Unit 312

Für Jonathan und Freunde gesammelt,
zur kritischen Diskussion

Aphorisms, advices, anecdotes, brain teasers, curious stories, epigrams, epigraphs, epitaphs, crazy-creative ideas, suggestions and set pieces for thriller and mystery writers, koans, memorabilia, mottos, poems, proverbs, riddles, algorithmics ideas catchment areas, quotations, sayings, slogans, scurrilities, besun, etc., collected for encouragement and the advantage of visitors and of myself.

An unconventional challenger,
„Arboretum - Algoretum - Crearetum“.

Materialsammlung, eine kreative Umgebung für mathematische/informatische Untersuchungen, z.B. Darstellung mathematischer Konstanten als nested expressions, Kettenbrüche, … oder Mischformen zur Sichtbarmachung innerer Strukturen

Variationen auf die sprudelnde Quelle e^x, ext.

** Entwicklung von e^2 in einen einfachen Kettenbruch
Simple continued fraction (scf) representation of e^2 [1,2]

scf(e^2-1) =

[6***1**; 2, 1, 1, 3, 6***3**, 5, 1, 1, 6, 6***5**, 8, 1, 1, 9, 6***7**, 11, 1, 1, 12, 6***9**, 14, 1, 1, 15, 6***11**, 17, 1, 1, 18, 6***13**, 20, 1,

1, 21, 6*15, 23, 1, 1, 24, 6*17, 26, 1, 1, 27, 6*19, 29, 1,
1, 30, 6*21, 32, 1, 1, 33, 6*23, 35, 1, 1, 36, 6*25, 38, 1,
1, 39, 6*27, 41, 1, 1, 42, 6*29, 44, 1, 1, 45, 6*31, 47, 1,
1, 48, 6*33, 50, 1, 1, 51, 6*35, 53, 1, 1, 54, 6*37, 56, 1,
1, 57, 6*39, 59, 1, 1, 60, 6*41, 62, 1, 1, 63, 6*43, 65, 1,
1, 66, 6*45, 68, 1, 1, 69, 6*47, 71, 1, 1, 72, 6*49, 74, 1,
1, 75, 6*51, 77, 1, 1, 78, 6*53, 80, 1, 1, 81, 6*55, 83, 1,
1, 84, 6*57, 86, 1, 1, 87, 6*59, 89, 1, 1, 90, 6*61, 92, 1,
1, 93, 6*63, 95, 1, 1, 96, 6*65, 98, 1, 1, 99, 6*67, 101,
1, 1, 102, 6*69, 104, 1, 1, 105, 6*71, 107, 1, 1, 108,
6*73, 110, 1, 1, 111, 6*75, 113, 1, 1, 114, 6*77, 116, 1,
1, 117,6*79, 119, 1, 1, 120, 6*81, 122, 1, 1, 123, 6*83,
125, 1, 1, 126, 6*85, 128, 1, 1, 129, 6*87, 131, 1, 1,
132, 6*89, 134, 1, 1, 135, 6*91, 137, 1, 1, 138, 6*93,
140, 1, 1, 141, 6*95, 143, 1, 1, 144, 6*97, 146, 1, 1,
147, 6*99, 149, 1, 1, 150, 6*101, 152, 1, 1, 153, 6*103,
155, 1, 1, 156, 6*105, 158, 1, 1, 159, 6*107, 161, 1, 1,
162, 6*109, 164, 1, 1, 165, 6*111, 167, 1, 1, 168,
6*113, 170, 1, 1, 171, 6*115, 173, 1, 1, 174, 6*117,
176, 1, 1, 177, 6*119, 179, 1, 1, 180, 6*121, 182, 1, 1,
183, 6*123, 185, 1, 1, 186, 6*125, 188, 1, 1, 189,
6*127, 191, 1, 1, 192, 6*129, 194, 1, 1, 195, 6*131,
197, 1, 1, 198, 6*133, 200, 1, 1, 201, 6*135, 203, 1, 1,
204, 6*137, 206, 1, 1, 207,…]
= 1+[**6*(2k+1)**,(3k+2),1,1,(3k+3)]$_{k=0,1,2,3,4,\ldots}$

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[1] **https**://de.wikipedia.org/wiki/Kettenbruch
https://en.wikipedia.org/wiki/Continued_fraction
[2] **https**://de.wikipedia.org/wiki/Euklidischer_Algorithmus

https://en.wikipedia.org/wiki/Euclidean_algorithm
Unit 26

** **Anschließende Fragen und Probleme:**
►**Weiter: scf(e^n) für n=3,4,5,…**
►**Graphische Darstellung → 2D-Musterbildung aus der vorstehenden 1D-scf(e^2) -Folge**
Vgl. [1,(2.S.48-50),3,4]), insbesondere als colorierte 2D-Ulam-Spirale (Unit 3). Diskussion: „Computerkunst“
►**1D-scf(e^2-1)-Folge → 2D-Musterbildung → 3D** ??
(Polyeder, Kristalle, Quasikristalle, Viren, …)

[3] **https**://www.spektrum.de/kolumne/freistetters-formelwelt-alien-botschaften-in-zahlen/2149719
Spektrum der Wissenschaft/Die Woche 25/2023
[4] **https**://de.wikipedia.org/wiki/Algorithmische_Zahlentheorie

[5] E.P. Stoschek. Abenteuer Algorithmus. Dresden University Press 1996, ISBN 3-931828-31-X

[6] E. Stoschek, D. Schönfeld. Computergraphik im Spannungsfeld zwischen Algorithmus und Phantasie. Verlag Harri Deutsch 2000, ISBN3-8171-1640-3

[7] Spektrum Kompakt30/2019 Primzahlen - Die Stars der Mathematik.
[8] Eli Maor. e.The story of a number.
Princeton University Press 1994, ISBN 0-691-03390-0
[9] **https**://www.spektrum.de/kolumne/mit-kettenbruechen-zur-irrationalsten-zahl-von-allen/2213426

►►Ersetzt man in vorstehender Entwicklung von e^2 in einen einfachen Kettenbruch den Faktor **6** durch eine Variable $\mathbf{x}\in\mathbb{R}$, so erhält man die durch einen scf dargestellte Funktion $f(scf(e^2\text{-}1),\mathbf{x}) = [\mathbf{x}*(2k+1),(3k+2),1,1,(3k+3)]_{k=0,1,2,3,4,\ldots}$
Berechnen Sie den Werteverlauf dieser Funktion(**x**) und stellen Sie ihn durch einen Graphen dar.

