Crazy Sequential Representations: Base 16 (0000 up to FFFF)

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Historic Overview
Decimal Crazy Sequential Representations

Inder Taneja published five papers on arXiv (for 1 up to 11111):

ARXIV Version	Evaluated Range	Allowed Operations	Missing Increasing	Missing Decreasing	Valid Representations
1 (06-02-2013)[1]	44 to 1000	+ * ^	2	10	1902 (of 1914)
2 (19-03-2013)[2]	44 to 4444	+ * ^	50	53	8699 (of 8802)
3 (05-06-2013)[3]	44 to 11111	+ * ^ ()	590	605	20941 (of 22136)
4 (05-08-2013)[4]	0 to 11111	+ * ^ () -	449	315	21460 (of 22224)
5 (08-01-2014)[5]	0 to 11111	+ * ^ () - /	9	10	22205 (of 22224)

Authors published three papers on Figshare/Zenodo (for -2147483647 up to 2147483647):

Date	Title
12-06-2018	Crazy Sequential Representations: Exhaustive Search [6]
14-06-2018	Crazy Sequential Representations: Negative Integers [7]
18-06-2018	Crazy Sequential Representations: Without Subtraction and/or Division [8]

Inder Taneja published three papers on RGMIA (for 11112 up to 30000):

Date	Title
12-09-2018	Crazy Representations of Natural Numbers From 11112 to 20000 [9]
10-11-2018	Crazy Representations of Natural Numbers From 20001 to 25000 [10]
10-11-2018	Crazy Representations of Natural Numbers From 25001 to 30000 [11]

Authors published one paper on Figshare/Zenodo (comparing results for 11112 up to 30000):

Date	Title
06-12-2018	Crazy Sequential Representations: 11112 up to 30000 [12]

Authors published three papers on Figshare/Zenodo (improving our previous work):

Date	Title
14-12-2018	Crazy Sequential Representations: Simplifications (01) [13]
24-12-2018	Crazy Sequential Representations: Fill the Gaps (01) [14]
02-01-2019	Crazy Sequential Representations: Fill the Gaps (02) [15]

Historic Overview
Non-Decimal Crazy Sequential Representations

Tim Wylie published one paper on arXiv (focusing on bases 3 through 10):

Date	Title
11-10-2018	Crazy Sequential Representations of Numbers for Small Bases

Base 16 Crazy Sequential Representation

For example, two valid base 16 crazy sequential representations:

16148_{10} $3F14_{16}$	**4402_{10} 1132_{16}**
$-1_{16}/2_{16}*(3_{16}-4_{16}+5_{16})\hat{}6_{16}+7_{16}*89A_{16}+BCD_{16}-EF_{16}$	$FED_{16}-CB_{16}+A9_{16}\hat{}(8_{16}-7_{16})*6_{16}/(-5_{16}+4_{16}+3_{16})+21_{16}$

For clarity, the corresponding base 10 representations:

$-1_{10}/2_{10}*(3_{10}-4_{10}+5_{10})\hat{}6_{10}+7_{10}*2202_{10}+3021_{10}-239_{10}$	$4077_{10}-203_{10}+169_{10}\hat{}(8_{10}-7_{10})*6_{10}/(-5_{10}+4_{10}+3_{10})+21_{10}$

Definition

Valid mathematical expression, thus well-formed interpretable syntactic construct.
Evaluation results is an integer value, thus a number without a fractional component.
Notation as used by most programming languages, thus restricted to following characters:

1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	+	-	*	/	^	(	)

Digits 1 up to F occur in increasing or decreasing order:

-1/2*(3-4+5)^6+7*89A+BCD-EF	FED-CB+A9^(8-7)*6/(-5+4+3)+21

Digits represent single-digit or multi-digit numbers (concatenation of digits is allowed):

-1/2*(3-4+5)^6+7*89A+BCD-EF	FED-CB+A9^(8-7)*6/(-5+4+3)+21

Numbers occur in positive form or negative form (negation of numbers by “-” is allowed).

