d-4","f-4",
"h-2","d-3","g-3","d-4","f-4",
"c-3","e-3","g-3","c-4","e-4",
"c-3","e-3","a-3","e-4","a-4",
"c-3","d-3","f#3","a-3","d-4",
"h-2","d-3","g-3","d-4","g-4",
"h-2","c-3","e-3","g-3","c-4",
"a-2","c-3","e-3","g-3","c-4",
"d-2","a-2","d-3","f#3","c-4",
"g-2","h-2","d-3","g-3","h-3",
"g-2","a#2","e-3","g-3","c#4",
"f-2","a-2","d-3","a-3","d-4",
"f-2","g#2","d-3","f-3","h-3",
"e-2","g-2","c-3","g-3","c-4",
"e-2","f-2","a-2","c-3","f-3",
"d-2","f-2","a-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-2","e-2","g-2","c-3","e-3",
"c-2","g-2","a#2","c-3","e-3",
"f-1","f-2","a-2","c-3","e-3",
"f#1","c-2","a-2","c-3","e-3",
"g#1","f-2","h-2","c-3","d-3",
"g-1","f-2","g-2","h-2","d-3",
"g-1","e-2","g-2","c-3","e-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"g-1","d#2","a-2","c-3","f#3",
"g-1","e-2","g-2","c-3","g-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-1","c-2","g-2","a#2","e-3"
```

Part 1:

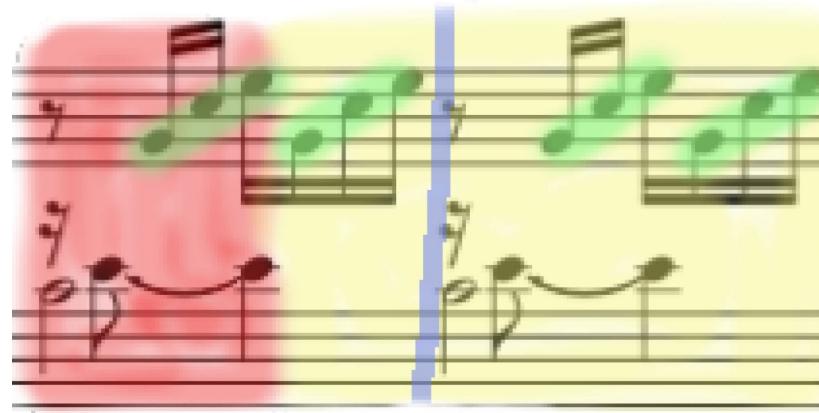
- 32 lines x 5 notes
- last 3 notes are repeated
- (8-note) lines are repeated

Data analysis

```
"c-3", "e-3", "g-3", "c-4", "e-4",
"c-3", "d-3", "a-3", "d-4", "f-4",
"h-2", "d-3", "g-3", "d-4", "f-4",
"c-3", "e-3", "g-3", "c-4", "e-4",
"c-3", "e-3", "a-3", "e-4", "a-4",
"c-3", "d-3", "f#3", "a-3", "d-4",
"h-2", "d-3", "g-3", "d-4", "g-4",
"h-2", "c-3", "e-3", "g-3", "c-4",
"a-2", "c-3", "e-3", "g-3", "c-4",
"d-2", "a-2", "d-3", "f#3", "c-4",
"g-2", "h-2", "d-3", "g-3", "h-3",
"g-2", "a#2", "e-3", "g-3", "c#4",
"f-2", "a-2", "d-3", "a-3", "d-4",
"f-2", "g#2", "d-3", "f-3", "h-3",
"e-2", "g-2", "c-3", "g-3", "c-4",
"e-2", "f-2", "a-2", "c-3", "f-3",
"d-2", "f-2", "a-2", "c-3", "f-3",
"g-1", "d-2", "g-2", "h-2", "f-3",
"c-2", "e-2", "g-2", "c-3", "e-3",
"c-2", "g-2", "a#2", "c-3", "e-3",
"f-1", "f-2", "a-2", "c-3", "e-3",
"f#1", "c-2", "a-2", "c-3", "e-3",
"g#1", "f-2", "h-2", "c-3", "d-3",
"g-1", "f-2", "g-2", "h-2", "d-3",
"g-1", "e-2", "g-2", "c-3", "e-3",
"g-1", "d-2", "g-2", "c-3", "f-3",
"g-1", "d-2", "g-2", "h-2", "f-3",
"g-1", "d#2", "a-2", "c-3", "f#3",
"g-1", "e-2", "g-2", "c-3", "g-3",
"g-1", "d-2", "g-2", "c-3", "f-3",
"g-1", "d-2", "g-2", "h-2", "f-3",
"c-1", "c-2", "g-2", "a#2", "e-3"
```

Part 1:

- 32 lines x 5 notes
- last 3 notes are repeated
- (8-note) lines are repeated



Data analysis

```
"c-3","e-3","g-3","c-4","e-4",
"c-3","d-3","a-3","d-4","f-4",
"h-2","d-3","g-3","d-4","f-4",
"c-3","e-3","g-3","c-4","e-4",
"c-3","e-3","a-3","e-4","a-4",
"c-3","d-3","f#3","a-3","d-4",
"h-2","d-3","g-3","d-4","g-4",
"h-2","c-3","e-3","g-3","c-4",
"a-2","c-3","e-3","g-3","c-4",
"d-2","a-2","d-3","f#3","c-4",
"g-2","h-2","d-3","g-3","h-3",
"g-2","a#2","e-3","g-3","c#4",
"f-2","a-2","d-3","a-3","d-4",
"f-2","g#2","d-3","f-3","h-3",
"e-2","g-2","c-3","g-3","c-4",
"e-2","f-2","a-2","c-3","f-3",
"d-2","f-2","a-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-2","e-2","g-2","c-3","e-3",
"c-2","g-2","a#2","c-3","e-3",
"f-1","f-2","a-2","c-3","e-3",
"f#1","c-2","a-2","c-3","e-3",
"g#1","f-2","h-2","c-3","d-3",
"g-1","f-2","g-2","h-2","d-3",
"g-1","e-2","g-2","c-3","e-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"g-1","d#2","a-2","c-3","f#3",
"g-1","e-2","g-2","c-3","g-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-1","c-2","g-2","a#2","e-3"
```

Part 1:

- 32 lines x 5 notes
- last 3 notes are repeated
- (8-note) lines are repeated

```
"c-1","c-2","f-2","a-2","c-3","f-3","c-3","a-2",
"c-3","a-2","f-2","a-2","f-2","d-2","f-2","d-2",
"c-1","h-1","g-3","h-3","d-4","f-4","d-4","h-3",
"d-4","h-3","g-3","h-3","d-3","f-3","e-3","d-3"
```

Part 2:

- 32 notes
- no tricks

Data analysis

```
"c-3","e-3","g-3","c-4","e-4",
"c-3","d-3","a-3","d-4","f-4",
"h-2","d-3","g-3","d-4","f-4",
"c-3","e-3","g-3","c-4","e-4",
"c-3","e-3","a-3","e-4","a-4",
"c-3","d-3","f#3","a-3","d-4",
"h-2","d-3","g-3","d-4","g-4",
"h-2","c-3","e-3","g-3","c-4",
"a-2","c-3","e-3","g-3","c-4",
"d-2","a-2","d-3","f#3","c-4",
"g-2","h-2","d-3","g-3","h-3",
"g-2","a#2","e-3","g-3","c#4",
"f-2","a-2","d-3","a-3","d-4",
"f-2","g#2","d-3","f-3","h-3",
"e-2","g-2","c-3","g-3","c-4",
"e-2","f-2","a-2","c-3","f-3",
"d-2","f-2","a-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-2","e-2","g-2","c-3","e-3",
"c-2","g-2","a#2","c-3","e-3",
"f-1","f-2","a-2","c-3","e-3",
"f#1","c-2","a-2","c-3","e-3",
"g#1","f-2","h-2","c-3","d-3",
"g-1","f-2","g-2","h-2","d-3",
"g-1","e-2","g-2","c-3","e-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"g-1","d#2","a-2","c-3","f#3",
"g-1","e-2","g-2","c-3","g-3",
"g-1","d-2","g-2","c-3","f-3",
"g-1","d-2","g-2","h-2","f-3",
"c-1","c-2","g-2","a#2","e-3"
```

Part 1:

- 32 lines x 5 notes
- last 3 notes are repeated
- (8-note) lines are repeated