Untersuchen und diskutieren Sie die Eigenschaften dieser Funktion.
Erweiterung x∈ℂ
Vgl. [10] Jahnke-Emde-Lösch. Tafeln Höherer Funktionen. B.G. Teubner Verlagsgesellschaft Stuttgart 1960

►►Wie müssen (transzendente/irrationale) Zahlen beschaffen sein, damit in ihrer Entwicklung in einen (unendlichen) einfachen Kettenbruch (scf) periodisch die Elementfolge (snip) …,**1,1**,… auftritt?
Beispiele
scf(e)=[2;1,2,**1,1**,4,**1,1**,6,**1,1**,8,**1,1**,10,**1,1**,12,**1,1**,14,**1,1**, …]
scf((3-e)/(e-2))=[0;2,**1,1**,4,**1,1**,6,**1,1**,8,**1,1**,10,**1,1**,12,1,1,…]
scf(**(**e^2-1)=[6;2,**1,1**,3,18,5,**1,1**,6,30,8,**1,1**,9,42,11,**1,1**,12,…]
scf(sqr(e))=[1,1,**1,1**,5,**1,1**,9,**1,1**,13,**1,1**,17,**1,1**,21,**1,1**,25,…]
scf(2^4(sqr(e)-1)$^{-1}$)=[24;1,1,1, 39,**1,1**, 3, 288, 5,**1,1**,
103,**1,1**, 7, 544, 9,**1,1**,
167,**1,1**,11, 800,13,**1,1**,
231,**1,1**,15,1056,17,**1,1**,…]
scf(2^{-3}(sqr(e)-1)$^{-1}$)= [0,2,3,1,2,15, 2,2,3,**1,1**, 2,1,
15, 4,2,3.**1,1**, 4,1,
15, 6,2,3,**1,1**, 6,1,
15, 8,2,3,**1,1**, 8,1,
15,10,2,3,**1,1**,10,1,
15,12,2,3,**1,1**,12,1,
15,14,2,3,**1,1**,14,1,
15,16,2,3,**1,1**,16,1,…]
scf((sqr(17)+1)(sqr(17)-1)$^{-1}$) = [1;1,**1,1**,3,**1,1**,3,**1,1**,3,**1,1**, …]

►►Untersuchen Sie das Auftreten dieser und anderer snips in scf(…) → …,1,3,… …,3,1,… Interpretation?
Beispiele
scf(2sqr(e)) = [3;3, 2,**1,3**,4,**1,3**,6,**1,3**, 8,**1,3**,10,**1,3**,…]
scf((1/2)sqr(e)) = [0;1,4,1,2,**3,1**,4,**3,1**,6,**3,1**, 8,**3,1**,10,**3,1**,…]
scf((sqr(17)+1)(sqr(17)-1)$^{-1}$) = [1;1,1,1,3,1,1,3,1,1,3,1,1,3,1,..]
?? [11] **https**://en.wikipedia.org/wiki/Mathematical_constant
[12] **https**://en.wikipedia.org/wiki/List_of_mathematical_constants
[13] **https**://de.wikipedia.org/wiki/Mathematische_Konstante

►►Die Folge der Elemente der Darstellung von e^2 durch einen einfachen Kettenbruch scf(e^2), der Träger, werde durch eine Zahlenfolge, das Signal, eindeutig umkehrbar moduliert. Konstruieren Sie einen solchen Modulationsalgorithmus und den zugehörigen Demodultionsalgorithmus, mit dessen Hilfe das Signal wiedergewonnen werden kann. Anwendungen?
[14] **https**://de.wikipedia.org/wiki/Modulation_(Technik)
[15] **https**://en.wikipedia.org/wiki/Modulation

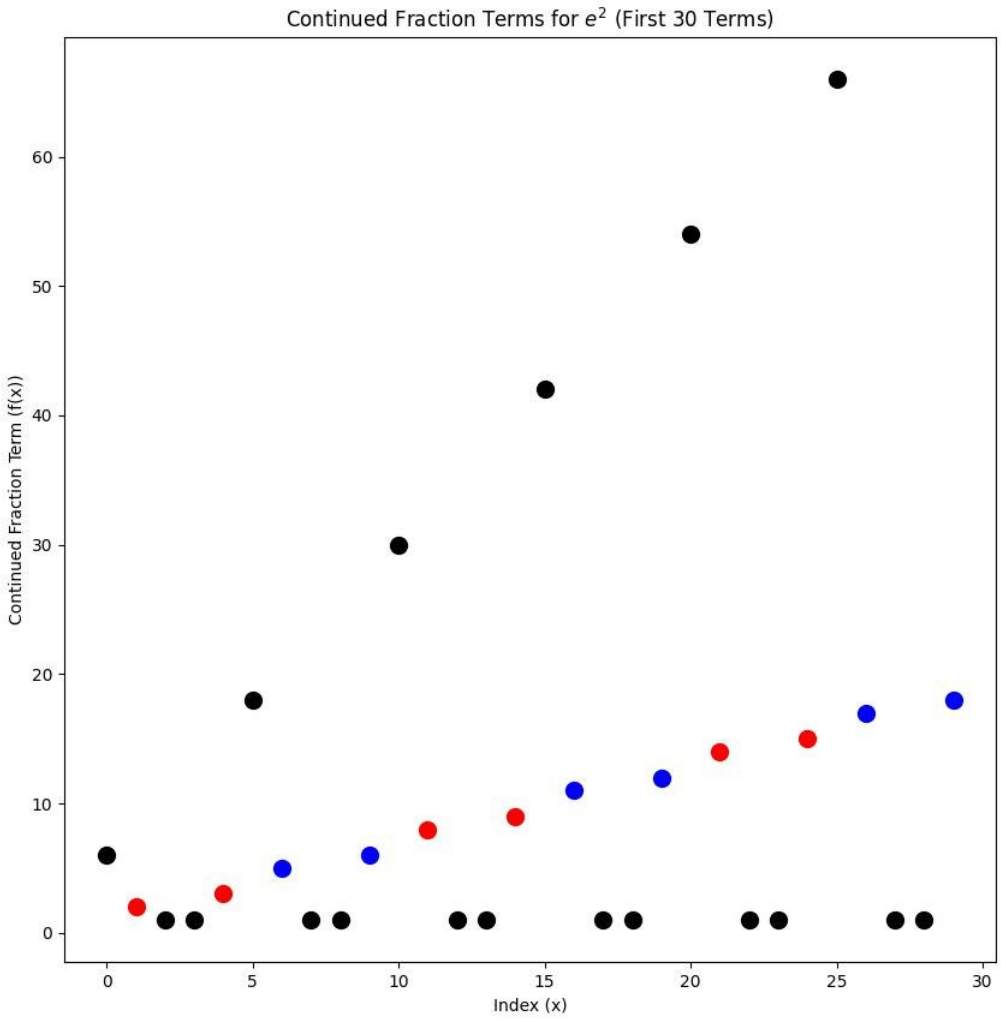
312.312 Graphic interpretation of scf(e^2), part 1

Input: Sequence of natural numbers f(1),f(2),f(3),f(4),f(5),… = sequence of elements of a simple continued fraction (scf) representation of a rational/irrational/transcendent number, f.i.
scf(e^2-1) =
[6*1; 2, 1, 1, 3, 6*3, 5, 1, 1, 6, 6*5, 8, 1, 1, 9, 6*7, 11, 1, 1, 12, 6*9, 14, 1, 1, 15, 6*11, 17, 1, 1, 18, 6*13, 20, 1, 1, 21, 6*15, 23, 1, 1, 24, 6*17, 26, 1, 1, 27, 6*19, 29, 1, 1, 30, 6*21, 32, 1, 1, 33, 6*23, 35, 1, 1, 36, 6*25, 38, 1, 1, 39, 6*27, 41, 1, 1, 42, 6*29, 44, 1, 1, 45, 6*31, 47, 1, 1, 48, 6*33, 50, 1, 1, 51, 6*35, 53, 1, 1, 54, 6*37, 56, 1, 1, 57, 6*39, 59, 1, 1, 60, 6*41, 62, 1, 1, 63, 6*43, 65, 1, 1, 66, 6*45, 68, 1, 1, 69, 6*47, 71, 1, 1, 72, 6*49, 74, 1,