-1/2*(3-4+5)^6+7*89A+BCD-EF	FED-CB+A9^(8-7)*6/(-5+4+3)+21

Allowed operations; addition, subtraction, multiplication, division and/or exponentiation.

-1/2*(3-4+5)^6+7*89A+BCD-EF	FED-CB+A9^(8-7)*6/(-5+4+3)+21

Order of evaluation may be influenced by parentheses (also nested parentheses).

-1/2*(3-4+5)^6+7*89A+BCD-EF	FED-CB+A9^(8-7)*6/(-5+4+3)+21

Representations with negation of segments in brackets are referred to as “pseudo”.

(1+2-3)*(45*-(6^7)+8-9ABCDEF)	(FEDCBA98+7*-(6^5)+4)*(3-2-1)
(1+2-3)*(45/-(6^7)+8-9ABCDEF)	(FEDCBA98+7/-(6^5)+4)*(3-2-1)
(1+2-3)*(45^-(6^7)+8-9ABCDEF)	(FEDCBA98+7^-(6^5)+4)*(3-2-1)
(-(1+2)+3)*(45^(6^7)+8-9ABCDEF)	(FEDCBA98+7^(6^5)+4)*(-(3-2)+1)
-(1-2+234*(6-(7+8-9))*ABCDEF)	-(FEDCBA*(9-(8+7-6))*543-2+1)

Representations without negation of segments in brackets are referred to as “genuine”.

Aim

Identify genuine base 16 crazy sequential representations for 0000_{16} up to $FFFF_{16}$

Expected number of representations = 2_{16} + $FFFF_{16}$ + $FFFF_{16}$ = 20000_{16} = 131072_{10}

Results

131072_{10} out of 131072_{10} were identified, see supplement.

Missing

Increasing	None
Decreasing	None

Notes

Authors consider base 16 crazy sequential representations to be proof-of-work, as identification is computationally expensive, while verification is trivial. Authors did not simplify and/or optimize the crazy sequential representations.

Other Bases

Authors also identified genuine crazy sequential representations for other bases:

Date	Title
04-01-2018	Crazy Sequential Representations: Base 11 (0000 up to AAAA) [17]
04-01-2018	Crazy Sequential Representations: Base 12 (0000 up to BBBB) [18]
04-01-2018	Crazy Sequential Representations: Base 13 (0000 up to CCCC) [19]
04-01-2018	Crazy Sequential Representations: Base 14 (0000 up to DDDD) [20]
04-01-2018	Crazy Sequential Representations: Base 15 (0000 up to EEEE) [21]
04-01-2018	Crazy Sequential Representations: Base 16 (0000 up to FFFF) [22]

References

1. https://arxiv.org/abs/1302.1479v1
   Natural Numbers from 44 to 1000 in terms of
   Increasing and Decreasing Orders of 1 to 9
   Inder J. Taneja. Wednesday 6 Feb 2013.

2. https://arxiv.org/abs/1302.1479v2
   Crazy Sequential Representation: Numbers from 44 to 4444 in terms of
   Increasing and Decreasing Orders of 1 to 9
   Inder J. Taneja. Tuesday 19 Mar 2013

3. https://arxiv.org/abs/1302.1479v3
   Crazy Sequential Representation: Numbers from 1 to 11111 in terms of
   Increasing and Decreasing Orders of 1 to 9
   Inder J. Taneja. Wednesday 5 Jun 2013

4. https://arxiv.org/abs/1302.1479v4
   More on Crazy Sequential Representation of Natural Numbers with Subtraction
   Inder J. Taneja. Monday 5 Aug 2013

5. https://arxiv.org/abs/1302.1479v5
   Crazy Sequential Representation: Numbers from 0 to 11111 in terms of
   Increasing and Decreasing Orders of 1 to 9
   Inder J. Taneja. Wednesday 8 Jan 2014

6. https://doi.org/10.6084/m9.figshare.6483968
   https://doi.org/10.5281/zenodo.1288822
   Crazy Sequential Representations: Exhaustive Search
   A.E. Bras, V.H.J. van der Velden. Tuesday 12 Jun 2018