```
"c-1","c-2","f-2","a-2","c-3","f-3","c-3","a-2",
"c-3","a-2","f-2","a-2","f-2","d-2","f-2","d-2",
"c-1","h-1","g-3","h-3","d-4","f-4","d-4","h-3",
"d-4","h-3","g-3","h-3","d-3","f-3","e-3","d-3"
```

Part 2:

- 32 notes
- no tricks

```
"c-1","c-2","e-3","g-3","c-4"
```

Part3:

- 5 notes
- no tricks

Histogram of raw (31 values, 197 notes)

; c-1:36	4	####		; 1.	c-3:60	23	#####
; f-1:41	1	#		; 2.	g-2:55	14	#####
; f#1:42	1	#		; 3.	e-3:64	14	#####
; g-1:43	9	#####		; 4.	g-3:67	13	#####
; g#1:44	1	#		; 5.	d-3:62	12	#####
; h-1:47	1	#		; 6.	a-2:57	12	#####
; c-2:48	6	#####		; 7.	f-2:53	11	#####
; d-2:50	9	#####		; 8.	f-3:65	10	#####
; d#2:51	1	#		; 9.	h-2:59	9	#####
; e-2:52	5	####		; 10.	g-1:43	9	#####
; f-2:53	11	#####		; 11.	d-2:50	9	#####
; g-2:55	14	#####		; 12.	d-4:74	8	#####
; g#2:56	1	#		; 13.	c-4:72	7	#####
; a-2:57	12	#####		; 14.	h-3:71	6	#####
; a#2:58	3	##		; 15.	c-2:48	6	#####
; h-2:59	9	#####		; 16.	e-2:52	5	#####
; c-3:60	23	#####		; 17.	c-1:36	4	#####
; d-3:62	12	#####		; 18.	a-3:69	4	#####
; e-3:64	14	#####		; 19.	f-4:77	3	###
; f-3:65	10	#####		; 20.	f#3:66	3	###
; f#3:66	3	##		; 21.	e-4:76	3	###
; g-3:67	13	#####		; 22.	a#2:58	3	###
; a-3:69	4	##		; 23.	h-1:47	1	#
; h-3:71	6	##		; 24.	g-4:79	1	#
; c-4:72	7	##		; 25.	g#2:56	1	#
; c#4:73	1	#		; 26.	g#1:44	1	#
; d-4:74	8	##		; 27.	f-1:41	1	#
; e-4:76	3	##		; 28.	f#1:42	1	#
; f-4:77	3	##		; 29.	d#2:51	1	#
; g-4:79	1	#		; 30.	c#4:73	1	#
; a-4:81	1	#		; 31.	a-4:81	1	#

Histogram of raw (31 values, 197 notes)

; c-1:36	4	####		; 1. c-3:60	23	#####
; f-1:41	1	#		; 2. g-2:55	14	#####
; f#1:42	1	#		; 3. e-3:64	14	#####
; g-1:43	9	#####		; 4. g-3:67	13	#####
; g#1:44	1	#		; 5. d-3:62	12	#####
; h-1:47	1	#		; 6. g-2:53	11	#####
; c-2:48	6	#####		; 7. f-2:53	11	#####
; d-2:50	9	#####		; 8. f-3:65	10	#####
; d#2:51	1	#		; 9. h-2:59	9	#####
; e-2:52	5	#####		; 10. g-1:42	8	#####
; f-2:53	11	#####		; 11. d-2:51	8	#####
; g-2:55	14	#####		; 12. d-4:74	8	#####
; g#2:56	1	#		; 13. c-4:72	7	#####
; a-2:57	12	#####		; 14. h-3:71	6	#####
; a#2:58	3	##		; 15. c-2:48	6	#####
; h-2:59	9	#####		; 16. e-2:52	5	#####
; c-3:60	23	#####		; 17. c-1:36	4	#####
; d-3:62	12	#####		; 18. a-3:69	4	#####
; e-3:64	14	#####		; 19. f-4:77	3	###
; f-3:65	10	#####		; 20. f#3:66	3	###
; f#3:66	3	##		; 21. e-4:76	3	###
; g-3:67	13	#####		; 22. a#2:58	3	###
; a-3:69	4	##		; 23. h-1:47	1	#
; h-3:71	6	##		; 24. g-4:79	1	#
; c-4:72	7	##		; 25. g#2:56	1	#
; c#4:73	1	#		; 26. g#1:44	1	#
; d-4:74	8	##		; 27. f-1:41	1	#
; e-4:76	3	##		; 28. f#1:42	1	#
; f-4:77	3	##		; 29. d#2:51	1	#
; g-4:79	1	#		; 30. c#4:73	1	#
; a-4:81	1	#		; 31. a-4:81	1	#

notes: 5 bit x 197 = 124 byte
table: 31 byte
total: 155 byte

Histogram of raw (31 values, 197 notes)

; c-1:36	4	####		; 1. c-3:60	23	#####
; f-1:41	1	#		; 2. g-2:55	14	#####
; f#1:42	1	#		; 3. e-3:64	14	#####
; g-1:43	9	#####		; 4. g-3:67	13	#####
; g#1:44	1	#		; 5. d-3:62	12	#####
; h-1:47	1	#		; 6. a-2:59	12	#####
; c-2:48	6	####		; 7. f-2:53	11	#####
; d-2:50	9	####		; 8. f-3:65	10	#####
; d#2:51	1	#		; 9. h-2:59	9	#####
; e-2:52	5	##		; 10. g-1:43	9	#####
; f-2:53	11	+		; 11. d-2:50	9	#####
; g-2:55	14	#####		; 12. d-4:74	8	#####
; g#2:56	1	#		; 13. c-4:72	7	#####
; a-2:57	12	#####		; 14. h-3:71	6	#####
; a#2:58	3	##		; 15. c-2:48	6	#####
; h-2:59	9	#####		; 16. e-2:52	5	#####
; c-3:60	23	#####		; 17. c-1:36	4	#####
; d-3:62	12	#####		; 18. a-3:69	4	#####
; e-3:64	14	#####		; 19. f-4:77	3	#####
; f-3:65	10	#####		; 20. f#3:66	3	#####
; f#3:66	3	##		; 21. e-4:76	3	#####
; g-3:67	13	#####		; 22. a#2:58	3	#####
; a-3:69	4	##		; 23. h-1:47	1	#
; h-3:71	6	##		; 24. g-4:79	1	#
; c-4:72	7	##		; 25. g#2:56	1	#
; c#4:73	1	#		; 26. g#1:44	1	#
; d-4:74	8	##		; 27. f-1:41	1	#
; e-4:76	3	##		; 28. f#1:42	1	#
; f-4:77	3	##		; 29. d#2:51	1	#
; g-4:79	1	#		; 30. c#4:73	1	#
; a-4:81	1	#		; 31. a-4:81	1	#

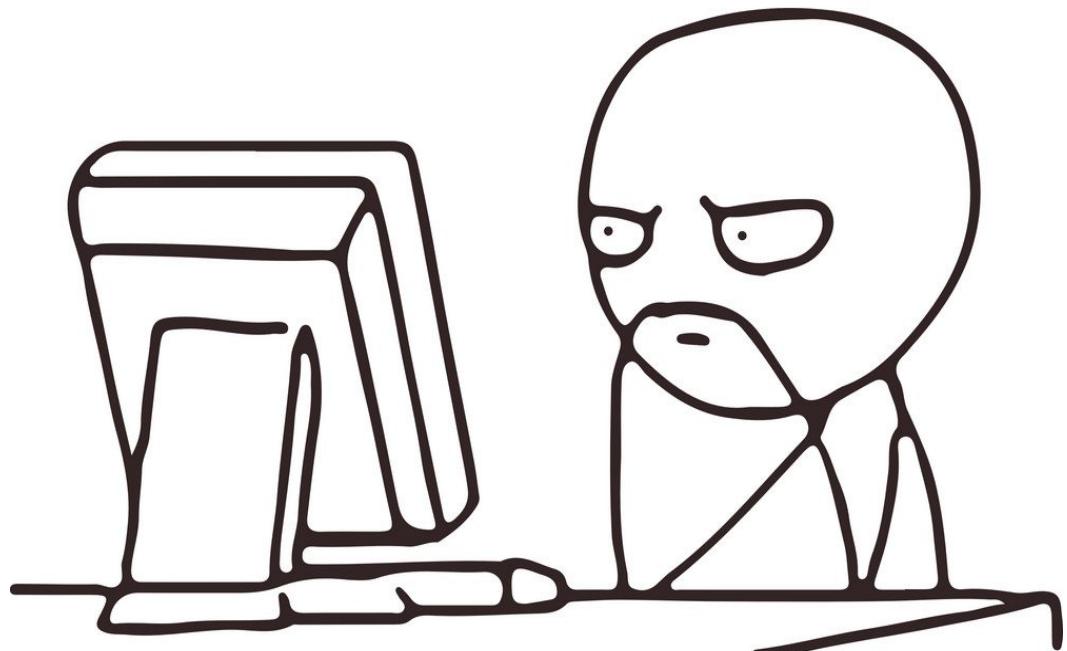
note range: 36 .. 81: 45 values

values: 6 bit x 197 = 148 byte

Think Diff