1, 75, 6*51, 77, 1, 1, 78, 6*53, 80, 1, 1, 81, 6*55, 83, 1,
1, 84, 6*57, 86, 1, 1, 87, 6*59, 89, 1, 1, 90, 6*61, 92, 1,
1, 93, 6*63, 95, 1, 1, 96, 6*65, 98, 1, 1, 99, 6*67, 101,
1, 1, 102, 6*69, 104, 1, 1, 105, 6*71, 107, 1, 1, 108,
6*73, 110, 1, 1, 111, 6*75, 113, 1, 1, 114, 6*77, 116, 1,
1, 117,6*79, 119, 1, 1, 120, 6*81, 122, 1, 1, 123, 6*83,
125, 1, 1, 126, 6*85, 128, 1, 1, 129, 6*87, 131, 1, 1,
132, 6*89, 134, 1, 1, 135, 6*91, 137, 1, 1, 138, 6*93,
140, 1, 1, 141, 6*95, 143, 1, 1, 144, 6*97, 146, 1, 1,
147, 6*99, 149, 1, 1, 150, 6*101, 152, 1, 1, 153, 6*103,
155, 1, 1, 156, 6*105, 158, 1, 1, 159, 6*107, 161, 1, 1,
162, 6*109, 164, 1, 1, 165, 6*111, 167, 1, 1, 168, 6*113,
170, 1, 1, 171, 6*115, 173, 1, 1, 174, 6*117, 176, 1, 1,
177, 6*119, 179, 1, 1, 180, 6*121, 182, 1, 1, 183,
6*123, 185, 1, 1, 186, 6*125, 188, 1, 1, 189, 6*127,
191, 1, 1, 192, 6*129, 194, 1, 1, 195, 6*131, 197, 1, 1,
198, 6*133, 200, 1, 1, 201, 6*135, 203, 1, 1, 204,
6*137, 206, 1, 1, 207, 6*138, 209, 1, 1, 210,…] =
$[6*(2k+1),(3k+2),1,1,(3k+3)]_{k=0,1,2,3,4,\ldots}$ =

[6; 2, 1, 1, 3, 18, 5, 1, 1, 6, 30, 8, 1, 1, 9, 42, 11, 1, 1, 12, 54, 14, 1,1
15, 66, 17, 1, 1, 18, 78, 20, 1, 1, 21, 90, 23, 1, 1, 24, 102, 26, 1, 1,
27, 114, 29, 1, 1, 30, 126, 32, 1, 1, 33, 138, 35, 1, 1, 36, 150, 38, 1, 1,
39, 162, 41, 1, 1, 42, 174, 44, 1, 1, 45, 186, 47, 1, 1, 48, 198, 50, 1, 1,
51, 210, 53, 1, 1, 54, 222, 56, 1, 1, 57, 234, 59, 1, 1, 60, 246, 62, 1, 1,
63, 258, 65, 1, 1, 66, 270, 68, 1, 1, 69, 282, 71, 1, 1, 72, 294, 74, 1, 1,
75, 306, 77, 1, 1, 78, 318, 80, 1, 1, 81, 330, 83, 1, 1, 84, 342, 86, 1, 1,
87, 354, 89, 1, 1 90, 366, 92, 1, 1, 93, 378, 95, 1, 1, 96, 390,
98, 1, 1, 99, 402, 101, 1, 1, 102, 414, 104, 1, 1, 105, 426, 107, 1, 1, 108, 438,
110, 1, 1, 111, 450, 113, 1, 1, 114, 462, 116, 1, 1, 117, 474, 119, 1, 1, 120, 486,
122, 1, 1, 123, 498, 125, 1, 1, 126, 510, 128, 1, 1, 129, 522, 131, 1,1, 132, 534,
134, 1, 1, 135, 546, 137, 1, 1, 138, 558,140, 1, 1, 141, 570, 143, 1,1, 144, 582,
146, 1, 1, 147, 594, 149, 1, 1, 150, 606,152, 1, 1, 153, 618, 155, 1, 1, 156, 630,
158, 1, 1, 159, 642, 161, 1, 1, 162, 654,164, 1, 1, 165, 666, 167, 1, 1, 168, 678,
170, 1, 1, 171, 690, 173, 1, 1, 174, 702,176, 1, 1, 177, 714, 179, 1, 1, 180, 726,
182, 1, 1, 183, 738, 185, 1, 1, 186, 750,188, 1, 1, 189, 762, 191, 1, 1, 192, 774,
194, 1, 1, 195, 786, 197, 1, 1, 198, 798,200, 1, 1, 201, 810, 203, 1, 1, 204, 822,
206, 1, 1, 207, 834, 209, 1, 1, 210, 846, …]

The following graphs are designed by Dr. Tianhai Liu, aicas Karlsruhe.

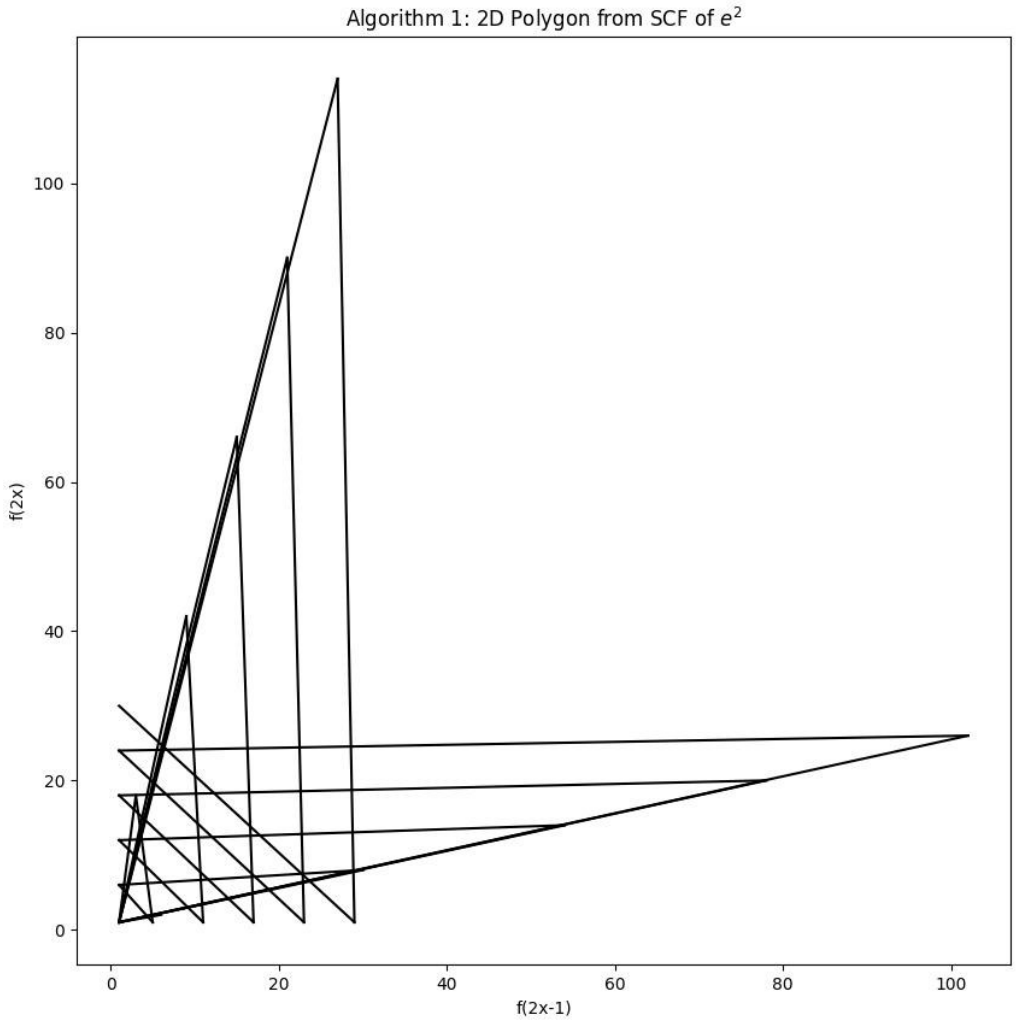


Algorithm 1

for x from 1 by 1 to k set point(x)=(f(2x-1),f(2x))