7. https://doi.org/10.6084/m9.figshare.6516131
   https://doi.org/10.5281/zenodo.1288892
   Crazy Sequential Representations: Negative Integers
   A.E. Bras, V.H.J. van der Velden. Thursday 14 Jun 2018

8. https://doi.org/10.6084/m9.figshare.6587117
   https://doi.org/10.5281/zenodo.1292115
   Crazy Sequential Representations: Without Subtraction and/or Division
   A.E. Bras, V.H.J. van der Velden. Monday 18 Jun 2018

9. https://rgmia.org/papers/v21/v21a108.pdf
   MD5: BB89800FB86BDF830D28EB07241D78C1
   Crazy Representations of Natural Numbers From 11112 to 20000
   Inder J. Taneja. Wednesday 12 Sep 2018

10. https://rgmia.org/papers/v21/v21a131.pdf
MD5: D135C0F9A417B7221AEBB1225FDF7B8D
Crazy Representations of Natural Numbers From 20001 to 25000
Inder J. Taneja. Saturday 10 Nov 2018

11. https://rgmia.org/papers/v21/v21a132.pdf
MD5: 87BF426B1827555F5FB701F7DAE33969
Crazy Representations of Natural Numbers From 25001 to 30000
Inder J. Taneja. Saturday 10 Nov 2018

12. https://doi.org/10.6084/m9.figshare.7429967
https://doi.org/10.5281/zenodo.1998118
Crazy Sequential Representations: 11112 up to 30000
A.E. Bras, V.H.J. van der Velden. Thursday 06 Dec 2018

13. https://doi.org/10.6084/m9.figshare.7467665
https://doi.org/10.5281/zenodo.2276623
Crazy Sequential Representations: Simplifications (01)
A.E. Bras, V.H.J. van der Velden. Friday 14 Dec 2018

14. https://doi.org/10.6084/m9.figshare.7505690
https://doi.org/10.5281/zenodo.2525823
Crazy Sequential Representations: Fill the Gaps (01)
A.E. Bras, V.H.J. van der Velden. Monday 24 Dec 2018

15. https://doi.org/10.6084/m9.figshare.7539311
https://doi.org/10.5281/zenodo.2530025
Crazy Sequential Representations: Fill the Gaps (02)
A.E. Bras, V.H.J. van der Velden. Wednesday 02 Jan 2019

16. https://arxiv.org/abs/1810.05070v1
Crazy Sequential Representations of Numbers for Small Bases
Tim Wylie. Thursday 11 Oct 2018

17. https://doi.org/10.6084/m9.figshare.7546955
https://doi.org/10.5281/zenodo.2530974
Crazy Sequential Representations: Base 11 (0000 up to AAAA)
A.E. Bras, V.H.J. van der Velden. Friday 04 Jan 2019

18. https://doi.org/10.6084/m9.figshare.7546958
https://doi.org/10.5281/zenodo.2530976
Crazy Sequential Representations: Base 12 (0000 up to BBBB)
A.E. Bras, V.H.J. van der Velden. Friday 04 Jan 2019

19. https://doi.org/10.6084/m9.figshare.7546970
https://doi.org/10.5281/zenodo.2530978
Crazy Sequential Representations: Base 13 (0000 up to CCCC)
A.E. Bras, V.H.J. van der Velden. Friday 04 Jan 2019

20. https://doi.org/10.6084/m9.figshare.7546982
https://doi.org/10.5281/zenodo.2530980
Crazy Sequential Representations: Base 14 (0000 up to DDDD)
A.E. Bras, V.H.J. van der Velden. Friday 04 Jan 2019

21. https://doi.org/10.6084/m9.figshare.7546985
https://doi.org/10.5281/zenodo.2530982
Crazy Sequential Representations: Base 15 (0000 up to EEEE)
A.E. Bras, V.H.J. van der Velden. Friday 04 Jan 2019

22. https://doi.org/10.6084/m9.figshare.7546991
https://doi.org/10.5281/zenodo.2530984
Crazy Sequential Representations: Base 16 (0000 up to FFFF)
A.E. Bras, V.H.J. van der Velden. Friday 04 Jan 2019