```
; c-3:60  e-3:64  g-3:67  c-4:72  e-4:76  (...)  
; c-3:60  d-3:62  a-3:69  d-4:74  f-4:77  (...)  
; h-2:59  d-3:62  g-3:67  d-4:74  f-4:77  (...)  
; c-3:60  e-3:64  g-3:67  c-4:72  e-4:76  (...)  
; c-3:60  e-3:64  a-3:69  e-4:76  a-4:81  (...)  
; c-3:60  d-3:62  f#3:66  a-3:69  d-4:74  (...)  
; h-2:59  d-3:62  g-3:67  d-4:74  g-4:79  (...)  
; h-2:59  c-3:60  e-3:64  g-3:67  c-4:72  (...)  
; a-2:57  c-3:60  e-3:64  g-3:67  c-4:72  (...)  
; d-2:50  a-2:57  d-3:62  f#3:66  c-4:72  (...)  
; g-2:55  h-2:59  d-3:62  g-3:67  h-3:71  (...)  
; g-2:55  a#2:58  e-3:64  g-3:67  c#4:73  (...)  
; f-2:53  a-2:57  d-3:62  a-3:69  d-4:74  (...)  
; f-2:53  g#2:56  d-3:62  f-3:65  h-3:71  (...)  
; e-2:52  g-2:55  c-3:60  g-3:67  c-4:72  (...)  
; e-2:52  f-2:53  a-2:57  c-3:60  f-3:65  (...)  
; d-2:50  f-2:53  a-2:57  c-3:60  f-3:65  (...)  
; g-1:43  d-2:50  g-2:55  h-2:59  f-3:65  (...)  
; c-2:48  e-2:52  g-2:55  c-3:60  e-3:64  (...)  
; c-2:48  g-2:55  a#2:58  c-3:60  e-3:64  (...)  
; f-1:41  f-2:53  a-2:57  c-3:60  e-3:64  (...)  
; f#1:42  c-2:48  a-2:57  c-3:60  e-3:64  (...)  
; g#1:44  f-2:53  h-2:59  c-3:60  d-3:62  (...)  
; g-1:43  f-2:53  g-2:55  h-2:59  d-3:62  (...)  
; g-1:43  e-2:52  g-2:55  c-3:60  e-3:64  (...)  
; g-1:43  d-2:50  g-2:55  c-3:60  f-3:65  (...)  
; g-1:43  d-2:50  g-2:55  h-2:59  f-3:65  (...)  
; g-1:43  d#2:51  a-2:57  c-3:60  f#3:66  (...)  
; g-1:43  e-2:52  g-2:55  c-3:60  g-3:67  (...)  
; g-1:43  d-2:50  g-2:55  c-3:60  f-3:65  (...)  
; g-1:43  d-2:50  g-2:55  h-2:59  f-3:65  (...)  
; c-1:36  c-2:48  g-2:55  a#2:58  e-3:64  (...)
```

```
; c-1:36  c-2:48  f-2:53  a-2:57  c-3:60  f-3:65  c-3:60  a-2:57  
; c-3:60  a-2:57  f-2:53  a-2:57  f-2:53  d-2:50  f-2:53  d-2:50  
; c-1:36  h-1:47  g-3:67  h-3:71  d-4:74  f-4:77  d-4:74  h-3:71  
; d-4:74  h-3:71  g-3:67  h-3:71  d-3:62  f-3:65  e-3:64  d-3:62  
; c-1:36  c-2:48  e-3:64  g-3:67  c-4:72
```



Think Diff

```
; c-3:60 e-3:64 g-3:67 c-4:72 e-4:76 (...)  
; c-3:60 d-3:62 a-3:69 d-4:74 f-4:77 (...)  
; h-2:59 d-3:62 g-3:67 d-4:74 f-4:77 (...)  
; c-3:60 e-3:64 g-3:67 c-4:72 e-4:76 (...)  
; a-3:60 e-3:64 a-3:69 e-4:76 a-4:81 (...)  
; c-3:60 d-3:62 f#3:66 a-3:69 d-4:74 (...)  
h-2:59 d-3:62 g-3:67 d-4:74 g-4:79 (...)  
h-2:59 c-3:60 e-3:64 g-3:67 c-4:72 (...)  
a-2:57 c-3:60 e-3:64 g-3:67 c-4:72 (...)  
d-2:50 a-2:57 d-3:62 f#3:66 c-4:72 (...)  
g-2:55 h-2:59 d-3:62 g-3:67 h-3:71 (...)  
g-2:55 a#2:58 e-3:64 g-3:67 c#4:73 (...)  
f-2:53 a-2:57 d-3:62 a-3:69 d-4:74 (...)  
e-2:53 g#2:56 d-3:62 a-3:69 d-4:71 (...)  
e-2:52 g-2:55 c-3:60 g-3:67 (...)  
e-2:52 f-2:53 a-2:57 c-3:60 (...)  
d-2:50 f-2:53 a-2:57 c-3:60 f-3:65 (...)  
g-1:43 d-2:50 g-2:55 h-2:59 f-3:65 (...)  
c-2:48 e-2:52 g-2:55 c-3:60 e-3:64 (...)  
c-2:48 g-2:55 a#2:58 c-3:60 e-3:64 (...)  
f-1:41 f-2:53 a-2:57 c-3:60 e-3:64 (...)  
f#1:42 c-2:48 a-2:57 c-3:60 e-3:64 (...)  
g#1:44 f-2:53 h-2:59 c-3:60 d-3:62 (...)  
g-1:43 f-2:53 g-2:55 h-2:59 d-3:62 (...)  
g-1:43 e-2:52 g-2:55 c-3:60 e-3:64 (...)  
g-1:43 d-2:50 g-2:55 c-3:60 f-3:65 (...)  
g-1:43 d-2:50 g-2:55 h-2:59 f-3:65 (...)  
g-1:43 d#2:51 a-2:57 c-3:60 f#3:66 (...)  
g-1:43 e-2:52 g-2:55 c-3:60 g-3:67 (...)  
g-1:43 d-2:50 g-2:55 c-3:60 f-3:65 (...)  
g-1:43 d-2:50 g-2:55 h-2:59 f-3:65 (...)  
c-1:36 c-2:48 g-2:55 a#2:58 e-3:64 (...)
```