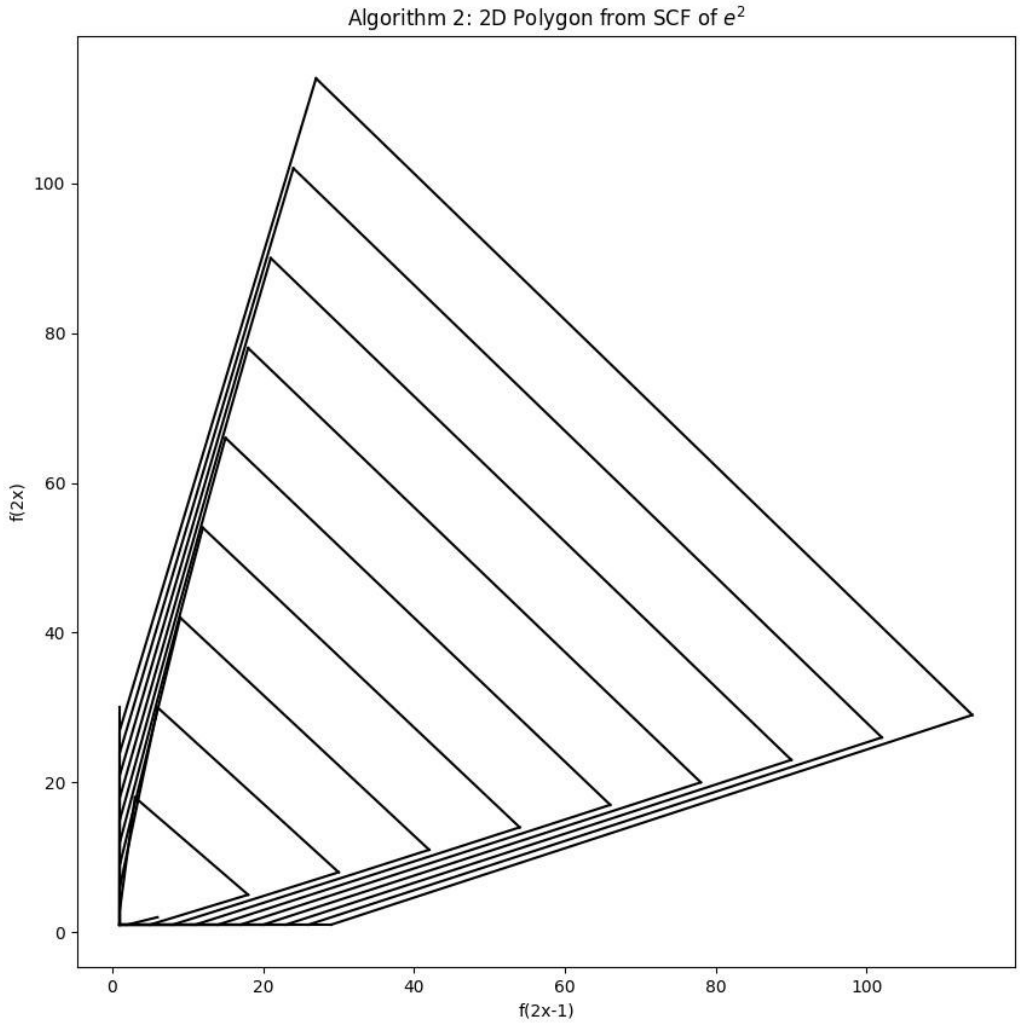
for x from 1 by 1 to k connect point(x) with point (x+1) by a line segment

Output: 2D Polygon 1↓



Algorithm 2

for x from 1 by 1 to k set p(x)=(f(2x-1),f(2x)) and p(x+1)=(f(2x),f(2x+1))
for x from 1 by 1 to k connect p(x) with p(x+1) by a line segment
Output: 2D Polygon 2↓

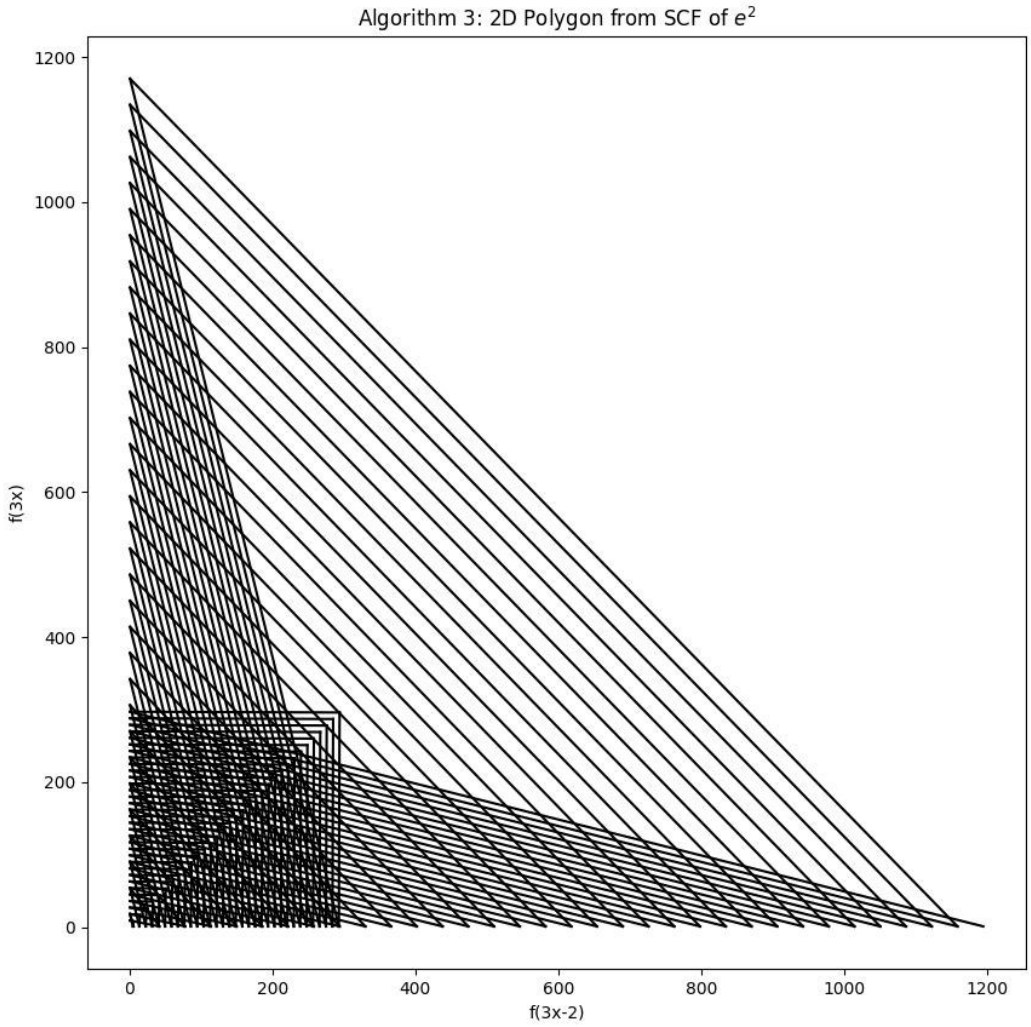


Algorithm 3

for x from 1 by 1 to k set p(x)=(f(3x-2),f(3x))

for x from 1 by 1 to k connect p(x) with p(x+1) by a line segment

Output: 2D Polygon 3↓



with the point sequence (6,1) (1,18) (5,1) (6,8) (1,9) (42,1) (1,54) (14,1) (15,17) (1,18) (78,1) (1,90) (23,1) (24,26) (1,27) (114,1) (1,126) (32,1) (33,35) (1,36) (150,1) (1,162) (41,1) (42,44) (1,45) (186,1) (1,198) (50,1) (51,53) (1,54) (222,1) (1,234) (59,1) (60,62) …

** 312.312 Graphic interpretation of scf(e^2), part 2

rest(a,b) = a mod b -- ganzzahliger Rest, der bei der Division a:b übrig bleibt, a,b∈ℕ ; z.B.rest(420,137)=9
a mod b -- natural number remainder left after the division of a by b, a,b∈ℕ ; f.i. 420 mod 137 = 9

Input: Sequence of natural numbers
g(1),g(2),g(3),g(4),g(5),…= f(1),f(2),f(3),f(4),f(5),…mod **p**
g(x) = f(x) mod **p**rime number

For scf(e^2 -1), p=37 ▶

g(1),g(2),g(3),g(4),g(5),…= [**6**;
2, 1, 1, **3**, **18**, **5**, 1, 1, **6**, **30**, **8**, 1, 1, **9**, **5**, **11**, 1, 1, **12**, **17**,
14, 1, 1, **15**, **29**, **17**, 1, 1, **18**, **4**, **20**, 1, 1, **21**, **16**, **23**, 1, 1,
24, **28**, **26**, 1, 1, **27**, **3**, **29**, 1, 1, **30**, **15**, **32**, 1, 1, **33**, **27**,
35, 1, 1, **36**, **2**, **1**, 1, 1, **2**, **14**, **4**, 1, 1, **5**, **26**, **7**, 1, 1, **8**, **1**,
10, 1, 1, **11**, **13**, **13**, 1, 1, **14**, **25**, **16**, 1, 1, **17**, **0**, **19**, 1, 1,
20, **12**, **22**, 1, 1, **23**, **24**, **25**, 1, 1, **26**, **36**, **28**, 1,1,**29**,**11**,
31,1,1,**32**,**23**,**34**,1,1,**35**,**35**,**0**,1,1,**1**,**10**,**3**,1,1,**4**,**22**,**6**,1,1,**7**,..

=

[**6**; **2**, 1, 1, **3**, **18**, **5**, 1, 1, **6**, **30**, **8**, 1, 1, **9**, **5**, **11**, 1, 1, **12**,
17, **14**, 1, 1, **15**, **29**, **17**, 1, 1, **18**, **4**, **20**, 1, 1, **21**, **16**, **23**, 1, 1, **24**,
28, **26**, 1, 1, **27**, **3**, **29**, 1, 1, **30**, **15**, **32**, 1, 1, **33**, **27**, **35**, 1, 1, **36**,
2, **1**, 1, 1, **2**, **14**, **4**, 1, 1, **5**, **26**, **7**, 1, 1, **8**, **1**, **10**, 1, 1, **11**,
13, **13**, 1, 1, **14**, **25**, **16**, 1, 1, **17**, **0**, **19**, 1, 1, **20**, **12**, **22**, 1, 1, **23**,
24, **25**, 1, 1, **26**, **36**, **28**, 1, 1, **29**, **11**, **31**, 1, 1, **32**, **23**, **34**, 1, 1, **35**,
35, **0**, 1, 1, **1**, **10**, **3**, 1, 1, **4**, **22**, **6**, 1, 1, **7**, **34**, **9**, 1, 1, **10**,
9, **12**, 1, 1, **13**, **21**, **15**, 1, 1, **16**, **33**, **18**, 1, 1, **19**, **8**, **21**, 1, 1, **22**,
20, **24**, 1, 1, **25**, **32**, **27**, 1, 1, **28**, **7**, **30**, 1, 1, **31**, **19**, **33**, 1, 1, **34**,
31, **36**, 1, 1, **0**, **6**, **2**, 1, 1, **3**, **18**, **5**, 1, 1, **6**, **30**, **8**, 1, 1, **9**,
5, **11**, 1, 1, **12**, **17**, **14**, 1, 1, **15**, **29**, **17**, 1, 1, **18**, **4**, **20**, 1, 1, **21**,
16, **23**, 1, 1, **24**, **28**, **26**, 1, 1, **27**, **3**, **29**, 1, 1, **30**, **15**, **32**, 1, 1, **33**,
27, **35**, 1, 1, **36**, **2**, **1**, 1, 1, **2**, **14**, **4**, 1, 1, **5**, **26**, **7**, 1, 1, **8**,
1, **10**, 1, 1, **11**, **13**, **13**, 1, 1, **14**, **25**, **16**, 1, 1, **17**, **0**, **19**, 1, 1, **20**,
12, **22**, 1, 1, **23**, **24**, **25**, 1, 1, **26**, **36**, **28**, 1, 1, **29**, **11**, **31**, 1,1, **32**,
23, **34**, 1, 1, **35**, **35**, **0**, 1, 1, **1**, **10**, **3**, 1, 1, **4**, **22**, **6**, 1, 1, **7**,
34, **9**, 1, 1, **10**, **9**, **12**, 1, 1, **13**, **21**, **15**, 1, 1, **16**, **33**, **18**, 1, 1, **19**,
8, **21**, 1, 1, **22**, **20**, **24**, 1, 1, **25**, **32**, **27**, 1, 1, **28**, **7**, **30**, 1, 1, **31**,
19, **33**, 1, 1, **34**, **31**, **36**, 1, 1, **0**, **6**, **2**, 1, 1, **3**, **18**, **5**, 1, 1, **6**,
30, **8**, 1, 1, **9**, **5**, **11**, 1, 1, **12**, **17**, **14**, 1, 1, **15**, **29**, **17**, 1, 1, **18**,
4, **20**, 1, 1, **21**, **16**, **23**, 1, 1, **24**, **28**, **26**, 1, 1, **27**, **3**, **29**, 1, 1, **30**,
15, **32**, 1, 1, **33**, **27**, **35**, 1, 1, **36**, **2**, **1**, 1, 1, **2**, **14**, **4**, 1, 1, **5**,
26, **7**, 1, 1, **8**, **1**, **10**, 1, 1, **11**, **13**, **13**, 1, 1, **14**, **25**, **16**, 1, 1, **17**,
0, **19**, 1, 1, **20**, **12**, **22**, 1, 1, **23**, **24**, **25**, 1, 1, **26**, **36**, **28**, 1, 1, **29**,
11, **31**, 1, 1, **32**, **23**, **34**, 1, 1, **35**, **35**, **0**, 1, 1, **1**, **10**, **3**, 1, 1, **4**,...]