```
; c-1:36 c-2:48 f-2:53 a-2:57 c-3:60 f-3:65 c-3:60 a-2:57  
; c-3:60 a-2:57 f-2:53 a-2:57 f-2:53 d-2:50 f-2:53 d-2:50  
; c-1:36 h-1:47 g-3:67 h-3:71 d-4:74 f-4:77 d-4:74 h-3:71  
; d-4:74 h-3:71 g-3:67 h-3:71 d-3:62 f-3:65 e-3:64 d-3:62  
; c-1:36 c-2:48 e-3:64 g-3:67 c-4:72
```

Focus on values of Part 1



Think Diff

c-3:60	e-3:64	g-3:67	c-4:72	e-4:76	d-2:50	f-2:53	a-2:57	c-3:60	f-3:65
c-3:60	d-3:62	a-3:69	d-4:74	f-4:77	g-1:43	d-2:50	g-2:55	h-2:59	f-3:65
h-2:59	d-3:62	g-3:67	d-4:74	f-4:77	c-2:48	e-2:52	g-2:55	c-3:60	e-3:64
c-3:60	e-3:64	g-3:67	c-4:72	e-4:76	c-2:48	g-2:55	a#2:58	c-3:60	e-3:64
c-3:60	e-3:64	a-3:69	e-4:76	a-4:81	f-1:41	f-2:53	a-2:57	c-3:60	e-3:64
c-3:60	d-3:62	f#3:66	a-3:69	d-4:74	f#1:42	c-2:48	a-2:57	c-3:60	e-3:64
h-2:59	d-3:62	g-3:67	d-4:74	g-4:79	g#1:44	f-2:53	h-2:59	c-3:60	e-3:64
h-2:59	c-3:60	e-3:64	g-3:67	c-4:72	g-1:43	f-2:53	g-2:55	h-2:59	d-3:62
a-2:57	c-3:60	e-3:64	g-3:67	c-4:72	g-1:43	e-2:52	g-2:55	c-3:60	d-3:62
d-2:50	a-2:57	d-3:62	f#3:66	c-4:72	g-1:43	d-2:50	g-2:55	c-3:60	e-3:64
g-2:55	h-2:59	d-3:62	g-3:67	h-3:71	g-1:43	d-2:50	g-2:55	c-3:60	f-3:65
g-2:55	a#2:58	e-3:64	g-3:67	c#4:73	g-1:43	d-2:50	g-2:55	h-2:59	f-3:65
f-2:53	a-2:57	d-3:62	a-3:69	d-4:74	g-1:43	d#2:51	a-2:57	c-3:60	f#3:66
f-2:53	g#2:56	d-3:62	f-3:65	h-3:71	g-1:43	e-2:52	g-2:55	c-3:60	g-3:67
e-2:52	g-2:55	c-3:60	g-3:67	c-4:72	g-1:43	d-2:50	g-2:55	c-3:60	f-3:65
e-2:52	f-2:53	a-2:57	c-3:60	f-3:65	g-1:43	d-2:50	g-2:55	h-2:59	f-3:65
					c-1:36	c-2:48	g-2:55	a#2:58	e-3:64

Think Diff

c-3:60	e-3:64	g-3:67	c-4:72	e-4:76	d-2:50	f-2:53	a-2:57	c-3:60	f-3:65
c-3:60	d-3:62	a-3:69	d-4:74	f-4:77	g-1:43	d-2:50	g-2:55	h-2:59	f-3:65
h-2:59	d-3:62	g-3:67	d-4:74	f-4:77	c-2:48	e-2:52	g-2:55	c-3:60	e-3:64
c-3:60	e-3:64	g-3:67	c-4:72	e-4:76	c-2:48	g-2:55	a#2:58	c-3:60	e-3:64
c-3:60	e-3:64	a-3:69	e-4:76	a-4:81	f-1:41	f-2:53	a-2:57	c-3:60	e-3:64
c-3:60	d-3:62	f#3:66	a-3:69	d-4:74	f#1:42	c-2:48	a-2:57	c-3:60	e-3:64
h-2:59	d-3:62	g-3:67	d-4:74	g-4:79	g#1:44	f-2:53	h-2:59	c-3:60	d-3:62
h-2:59	c-3:60	e-3:64	g-3:67	c-4:72	g-1:43	f-2:53	g-2:55	h-2:59	d-3:62
a-2:57	c-3:60	e-3:64	g-3:67	c-4:72	g-1:43	e-2:52	g-2:55	c-3:60	e-3:64
d-2:50	a-2:57	d-3:62	f#3:66	c-4:72	g-1:43	d-2:50	g-2:55	c-3:60	f-3:65
g-2:55	h-2:59	d-3:62	g-3:67	h-3:71	g-1:43	d-2:50	g-2:55	h-2:59	f-3:65
g-2:55	a#2:58	e-3:64	g-3:67	c#4:73	g-1:43	d#2:51	a-2:57	c-3:60	f#3:66
f-2:53	a-2:57	d-3:62	a-3:69	d-4:74	g-1:43	e-2:52	g-2:55	c-3:60	g-3:67
f-2:53	g#2:56	d-3:62	f-3:65	h-3:71	g-1:43	d-2:50	g-2:55	c-3:60	f-3:65
e-2:52	g-2:55	c-3:60	g-3:67	c-4:72	g-1:43	d-2:50	g-2:55	h-2:59	f-3:65
e-2:52	f-2:53	a-2:57	c-3:60	f-3:65	c-1:36	c-2:48	g-2:55	a#2:58	e-3:64

Think Diff

c-3:60	e-3:64	g-3:67	c-4:72	e-4:76
c-3:60	d-3:62	a-3:69	d-4:74	f-4:77
h-2:59	d-3:62	g-3:67	d-4:74	f-4:77
c-3:60	e-3:64	g-3:67	c-4:72	e-4:76
c-3:60	e-3:64	a-3:69	e-4:76	a-4:81
c-3:60	d-3:62	f#3:66	a-3:69	d-4:74
h-2:59	d-3:62	g-3:67	d-4:74	g-4:79
h-2:59	c-3:60	e-3:64	g-3:67	c-4:72
a-2:57	c-3:60	e-3:64	g-3:67	c-4:72
d-2:50	a-2:57	d-3:62	f#3:66	c-4:72
g-2:55	h-2:59	d-3:62	g-3:67	h-3:71
g-2:55	a#2:58	e-3:64	g-3:67	c#4:73
f-2:53	a-2:57	d-3:62	a-3:69	d-4:74
f-2:53	g#2:56	d-3:62	f-3:65	h-3:71
e-2:52	g-2:55	c-3:60	g-3:67	c-4:72
e-2:52	f-2:53	a-2:57	c-3:60	f-3:65

d-2:50	f-2:53	a-2:57	c-3:60	f-3:65
g-1:43	d-2:50	g-2:55	h-2:59	f-3:65
c-2:48	e-2:52	g-2:55	c-3:60	e-3:64
c-2:48	g-2:55	a#2:58	c-3:60	e-3:64
f-1:41	f-2:53	a-2:57	c-3:60	e-3:64
f#1:42	c-2:48	a-2:57	c-3:60	e-3:64
g#1:44	f-2:53	h-2:59	c-3:60	d-3:62
g-1:43	f-2:53	g-2:55	h-2:59	d-3:62
g-1:43	e-2:52	g-2:55	c-3:60	e-3:64
g-1:43	d-2:50	g-2:55	c-3:60	f-3:65
g-1:43	d-2:50	g-2:55	h-2:59	f-3:65
g-1:43	d#2:51	a-2:57	c-3:60	f#3:66
g-1:43	e-2:52	g-2:55	c-3:60	g-3:67
g-1:43	d-2:50	g-2:55	c-3:60	f-3:65
g-1:43	d-2:50	g-2:55	h-2:59	f-3:65
c-1:36	c-2:48	g-2:55	a#2:58	e-3:64



The raw-diff-5 theory

Think Diff: why raw-diff-5?

Why raw?

Think Diff: why raw-diff-5?

Why raw?

- Two options:
 - raw MIDI notes or
 - indexed data

Think Diff: why raw-diff-5?

Why raw?

- Two options:
 - raw MIDI notes or
 - indexed data
- Dispersion: 31 values in range of 45

Think Diff: why raw-diff-5?

Why raw?

- Two options:
 - raw MIDI notes or
 - indexed data
- Dispersion: 31 values in range of 45
- Indexed requires extra 31-byte table

Think Diff: why raw-diff-5?

Why raw?

- Two options:
 - raw MIDI notes or
 - indexed data
- Dispersion: 31 values in range of 45
- Indexed requires extra 31-byte table
- Can't compress table, only data

Think Diff: why raw-diff-5?

Why diff-5?

Think Diff: why raw-diff-5?

Why diff-5?

- Part 1 contains chord breaks

Think Diff: why raw-diff-5?

Why diff-5?

- Part 1 contains chord breaks
- Chords are evolving slowly to next one

Think Diff: why raw-diff-5?

Why diff-5?

- Part 1 contains chord breaks
- Chords are evolving slowly to next one
- Slowness is emphasized by repeating all chord breaks twice (not stored)

Think Diff: why raw-diff-5?

Why diff-5?

- Part 1 contains chord breaks
- Chords are evolving slowly to next one
- Slowness is emphasized by repeating all chord breaks twice (not stored)
- Slow change means small diffs

Think Diff: why raw-diff-5?

Why diff-5?

- Part 1 contains chord breaks
- Chords are evolving slowly to next one
- Slowness is emphasized by repeating all chord breaks twice (not stored)
- Slow change means small diffs
- Chord breaks are 8 notes long

Think Diff: why raw-diff-5?