Algorithm 1/2/3 …

Output: 2D Polygon 1/2/3

►► Related graphs 1/2/3 ? Discussion!
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** **Brückenschlag zu:**

[16] **https**://www.spektrum.de/news/neue-mathematische-form-entschluesselt-geometrie-von-perlbooten/2234077?utm_source=sdwv_daily&utm_medium=nl&utm_content=heute
[17] **https**://www.spektrum.de/news/quantenfehlerkorrektur-mit-aperiodischen-kachelungen/2208722
[18] **https**://www.spektrum.de/podcast/einstein-kachel-wie-ein-hobby-mathematiker-die-fachwelt-ueberraschte/2185365
[19] **https**://www.spektrum.de/news/parkettierung-mathematiker-feiern-hatfest-fuer-einstein-kachel/2168346
[20] **https**://www.spektrum.de/news/vampir-kachel-loest-den-einstein-ab/2146095
[21] **https**://www.spektrum.de/kolumne/mit-geometrie-das-universum-verstehen/2126919
[22] Spektrum Kompakt40/2023 Parkettierungen - Mathematik mit Fliesen und Klötzchen
[23] Spektrum Kompakt3/2020 Mathematisches Parkett.
[24] K. Hartnett. Eine neue Art der Symmetrie. Spektrum der Wissenschaft 9.24, S. 42 - 47

Links zu den Units 26, 30.1, 79.3, 88, 193, 59, Lambda 1,2
****

** **scf(e^x) mit halbzahligem Argument:**

x = 2/(2n+1) = 1/(n + ½); n∈ℕ

scf($e^{2/3}$)= [1;1,
18* 1, 7,1,1, 10,**18* 3**, 16,1,1, 19,
18* 5, 25,1,1, 28,**18* 7**, 34,1,1, 37,
18* 9, 43,1,1, 46,**18*11**, 52,1,1, 55,
18*13, 61,1,1, 64,**18*15**, 70,1,1, 73,
18*17, 79,1,1, 82,**18*19**, 88,1,1, 91,

18*21, 97,1,1,100,**18*23**,106,1,1,109,
18*25,115,1,1,118,**18*27**,124,1,1,127,
18*29,133,1,1,136,**18*31**,142,1,1,145,
18*33,151,1,1,154,**18*35**,160,1,1,163,
18*37,169,1,1,172,**18*39**,178,1,1,181,
18*41,187,1,1,190,**18*43**,196,1,1,199,
18*45,205,1,1,208,**18*47**,214,1,1,217,
18*49,223,1,1,226,**18*51**,232,1,1,235,
18*53,241,1,1,244,**18*55**,250,1,1,253,
18*57,259,1,1,262,**18*59**,268,1,1,271,
18*61,277,1,1,280,**18*63**,286,1,1,289,
18*65,295,1,1,298,**18*67**,304,1,1,307,
18*69,313,1,1,316,**18*71**,322,1,1,325,
18*73,331,1,1,334,**18*75**,340,1,1,343,
18*77,349,1,1,352,**18*79**,358,1,1,361,…]

scf($e^{2/5}$)= [1;2,
30* 1, 12,1,1, 17,**30* 3**, 27,1,1, 32,
30* 5, 42,1,1, 47,**30* 7**, 57,1,1, 62,
30* 9, 72,1,1, 77,**30*11**, 87,1,1, 92,
30*13,102,1,1,107,**30*15**,117,1,1,122,
30*17,132,1,1,137,**30*19**,147,1,1,152,
30*21,162,1,1,167,**30*23**,177,1,1,182,
30*25,192,1,1,197,**30*27**,207,1,1,212,
30*29,222,1,1,227,**30*31**,237,1,1,242,
30*33,252,1,1,257,**30*35**,267,1,1,272,
30*37,282,1,1,287,**30*39**,297,1,1,302,
30*41,312,1,1,317,**30*43**,327,1,1,332,
30*45,342,1,1,347,**30*47**,357,1,1,362,
30*49,373,1,1,377,**30*51**,387,1,1,392,
30*53,402,1,1,407,**30*55**,417,1,1,422,
30*57,432,1,1,437,**30*59**,447,1,1,452,
30*61,462,1,1,467,**30*63**,477,1,1,482,

30*65,492,1,1,497,**30*67**,507,1,1,512,
30*69,522,1,1,527,**30*71**,537,1,1,542,
30*73,552,1,1,557,**30*75**,567,1,1,572,
30*77,582,1,1,587,**30*79**,597,1,1,602,…]

scf($e^{2/7}$)= [1;3,
42* 1, 17,1,1, 24,**42* 3**, 38,1,1, 45,
42* 5, 59,1,1, 66,**42* 7**, 80,1,1, 87,
42* 9,101,1,1,108,**42*11**,122,1,1,129,
42*13,143,1,1,150,**42*15**,164,1,1,171,
42*17,185,1,1,192,**42*19**,206,1,1,213,
42*21,227,1,1,234,**42*23**,248,1,1,255,
42*25,269,1,1,276,**42*27**,290,1,1,297,
42*29,311,1,1,318,**42*31**,332,1,1,339,
42*33,353,1,1,360,**42*35**,374,1,1,381,
42*37,395,1,1,402,**42*39**,416,1,1,423,
42*41,437,1,1,444,**42*43**,458,1,1,465,
42*45,479,1,1,486,**42*47**,500,1,1,507,
42*49,521,1,1,528,**42*51**,542,1,1,549,
42*53,563,1,1,570,**42*55**,584,1,1,591,
42*57,605,1,1,612,**42*59**,626,1,1,633,
42*61,647,1,1,654,**42*63**,668,1,1,675,
42*65,689,1,1,696,**42*67**,710,1,1,717,
42*69,731,1,1,738,**42*71**,752,1,1,759,
42*73,773,1,1,780,**42*75**,794,1,1,801,
42*77,815,1,1,822,**42*79**,836,1,1,843,…]

scf($e^{2/11}$) = [1;5,
66* 1, 27,1,1, 38,**66* 3**, 60,1,1, 71,
66* 5, 93,1,1,104,**66* 7**,126,1,1,137,
66* 9,159,1,1,170,**66*11**,192,1,1,203,
66*13,225,1,1,236,**66*15**,258,1,1,269,
66*17,291,1,1,302,**66*19**,324,1,1,335,
66*21,357,1,1,368,**66*23**,390,1,1,401,

66*25,423,1,1,434,**66*27**,456,1,1,467,
66*29,489,1,1,500,**66*31**,522,1,1,533,
66*33,555,1,1,566,**66*35**,588,1,1,599,
66*37,621,1,1,632,**66*39**,654,1,1,665,
66*41,687,1,1,698,**66*43**,720,1,1,731,
66*45,753,1,1,764,**66*47**,786,1,1,797,
66*49,819,1,1,830,**66*51**,852,1,1,863,
66*53,885,1,1,896,**66*55**,918,1,1,929,
66*57,951,1,1,962,**66*59**,984,1,1,995,…]

scf($e^{2/15}$) = [1;7,
90* 1, 37,1,1, 52,**90* 3**, 82,1,1, 97,
90* 5,127,1,1,142,**90* 7**,172,1,1,187,
90* 9,217,1,1,232,**90*11**,262,1,1,277,
90*13,307,1,1,322,**90*15**,352,1,1,367,
90*17,397,1,1,412,**90*19**,442,1,1,457,
90*21,487,1,1,502,**90*23**,532,1,1,547,
90*25,577,1,1,592,**90*27**,622,1,1,637,
90*29,667,1,1,682,**90*31**,712,1,1,727,
90*33,757,1,1,772,**90*35**,802,1,1,817,
90*37,847,1,1,862,**90*39**,892,1,1,907,
90*41,937,1,1,952,**90*43**,982,1,1,997,…]

Aus vorstehenden (numerischen, experimentellen) Einzel-scf-Entwicklungen induziert:
** scf($e^{(2/(2n+1))}$) = scf($e^{(1/(n+1/2))}$) =
[1;n,**6(2n+1)(2k-1)**,a(n,k),1,1,b(n,k),]$_{k=1,2,3,\ldots}$
mit a(n,k)=3k(2n+1)-(n+1), b(n,k)=3k(2n+1)+n; n∈$\mathbb{N}_0$,
Offene Fragen:
Detaillierte Herleitung, Beweis durch vollständige Induktion.
scf($e^{1/x}$) mit halbzahligem Argument: x = (n+1/2); n∈$\mathbb{N}$,
Diskussion von Spezialfällen → n ist Primzahl, Fibonacci-Zahl, magische Zahl (Kernphysik), …
** Graphische Darstellung → 2D-Musterbildung aus den

1D-scf-Folgen in Unit 312 (vgl. Unit 3),
insbesondere als colorierte 2D-Ulam-Spiralen und gaussian-prime-spirals [38]

Unit 312-1D-scf-Folgen → 2D-Musterbildung → 3D ??
(Polyeder, Kristalle, Quasikristalle, Viren, …)

Ist aus dem periodischen Auftreten der snips ,1,1, im scf einer Dezimalzahl zu schließen, daß der sie generierende Formelausdruck **e** enthält? Beipiele, Gegenbeispiele, Diskussion, vgl. [25]. ↓↓

Beispiele

scf(e) = [2;1,2,1,1,4,1,1,6,1,1,8,1,1,10,1,1,12,…]

scf((3-e)/(e-2)) = [0;2,1,1,4,1,1,6,1,1,8,1,1,10,1,1,12,1,1,…]

scf(e^2-1) =
[6;2,1,1,3,18,5,1,1,6,30,8,1,1,9,42,11,1,1,12,54,14,1,1,
15,66,17,1,1,18,78,20,1,1,21,90,23,1,1,24,…]

scf($\sqrt{e}$) = [1;1,1,1,5,1,1,9,1,1,13,1,1,17,1,1,21,1,1,…]

scf($\sqrt{(e/2)}$) = [1,6,32,1,2,1,1,3,1,2,2,1,1,4,1,2,1,2,1,1,…]

scf($\sqrt[3]{e}$) = [1;2,1,1,8,1,1,14,1,1,20,1.1,26,1,1,32,1,1,…]

scf(1/($\sqrt[4]{e}$ -1) = [3;1,1,11,1,1,19,1,1,27,1,1,35,1,1,43,1,1,…]

scf(16/($\sqrt{e}$-1)) =
[24;1,1,1,39,1,1,3,288,5,1,1,103,1,1,7,544,9,1,1,167,1,1,
11,800,13,1,1,231,1,1,15,1056,17,1,1,295,1,1,19,1312,21,…]

scf(1/(16($\sqrt[4]{e}$ -1)) = [0;4,1,1,5,7,1,2,2,1,1,3,2,
31, 2,4,1,1,3,2,2,7,1,1,2,1,2,1,1,3,1,2,1,
31, 4,4,1,1,3,4,2,7,1,1,4,1,2,1,1,3,1,4,1,
31, 6,4,1,1,3,6,2,7,1,1,6,1,2,1,1,3,1,6,1,…]

scf(1/(8($\sqrt[4]{e}$ -1)) = [0;2,3,1,2,
15, 2,2,3,1,1, 2,1,
15, 4,2,3.1,1, 4,1,
15, 6,2,3,1,1, 6,1,
15, 8,2,3,1,1, 8,1,
15,10,2,3,1,1,10,1,…]

scf($e^{2/5}$)= [1;2,
030, 12,1,1, 17, 90, 27,1,1, 32,
150, 42,1,1, 47,210, 57,1,1, 62,
270, 72,1,1, 77,330, 87,1,1, 92,
390,102,1,1,107,450,117,1,1,122,
510,132,1,1,137,570,147,1,1,152,…]

scf($e^{2/11}$) = [1;5,
66* 1, 27,1,1, 38,**66* 3**, 60,1,1, 71,
66* 5, 93,1,1,104,**66* 7**,126,1,1,137,
66* 9,159,1,1,170,**66*11**,192,1,1,203,
66*13,225,1,1,236,**66*15**,258,1,1,269,
66*17,291,1,1,302,**66*19**,324,1,1,335,
66*21,357,1,1,368,**66*23**,390,1,1,401,
66*25,423,1,1,434,**66*27**,456,1,1,467,
66*29,489,1,1,500,**66*31**,522,1,1,533,…]

Gegenbeispiele
scf(2sqr(e)) = [3;3,2,1,3,4,1,3,6,1,3, 8,1,3,10,1,3,…]
scf((1/2)sqr(e)) = [0;1,4,1,2,3,1,4,3,1,6,3,1, 8,3,1,10,3,1,…]
scf((√(17)+1)/(√(17)-1)) = [1;1,1,1,3,1,1,3,1,1,3,1,1, …]

►►Vervollständigung der Sammlung der Beispiele und Gegenbeispiele, Diskussion
****

Start mit
scf(e) = [2;1,2,1,1,4,1,1,6,1,1,8,1,1,10,1,1,12,…] (s1.1)
scf((3-e)/(e-2)) =
[0;2,1,1,4,1,1,6,1,1,8,1,1,10,1,1,12,1,1,…] = s(1.2))
Einfügen anderer snips in
[0;2,4.6.8.10,12,…] = s(0) ►
[0;2,1,4,1,6,1,8,1,10,1,12,1,…] = s(2)
[0;2,1,1,1,4,1,1,1,6,1,1,1,8,1,1,1,10,1,1,1,12,1,1,1,…] = s(3)
[0;2,1,1,1,1,4,1,1,1,1,6,1,1,1,1,8,1,1,1,1,10,1,1,1,1,…] = s(4)

[0;2,1,1,4,1,1,1,6,1,1,8,1,1,1,10,1,1,12,1,1,1,…] = s(2,3)
[0;2,1,1,1,4,1,1,6,1,1,1,8,1,1,10,1,1,1,12,1,1,…] = s(3,2)
ergibt
s(0) = 0.44638996… = ….
s(1.1) = e
s(1.2) = scf((3-e)/(e-2))
s(2) = …
s(3) = …
s(4) = …
s(2,3) = …
s(3,2) = …
scf(1+ $\frac{1}{4(\sqrt{e}\ -1)}$) = [1;2,1,1,2,7,
2,2,**1,1,1**,2,1,7,
4,2,**1,1,1**,4,1,7,
6,2,**1,1,1**,6,1,7,
8,2,**1,1,1**,8,1,7,
10,2,**1,1,1**,10,1,7,…]
Einfügen von snips ,1, ,1,1, ,1,1,1, … in scf-Darstellungen anderer mathematischer Konstanten [30,31], sie enthaltender Formelausdrücke und von Werten spezieller Funktionen [36,40]. Diskussion.
Suche nach dem Vorkommen weiterer zweielementiger snips, Materialsammlung, startend mit
scf(2√e) = [3;3,2,**1,3**,4,**1,3**,6,**1,3**, 8,**1,3**,10,**1,3**,…]
scf((1/2)√e) = [0;1,4,1,2,**3,1**,4,**3,1**,6,**3,1**, 8,**3,1**,10,**3,1**,…]
scf ($\frac{1}{4(\sqrt[4]{e}-1)}$) = **[**0,**1,7**,2,**1,7**,4,**1,7**,6,**1,7**,8,**1,7**,10,…**]**

Mehr:

scf($\frac{\mathbf{1}}{\mathbf{2\sqrt{e}\ -2)}}$) = [0;**1,3**,2,**1,3**,4,**1,3**,6,**1,3**,8,**1,3**,10,…]

$\mathrm{scf}\left(\frac{\mathbf{2-\sqrt{e}}}{\mathbf{2\sqrt{e}-2}}\right) = [0;\mathbf{3,1},2,\mathbf{3,1},4,\mathbf{3,1},6,\mathbf{3,1},8,\mathbf{3,1},10,\mathbf{3,1},\ldots]$

$\mathrm{scf}\,(6(e^{(1/6)}-1))^{-1} = [0;\mathbf{1,11},2,\mathbf{1,11},4,\mathbf{1,11},6,\mathbf{1,11},8,\mathbf{1,11},10,\ldots]$