Why diff-5?

- Part 1 contains chord breaks
- Chords are evolving slowly to next one
- Slowness is emphasized by repeating all chord breaks twice (not stored)
- Slow change means small diffs
- Chord breaks are 8 notes long
- Which are stored in 5 bytes

Think Diff: why raw-diff-5?

Why diff-5?

- Part 1 contains chord breaks
- Chords are evolving slowly to next one
- Slowness is emphasized by repeating all chord breaks twice (not stored)
- Slow change means small diffs
- Chord breaks are 8 notes long
- Which are stored in 5 bytes
- Diff-5 is diff to previous line

Think Diff: raw-diff-5 data overview

Added diff values in dump:

c-3:60:/00	e-3:64:/00	g-3:67:/00	c-4:72:/00	e-4:76:/00
c-3:60:=00	d-3:62:-02	a-3:69:+02	d-4:74:+02	f-4:77:+01
h-2:59:-01	d-3:62:=00	g-3:67:-02	d-4:74:=00	f-4:77:=00
(. . .)				

Think Diff: raw-diff-5 data overview

c-3:60:/00	e-3:64:/00	g-3:67:/00	c-4:72:/00	e-4:76:/00							
c-3:60:=00	d-3:62:-02	a-3:69:+02	d-4:74:+02	f-4:77:+01							
h-2:59:-01	d-3:62:=00	g-3:67:-02	d-4:74:=00	f-4:77:=00	d-2:50:-02	f-2:53:=00	a-2:57:=00	c-3:60:=00	f-3:65:=00		
c-3:60:+01	e-3:64:+02	g-3:67:=00	c-4:72:-02	e-4:76:-01	g-1:43:-07	d-2:50:-03	g-2:55:-02	h-2:59:-01	f-3:65:=00		
c-3:60:=00	e-3:64:=00	a-3:69:+02	e-4:76:+04	a-4:81:+05	c-2:48:+05	e-2:52:+02	g-2:55:=00	c-3:60:+01	e-3:64:-01		
c-3:60:=00	d-3:62:-02	f#3:66:-03	a-3:69:-07	d-4:74:-07	c-2:48:=00	g-2:55:+03	a#2:58:+03	c-3:60:=00	e-3:64:=00		
h-2:59:-01	d-3:62:=00	g-3:67:+01	d-4:74:+05	g-4:79:+05	f-1:41:-07	f-2:53:-02	a-2:57:-01	c-3:60:=00	e-3:64:=00		
h-2:59:=00	c-3:60:-02	e-3:64:-03	g-3:67:-07	c-4:72:-07	f#1:42:+01	c-2:48:-05	a-2:57:=00	c-3:60:=00	e-3:64:=00		
a-2:57:-02	c-3:60:=00	e-3:64:=00	g-3:67:=00	c-4:72:=00	g#1:44:+02	f-2:53:+05	h-2:59:+02	c-3:60:=00	d-3:62:-02		
d-2:50:-07	a-2:57:-03	d-3:62:-02	f#3:66:-01	c-4:72:=00	g-1:43:-01	f-2:53:=00	g-2:55:-04	h-2:59:-01	d-3:62:=00		
g-2:55:+05	h-2:59:+02	d-3:62:=00	g-3:67:+01	h-3:71:-01	g-1:43:=00	e-2:52:-01	g-2:55:=00	c-3:60:+01	e-3:64:+02		
g-2:55:=00	a#2:58:-01	e-3:64:+02	g-3:67:=00	c#4:73:+02	g-1:43:=00	d-2:50:-02	g-2:55:=00	c-3:60:=00	f-3:65:+01		
f-2:53:-02	a-2:57:-01	d-3:62:-02	a-3:69:+02	d-4:74:+01	g-1:43:=00	d-2:50:=00	g-2:55:=00	h-2:59:-01	f-3:65:=00		
f-2:53:=00	g#2:56:-01	d-3:62:=00	f-3:65:-04	h-3:71:-03	g-1:43:=00	d#2:51:+01	a-2:57:+02	c-3:60:+01	f#3:66:+01		
e-2:52:-01	g-2:55:-01	c-3:60:-02	g-3:67:+02	c-4:72:+01	g-1:43:=00	e-2:52:+01	g-2:55:-02	c-3:60:=00	g-3:67:+01		
e-2:52:=00	f-2:53:-02	a-2:57:-03	c-3:60:-07	f-3:65:-07	g-1:43:=00	d-2:50:-02	g-2:55:=00	c-3:60:=00	f-3:65:-02		
					g-1:43:=00	d-2:50:=00	g-2:55:=00	h-2:59:-01	f-3:65:=00		
					c-1:36:-07	c-2:48:-02	g-2:55:=00	a#2:58:-01	e-3:64:-01		

c-1:36:=00	c-2:48:=00	f-2:53:-02	a-2:57:-01	c-3:60:-04	f-3:65:+29	c-3:60:+12	a-2:57:+04				
c-3:60:+03	a-2:57:-03	f-2:53:-12	a-2:57:-03	f-2:53:-04	d-2:50:-10	f-2:53:-04	d-2:50:-03				
c-1:36:-21	h-1:47:-06	g-3:67:+17	h-3:71:+18	d-4:74:+24	f-4:77:+41	d-4:74:+27	h-3:71:+04				
d-4:74:+03	h-3:71:-03	g-3:67:-10	h-3:71:-03	d-3:62:-09	f-3:65:-09	e-3:64:-07	d-3:62:-05				

c-1:36:-35 c-2:48:-14 e-3:64:-01 g-3:67:+03 c-4:72:+10

Think Diff: raw-diff-5 data overview

c-3:60:/00	e-3:64:/00	g-3:67:/00	c-4:72:/00	e-4:76:/00
c-3:60:=00	d-3:62:-02	a-3:69:+02	d-4:74:+02	f-4:77:+01
h-2:59:-01	d-3:62:=00	g-3:67:-02	d-4:74:=00	f-4:77:=00
c-3:60:+01	e-3:64:+02	g-3:67:=00	c-4:72:-02	e-4:76:-01
c-3:60:=00	e-3:64:=00	a-3:69:+02	e-4:76:+04	a-4:81:+05
c-3:60:=00	d-3:62:-02	f#3:66:-03	a-3:69:-07	d-4:74:-07
h-2:59:-01	d-3:62:=00	g-3:67:+01	d-4:74:+05	g-4:79:+05
h-2:59:=00	c-3:60:-02	e-3:64:-03	g-3:67:-07	c-4:72:-07
a-2:57:-02	c-3:60:=00	e-3:64:=00	g-3:67:=00	c-4:72:=00
d-2:50:-07	a-2:57:-03	d-3:62:-02	f#3:66:-01	c-4:72:=00
g-2:55:+05	h-2:59:+02	d-3:62:=00	g-3:67:+01	h-3:71:-01
g-2:55:=00	a#2:58:-01	e-3:64:+02	g-3:67:=00	c#4:73:+02
f-2:53:-02	a-2:57:-01	d-3:62:-02	a-3:69:+02	d-4:74:+01
f-2:53:=00	g#2:56:-01	d-3:62:=00	f-3:65:-04	h-3:71:-03
e-2:52:-01	g-2:55:-01	c-3:60:-02	g-3:67:+02	c-4:72:+01
e-2:52:=00	f-2:53:-02	a-2:57:-03	c-3:60:-07	f-3:65:-07

d-2:50:-02	f-2:53:=00	a-2:57:=00	c-3:60:=00	f-3:65:=00
g-1:43:-07	d-2:50:-03	g-2:55:-02	h-2:59:-01	f-3:65:=00
c-2:48:+05	e-2:52:+02	g-2:55:=00	c-3:60:+01	e-3:64:-01
c-2:48:=00	g-2:55:+03	a#2:58:+03	c-3:60:=00	e-3:64:=00
f-1:41:-07	f-2:53:-02	a-2:57:-01	c-3:60:=00	e-3:64:=00
f#1:42:+01	c-2:48:-05	a-2:57:=00	c-3:60:=00	e-3:64:=00
g#1:44:+02	f-2:53:+05	h-2:59:+02	c-3:60:=00	d-3:62:-02
g-1:43:-01	f-2:53:=00	g-2:55:-04	h-2:59:-01	d-3:62:=00
g-1:43:=00	e-2:52:-01	g-2:55:=00	c-3:60:+01	e-3:64:+02
g-1:43:=00	d-2:50:-02	g-2:55:=00	c-3:60:=00	f-3:65:+01
g-1:43:=00	d-2:50:=00	g-2:55:=00	h-2:59:-01	f-3:65:=00
g-1:43:=00	d#2:51:+01	a-2:57:+02	c-3:60:+01	f#3:66:+01
g-1:43:=00	e-2:52:+01	g-2:55:-02	c-3:60:=00	g-3:67:+01
g-1:43:=00	d-2:50:-02	g-2:55:=00	c-3:60:=00	f-3:65:-02
g-1:43:=00	d-2:50:=00	g-2:55:=00	h-2:59:-01	f-3:65:=00
c-1:36:-07	c-2:48:-02	g-2:55:=00	a#2:58:-01	e-3:64:-01

c-1:36:=00	c-2:48:=00	f-2:53:-02	a-2:57:-01	c-3:60:-04	f-3:65:+29	c-3:60:+12	a-2:57:+04
c-3:60:+03	a-2:57:-03	f-2:53:+12	a-2:57:-03	f-2:53:-04	d-2:50:-10	f-2:53:-04	d-2:50:-03
c-1:36:-21	h-1:47:-06	g-3:67:+17	h-3:71:+18	d-4:74:+24	f-4:77:+41	d-4:74:+27	h-3:71:+04
d-4:74:+03	h-3:71:-03	g-3:67:-10	h-3:71:-03	d-3:62:-09	f-3:65:-09	e-3:64:-07	d-3:62:-05

c-1:36:**-35** c-2:48:**-14** e-3:64:-01 g-3:67:+03 c-4:72:+10

Think Diff: raw-diff-5 data overview

```
c-3:60:/00 e-3:64:/00 g-3:67:/00 c-4:72:/00 e-4:76:/00
c-3:60:=00 d-3:62:-02 a-3:69:+02 d-4:74:+02 f-4:77:+01
h-2:59:-01 d-3:62:=00 g-3:67:-02 d-4:74:=00 f-4:77:=00
c-3:60:+01 e-3:64:+02 g-3:67:+00 c-4:72:-02 e-4:76:-01
c-3:60:=00 e-3:64:=00 a-3:69:+02 e-4:76:+04 a-4:81:+05
c-3:60:=00 d-3:62:-02 f#3:66:-03 a-3:69:-07 d-4:74:-07
h-2:59:-01 d-3:62:=00 g-3:67:+01 d-4:74:+05 g-4:79:+05
h-2:59:=00 c-3:60:-02 e-3:64:-03 g-3:67:-07 c-4:72:-07
a-2:57:-02 c-3:60:=00 e-3:64:=00 g-3:67:=00 c-4:72:=00
d-2:50:-07 a-2:57:-03 d-3:62:-02 f#3:66:-01 c-4:72:=00
g-2:55:+05 h-2:59:+02 d-3:62:=00 g-3:67:+01 h-3:71:-01
g-2:55:+00 a#2:58:-01 e-3:64:+02 g-3:67:=00 c#4:73:+02
f-2:53:-02 a-2:57:-01 d-3:62:-02 a-3:69:+02 d-4:74:+01
f-2:53:=00 g#2:56:-01 d-3:62:=00 f-3:65:-04 h-3:71:-03
e-2:52:-01 g-2:55:-01 c-3:60:-02 g-3:67:+02 c-4:72:+01
e-2:52:=00 f-2:53:-02 a-2:57:-03 c-3:60:-07 f-3:65:-07
```

d-2:50:-02	f-2:53:=00	a-2:57:=00	c-3:60:=00	f-3:65:=00
g-1:43:-07	d-2:50:-03	g-2:55:-02	h-2:59:-01	f-3:65:=00
c-2:48:+05	e-2:52:+02	g-2:55:=00	c-3:60:+01	e-3:64:-01
c-2:48:=00	g-2:55:+03	a#2:58:+03	c-3:60:=00	e-3:64:=00
f-1:41:-07	f-2:53:-02	a-2:57:-01	c-3:60:=00	e-3:64:=00
f#1:42:+01	c-2:48:-05	a-2:57:=00	c-3:60:=00	e-3:64:=00
g#1:44:+02	f-2:53:+05	h-2:59:+02	c-3:60:=00	d-3:62:-02
g-1:43:-01	f-2:53:=00	g-2:55:-04	h-2:59:-01	d-3:62:=00
g-1:43:=00	e-2:52:-01	g-2:55:=00	c-3:60:+01	e-3:64:+02
g-1:43:=00	d-2:50:-02	g-2:55:=00	c-3:60:=00	f-3:65:+01
g-1:43:=00	d-2:50:=00	g-2:55:=00	h-2:59:-01	f-3:65:=00
g-1:43:=00	d#2:51:+01	a-2:57:+02	c-3:60:+01	f#3:66:+01
g-1:43:=00	e-2:52:+01	g-2:55:-02	c-3:60:=00	g-3:67:+01
g-1:43:=00	d-2:50:-02	g-2:55:=00	c-3:60:=00	f-3:65:-02
g-1:43:=00	d-2:50:=00	g-2:55:=00	h-2:59:-01	f-3:65:=00
c-1:36:-07	c-2:48:-02	g-2:55:=00	a#2:58:-01	e-3:64:-01