$\mathrm{scf}\,(5(e^{(1/5)}-1))^{-1} = [0;\mathbf{1,9},2,\mathbf{1,9},4,\mathbf{1,9},6,\mathbf{1,9},8,\mathbf{1,9},10,\mathbf{1,9},12,\ldots]$

$\mathrm{scf}\left(\frac{\mathbf{1}}{\mathbf{3\sqrt[3]{}-3}}\right) = [0;\mathbf{1,5},2,\mathbf{1,5},4,\mathbf{1,5},6,\mathbf{1,5},8,\mathbf{1,5},10,\mathbf{1,5},12,\ldots]$

$\mathrm{scf}\left(\frac{\mathbf{1}}{\mathbf{4\sqrt[4]{e}-4}}\right) = [0,\mathbf{1,7},2,\mathbf{1,7},4,\mathbf{1,7},6,\mathbf{1,7},8,\mathbf{1,7},10,1,7,12,\ldots\mathbf{]}$

$\mathrm{scf}\,(7(e^{(1/7)}-1))^{-1} = [0,\mathbf{1,13},2,\mathbf{1,13},4,\mathbf{1,13}.6,\mathbf{1,13},8,\mathbf{1,13},10,\ldots]$

$\mathrm{scf}\left(\frac{\mathbf{2-\sqrt{e}}}{\mathbf{2\sqrt{e}-2}}\right) = [0;\mathbf{3,1},2,\mathbf{3,1},4,\mathbf{3,1},6,\mathbf{3,1},8,\mathbf{3,1},10,\mathbf{3,1},\ldots]$

$\mathrm{scf}\left(\frac{1}{e-1}\right) = [0;\mathbf{1,1},2,\mathbf{1,1},4,\mathbf{1,1},6,\mathbf{1,1},8,\mathbf{1,1},10,\ldots]$

$\mathrm{scf}\left(\frac{1}{2\sqrt{e}\ -2)}\right) = [0;\mathbf{1,3},2,\mathbf{1,3},4,\mathbf{1,3},6,\mathbf{1,3},8,\mathbf{1,3},10,\ldots]$

$\mathrm{scf}\,(3(e^{(1/3)}-1))^{-1} = [0;\mathbf{1,5},2,\mathbf{1,5},4,\mathbf{1,5},6,\mathbf{1,5},8,\mathbf{1,5},10,\mathbf{1,5},12,\ldots]$

$\mathrm{scf}\,(4(e^{(1/4)}-1))^{-1} = [0,\mathbf{1,7},2,\mathbf{1,7},4,\mathbf{1,7},6,\mathbf{1,7},8,\mathbf{1,7},10,1,7,12,\ldots\mathbf{]}$

$\mathrm{scf}\,(5(e^{(1/5)}-1))^{-1} = [0;\mathbf{1,9},2,\mathbf{1,9},4,\mathbf{1,9},6,\mathbf{1,9},8,\mathbf{1,9},10,\mathbf{1,9},12,\ldots]$

$\mathrm{scf}\,(6(e^{(1/6)}-1))^{-1} = [0;\mathbf{1,11},2,\mathbf{1,11},4,\mathbf{1,11},6,\mathbf{1,11},8,\mathbf{1,11},10,\ldots]$

$\mathrm{scf}((7(e^{(1/7)}-1))^{-1} = [0,\mathbf{1,13},2,\mathbf{1,13},4,\mathbf{1,13}.6,\mathbf{1,13},8,\mathbf{1,13},10,\ldots]$

Aus vorstehenden (numerischen, experimentellen) Einzel-scf-Entwicklungen induziert:

$\mathrm{scf}((n(e^{(1/n)}-1))^{-1}) =$

$[0,\mathbf{1,2n-1},2,\mathbf{1,2n-1},4,\mathbf{1,2n-1},6,\mathbf{1,2n-1},8,\mathbf{1,2n-1},10,\mathbf{1,2n-1},12,..]$

** Snip-Paare

$\mathrm{scf}\left(\frac{1}{e-1}\right) = \quad [0;\mathbf{1,1},2,\mathbf{1,1},4,\mathbf{1,1},6,\mathbf{1,1},8,\mathbf{1,1},10,\mathbf{1,1},\ldots]$

$\text{scf}\left(\frac{1}{2\sqrt{e}-2}\right) = [0;1,3,2,1,3,4,1,3,6,1,3,8,1,3,10,1,3,\ldots]$

$\text{scf}\left(\frac{2-\sqrt{e}}{2\sqrt{e}-2}\right) = [0;3,1,2,3,1,4,3,1,6,3,1,8,3,1,10,3,1,\ldots]$

$\text{scf}\left(\frac{1}{3\sqrt[3]{e}-3}\right) = [0;1,5,2,1,5,4,1,5,6,1,5,8,1,5,10,1,5,\ldots]$

$\text{scf}\left(\frac{3-2\sqrt[3]{e}}{3\sqrt[3]{e}-3}\right) = [0;5,1,2,5,1,4,5,1,6,5,1,8,5,1,10,5,1,\ldots]$

$\text{scf}\left(\frac{1}{4\sqrt[4]{e}-4}\right) = [0,1,7,2,1,7,4,1,7,6,1,7,8,1,7,10,\ldots]$

$\text{scf}\left(\frac{4-3\sqrt[4]{e}}{4\sqrt[4]{e}-4}\right) = [0;7,1,2,7,1,4,7,1,6,7,1,8,7,1,10,\ldots]$

$[0;1,3,2,1,3,4,1,3,6,1,3,8,1,3,10,1,3,\ldots] - [0;3,1,2,3,1,4,3,1,6,3,1,8,3,1,10,3,1,\ldots] = \frac{1}{2}$

$[0;1,5,2,1,5,4,1,5,6,1,5,8,1,5,10,1,5,\ldots] - [0;5,1,2,5,1,4,5,1,6,5,1,8,5,1,10,5,1,\ldots] = \frac{2}{3}$

$[0,1,7,2,1,7,4,1,7,6,1,7,8,1,7,10,1,7,\ldots] - [0;7,1,2,7,1,4,7,1,6,7,1,8,7,1,10,7,1,\ldots] = \frac{3}{4}$

** Aus vorstehenden numerischen Einzel-scf-Entwicklungen induziert:

$\text{scf}\left(\frac{1}{ne^{\wedge}(1/n)-n}\right) =$

$[0;1,(2n-1),2,(2n-1),4,1,(2n-1),6,1,(2n-1),8,1,(2n-1),10,\ldots]$

$\text{scf}\left(\frac{n-(n-1)e^{\wedge}(1/n)}{ne^{\wedge}(1/n)-n}\right) =$

$[0;(2n-1),1,2,(2n-1),1,4,(2n-1),1,6,(2n-1),1,8,(2n-1),1,10,\ldots]$

$[0;1,(2n-1),2,(2n-1),4,1,(2n-1),6,1,(2n-1),8,1,(2n-1),10,\ldots] -$
$[0;(2n-1),1,2,(2n-1),1,4,(2n-1),1,6,(2n-1),1,8,(2n-1),1,10,\ldots] = \frac{n-1}{n}$

mit n=1,2,3,4,5,…

** Detaillierte Herleitungen, Beweise durch vollständige Induktion [41,42].

** # Darstellung von $e^{(2/(2n+1))}$ durch einen verzweigten Kettenbruch/eine verzweigte Kettenstruktur (vgl. Unit 12.C)/ eine Kettenwurzel (vgl. Unit 90) [37].

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