```
c-1:36:=00 c-2:48:=00 f-2:53:-02 a-2:57:-01 c-3:60:-04 f-3:65:+29 c-3:60:+12 a-2:57:+04
c-3:60:+03 a-2:57:-03 f-2:53:+12 a-2:57:-03 f-2:53:-04 d-2:50:-10 f-2:53:-04 d-2:50:-03
c-1:36:-21 h-1:47:-06 g-3:67:+17 h-3:71:+18 d-4:74:+24 f-4:77:+41 d-4:74:+27 h-3:71:+04
d-4:74:+03 h-3:71:-03 g-3:67:-10 h-3:71:-03 d-3:62:-09 f-3:65:-09 e-3:64:-07 d-3:62:-05
```

```
c-1:36:+35 c-2:48:-14 e-3:64:-01 g-3:67:+03 c-4:72:+10
```

Think Diff: raw-diff-5 data overview

```

c-3:60:/00 e-3:64:/00 g-3:67:/00 c-4:72:/00 e-4:76:/00
c-3:60:=00 d-3:62:-02 a-3:69:+02 d-4:74:+02 f-4:77:+01
h-2:59:-01 d-3:62:=00 g-3:67:-02 d-4:74:+00 f-4:77:+00
c-3:60:+01 e-3:64:+02 g-3:67:=00 c-4:72:-02 e-4:76:-01
c-3:60:=00 e-3:64:=00 a-3:69:+02 e-4:76:+04 a-4:81:+05
c-3:60:=00 d-3:62:-02 f#3:66:-03 a-3:69:-07 d-4:74:+07
h-2:59:-01 d-3:62:=00 g-3:67:+01 d-4:74:+05 g-4:79:+05
h-2:59:=00 c-3:60:-02 e-3:64:-03 g-3:67:-07 c-4:72:-07
a-2:57:-02 c-3:60:=00 e-3:64:=00 g-3:67:+00 c-4:72:+00
d-2:50:-07 a-2:57:-03 d-3:62:-02 f#3:66:-01 c-4:72:+00
g-2:55:+05 h-2:59:+02 d-3:62:=00 g-3:67:+01 h-3:71:-01
g-2:55:=00 a#2:58:-01 e-3:64:+02 g-3:67:+00 c#4:73:+02
f-2:53:-02 a-2:57:-01 d-3:62:-02 a-3:69:+02 d-4:74:+01
f-2:53:=00 g#2:56:-01 d-3:62:=00 f-3:65:-04 h-3:71:-03
e-2:52:-01 g-2:55:-01 c-3:60:-02 g-3:67:+02 c-4:72:+01
e-2:52:=00 f-2:53:-02 a-2:57:-03 c-3:60:-07 f-3:65:-07
d-2:50:-02 f-2:53:=00 a-2:57:+00 c-3:60:=00 f-3:65:=00
g-1:43:-07 d-2:50:-03 g-2:55:-02 h-2:59:-01 f-3:65:=00
c-2:48:+05 e-2:52:+02 g-2:55:+00 c-3:60:+01 e-3:64:-01
c-2:48:=00 g-2:55:+03 a#2:58:+03 c-3:60:=00 e-3:64:=00
f-1:41:-07 f-2:53:-02 a-2:57:-01 c-3:60:=00 e-3:64:=00
f#1:42:+01 c-2:48:-05 a-2:57:+00 c-3:60:=00 e-3:64:=00
c-1:42:-01 f-2:53:+02 a-2:57:+00 c-3:60:=00 d-3:62:-02
g#1:44:+02 f-2:53:+03 h-2:59:+02 c-3:60:=00 d-3:62:-02
g-1:43:-01 f-2:53:=00 g-2:55:-04 h-2:59:-01 d-3:62:=00
g-1:43:-00 e-2:52:-01 g-2:55:+00 c-3:60:+01 e-3:64:+02
g-1:43:-00 d-2:52:-01 g-2:55:+00 c-3:60:+01 f-3:65:+01
g-1:43:-00 d-2:50:-02 g-2:55:+00 c-3:60:=00 h-2:59:-01 f-3:65:+01
g-1:43:-00 d-2:50:-01 g-2:55:+00 c-3:60:+01 f#3:66:+01
g-1:43:-00 e-2:52:+01 g-2:55:-02 c-3:60:=00 g-3:67:+01
g-1:43:-00 d-2:50:-02 g-2:55:+00 c-3:60:=00 f-3:65:-02
g-1:43:-00 d-2:50:+00 g-2:55:+00 h-2:59:-01 f-3:65:=00
c-1:36:-07 c-2:48:-02 g-2:55:+00 a#2:58:-01 e-3:64:-01

```

c-1:36:=00	c-2:48:=00	f-2:53:-02	a-2:57:-01	c-3:60:-04	f-3:65:+29	c-3:60:+12	a-2:57:+04
c-3:60:+03	a-2:57:-03	f-2:53:-12	a-2:57:-03	f-2:53:-04	d-2:50:-10	f-2:53:-04	d-2:50:-03
c-1:36:-21	h-1:47:-06	g-3:67:+17	h-3:71:+18	d-4:74:+24	f-4:77:+41	d-4:74:+27	h-3:71:+04
d-4:74:+03	h-3:71:-03	g-3:67:-10	h-3:71:-03	d-3:62:-09	f-3:65:-09	e-3:64:-07	d-3:62:-05

c-1:36:-35 c-2:48:-14 e-3:64:-01 g-3:67:+03 c-4:72:+10

Histogram of raw-diff-5 (27 values, 197 notes)

```
; -35 1 1 #
; -21 1 2 #
; -14 1 3 #
; -12 1 4 #
; -10 2 6 ##
; -09 2 8 ##
; -07 11 19 #####
; -06 1 20 #
; -05 2 22 ##
; -04 5 27 #####
; -03 11 38 #####
; -02 21 59 #####
; -01 22 81 #####
; =00 65 146 #####
; +01 15 161 #####
; +02 14 175 #####
; +03 5 180 #####
; +04 3 183 ###
; +05 6 189 #####
; +10 1 190 #
; +12 1 191 #
; +17 1 192 #
; +18 1 193 #
; +24 1 194 #
; +27 1 195 #
; +29 1 196 #
; +41 1 197 #
```

Histogram of raw-diff-5 (27 values, 197 notes)

```
; 1. =00 65 65 #####
; 2. -01 22 87 #####
; 3. -02 21 108 #####
; 4. +01 15 123 #####
; 5. +02 14 137 #####
; 6. -07 11 148 #####
; 7. -03 11 159 #####
; 8. +05 6 165 #####
; 9. -04 5 170 #####
; 10. +03 5 175 #####
; 11. +04 3 178 ##
; 12. -10 2 180 ##
; 13. -09 2 182 ##
; 14. -05 2 184 ##
; 15. -35 1 185 #
; 16. -21 1 186 #
; 17. -14 1 187 #
; 18. -12 1 188 #
; 19. -06 1 189 #
; 20. +41 1 190 #
; 21. +29 1 191 #
; 22. +27 1 192 #
; 23. +24 1 193 #
; 24. +18 1 194 #
; 25. +17 1 195 #
; 26. +12 1 196 #
; 27. +10 1 197 #
```

Histogram of raw-diff-5 (27 values, 197 notes)

```
; 1. =00 65 65 ##########
; 2. -01 22 87 #####
; 3. -02 21 108 #####
; 4. +01 15 123 #####
; 5. +02 14 137 #####
; 6. -07 11 148 #####
; 7. -03 11 159 #####
; 8. +05 6 165 #####
; 9. -04 5 170 #####
; 10. +03 5 175 #####
; 11. +04 3 178 ###
; 12. -10 2 180 ##
; 13. -09 2 182 ##
; 14. -05 2 184 ##
; 15. -35 1 185 #
; 16. -21 1 186 #
; 17. -14 1 187 #
; 18. -12 1 188 #
; 19. -06 1 189 #
; 20. +41 1 190 #
; 21. +29 1 191 #
; 22. +27 1 192 #
; 23. +24 1 193 #
; 24. +18 1 194 #
; 25. +17 1 195 #
; 26. +12 1 196 #
; 27. +10 1 197 #
```

Histogram of raw-diff-5 (27 values, 197 notes)

```

; 1. =00 65 65 #####
; 2. -01 22 87 #####
; 3. -02 21 108 #####
; 4. +01 15 123 #####
; 5. +02 14 137 #####
; 6. -07 11 148 #####
; 7. -03 11 159 #####
; 8. +05 6 165 #####
; 9. -04 5 170 #####
; 10. +03 5 175 #####
; 11. +04 3 178 #####
; 12. -10 2 180 ##
; 13. -09 2 182 ##
; 14. -05 2 184 ##
; 15. -35 1 185 #
; 16. -21 1 186 #
; 17. -14 1 187 #
; 18. -12 1 188 #
; 19. -06 1 189 #
; 20. +41 1 190 #
; 21. +29 1 191 #
; 22. +27 1 192 #
; 23. +24 1 193 #
; 24. +18 1 194 #
; 25. +17 1 195 #
; 26. +12 1 196 #
; 27. +10 1 197 #

```

Upper half:

- extreme top weight
- top 7: 159/197

Histogram of raw-diff-5 (27 values, 197 notes)

;	1.	=00	65	65	#####
;	2.	-01	22	87	#####
;	3.	-02	21	108	#####
;	4.	+01	15	123	#####
;	5.	+02	14	137	#####
;	6.	-07	11	148	#####
;	7.	-03	11	159	#####
;	8.	+05	6	165	#####
;	9.	-04	5	170	#####
;	10.	+03	5	175	#####
;	11.	+04	3	178	###
;	12.	-10	2	180	##
;	13.	-09	2	182	##
;	14.	-05	2	184	##
;	15.	-35	1	185	#
;	16.	-21	1	186	#
;	17.	-14	1	187	#
;	18.	-12	1	188	#
;	19.	-06	1	189	#
;	20.	+41	1	190	#
;	21.	+29	1	191	#
;	22.	+27	1	192	#
;	23.	+24	1	193	#
;	24.	+18	1	194	#
;	25.	+17	1	195	#
;	26.	+12	1	196	#
;	27.	+10	1	197	#

Upper half:

- extreme top weight
 - top 7: 159/197

Lower half:

- low weights, typically 1
 - long tail

Compression

Compression method:

- Split data to top frequent and less frequent set of values around 80%-20%
- Store most frequent values in short-words

ccc ccc ccc ccc ccc ccc ccc ccc ccc

- Store special marker short-word then long-word for less frequent values

sss+uuuuu sss+uuuuu sss+uuuuu ccc ccc ccc sss+uuuu

- Needs index tables

Compression: raw-diff-5 @ 3

```
; 1. =00 65 65 ##########
; 2. -01 22 87 #####
; 3. -02 21 108 #####
; 4. +01 15 123 #####
; 5. +02 14 137 #####
; 6. -07 11 148 #####
; 7. -03 11 159 #####
; 8. +05 6 165 #####
; 9. -04 5 170 #####
; 10. +03 5 175 #####
; 11. +04 3 178 ##
; 12. -10 2 180 ##
; 13. -09 2 182 ##
; 14. -05 2 184 ##
; 15. -35 1 185 #
; 16. -21 1 186 #
; 17. -14 1 187 #
; 18. -12 1 188 #
; 19. -06 1 189 #
; 20. +41 1 190 #
; 21. +29 1 191 #
; 22. +27 1 192 #
; 23. +24 1 193 #
; 24. +18 1 194 #
; 25. +17 1 195 #
; 26. +12 1 196 #
; 27. +10 1 197 #
```

Compression: raw-diff-5 @ 3

```

; 1. =00 65 65 ##########
; 2. -01 22 87 #####
; 3. -02 21 108 #####
; 4. +01 15 123 #####
; 5. +02 14 137 #####
; 6. -07 11 148 #####
; 7. -03 11 159 #####
; 8. +05 6 165 #####
; 9. -04 5 170 #####
; 10. +03 5 175 #####
; 11. +04 3 178 ##
; 12. -10 2 180 ##
; 13. -09 2 182 ##
; 14. -05 2 184 ##
; 15. -35 1 185 #
; 16. -21 1 186 #
; 17. -14 1 187 #
; 18. -12 1 188 #
; 19. -06 1 189 #
; 20. +41 1 190 #
; 21. +29 1 191 #
; 22. +27 1 192 #
; 23. +24 1 193 #
; 24. +18 1 194 #
; 25. +17 1 195 #
; 26. +12 1 196 #
; 27. +10 1 197 #

```

Top 80%:

- 3-bit value
- 7-elem table

Bottom 20%:

- 3-bit marker
+ 5-bit value
- 20-elem table

Compression: raw-diff-5 @ 3

```

; 1. =00 65 65 ##########
; 2. -01 22 87 #####
; 3. -02 21 108 #####
; 4. +01 15 123 #####
; 5. +02 14 137 #####
; 6. -07 11 148 #####
; 7. -03 11 159 #####
; 8. +05 6 165 #####
; 9. -04 5 170 #####
; 10. +03 5 175 #####
; 11. +04 3 178 ##
; 12. -10 2 180 ##
; 13. -09 2 182 ##
; 14. -05 2 184 ##
; 15. -35 1 185 #
; 16. -21 1 186 #
; 17. -14 1 187 #
; 18. -12 1 188 #
; 19. -06 1 189 #
; 20. +41 1 190 #
; 21. +29 1 191 #
; 22. +27 1 192 #
; 23. +24 1 193 #
; 24. +18 1 194 #
; 25. +17 1 195 #
; 26. +12 1 196 #
; 27. +10 1 197 #

```

Top 80%:

- 3-bit value
- 7-elem table

Bottom 20%:

- 3-bit marker
+ 5-bit value
- 20-elem table

Compression: raw-diff-5 @ 3