Unit 15, part 76.3

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, quotations, sayings, slogans, scurrilities, besun, etc.
collected for encouragement and the advantage of my students and of myself.

Wort-Fundstücke, Gehörtes, Gelesenes, Zugelaufenes, Angeschwemmtes, …

http://www.spiegel.de/kultur/gesellschaft/**lust-der-taeuschung**-ausstellung-in-der-kunsthalle-muenchen-ueber-taeuschende-kunst-a-1223971.html
https://www.kunsthalle-muc.de/ausstellungen/details/**lustdertaeuschung**/

Super recognizer
https://en.wikipedia.org/wiki/**Super_recogniser**
https://www.focus.de/wissen/videos/spektakulaere-begabung-sie-halfen-nach-koelner-silvesternacht-so-ueberfuehren-super-recognizer-verbrecher_id_6172810.html Super recognizer in algorithmics?

https://t3n.de/news/**brainteaser**-610952/
Find creativity challenging brainteasers.

Förderung von Sprunginnovationen
https://www.bundestag.de/presse/hib/-/564400

https://www.bmbf.de/de/bundeskabinett-beschliesst-agentur-zur-foerderung-von-**sprunginnovationen**-6817.html
https://www.gruenderszene.de/technologie/bundesregierung-agentur-fuer-sprunginnovationen
https://www.ihk-muenchen.de/ihk/documents/%C3%9Cber-Uns/TOP-6.4-Position-zur-Einrichtung-einer-Agentur-f%C3%BCr-Sprunginnovationen-Bayern.pdf
Das Salz der Erde.
No bait, no fish.
Disruptive innovations in algorithmics?

https://www.wissenschaft-aktuell.de/artikel/**Physikalisches_Modell_sagt_Wirtschaftswachstum_voraus**1771015590610.html
A. Tacchella, D. Mazzilli, L. Pietronero. A dynamical systems approach to gross domestic product forecasting. Nature Physics vol. 14 (2018), p. 861–865
DOI: 10.1038/s41567-018-0204-y

The social network of Batus barbicornis.

What algorithm is encoded (and how) in this sentence?

Infernal machine 1 (see also Unit 12)
Input: x, accuracy ε

$s := 1; \begin{pmatrix} u \\ v \end{pmatrix} := \begin{pmatrix} 1 \\ x \end{pmatrix}$; i:=1; f(1,x);=1

$s := s + \frac{1}{v}$

$\begin{pmatrix} u \\ v \end{pmatrix} := \begin{pmatrix} 0 & 1 \\ -1 & x \end{pmatrix} \begin{pmatrix} u \\ v \end{pmatrix}$

i:=i+1

$\frac{1}{v} \leq \varepsilon$ (in case of convergence)

f(i,x) := s $\rightarrow$

Output: $\langle f(i,x) \rangle$

Execution record for x=0.2

init s=1

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 1 \\ 0.2 \end{pmatrix}$$

**2 $s = 1 + \frac{1}{0.2} = 6$

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0.2 \end{pmatrix} \begin{pmatrix} 1 \\ 0.2 \end{pmatrix} = \begin{pmatrix} 0.2 \\ -0.96 \end{pmatrix}$$

**3 $s = 6 + \frac{1}{-0.96} = 4.958(3)\text{per}$

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0.2 \end{pmatrix} \begin{pmatrix} 0.2 \\ -0.96 \end{pmatrix} = \begin{pmatrix} -0.96 \\ -0.392 \end{pmatrix}$$

**4 $s = 4.958(3)\text{per} + \frac{1}{-0.3922} = 2.407312925\ldots$

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0.2 \end{pmatrix} \begin{pmatrix} -0.96 \\ -0.392 \end{pmatrix} = \begin{pmatrix} -0.392 \\ 0.8816 \end{pmatrix}$$

**5 $s = 2.407312925\ldots + \frac{1}{0.8816} = 3.541614195\ldots$

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0.2 \end{pmatrix} \begin{pmatrix} -0.392 \\ 0.8816 \end{pmatrix} = \begin{pmatrix} 0.8816 \\ 0.56832 \end{pmatrix}$$

**6 $s = 3.541614195\ldots + \frac{1}{0.56832} = 5.301186267\ldots$

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 0.2 \end{pmatrix} \begin{pmatrix} 0.8816 \\ 0.56832 \end{pmatrix} = \begin{pmatrix} 0.56832 \\ -0.767936 \end{pmatrix}$$

**7 …..

$\langle f(i, 0.2) \rangle =$

20 digits

{1, 6, 4.958(3)per,
2.4073129251700680272 ...,
3.5416141955874908947…,

5.30118626765956296679656804105857774512 2…,
3.99899441833878623540228518415383568328 3…,
2.61377482224665694232971297542673059276 7…,
4.21748372624376667399457322438934915032…,
5.39865382622858722080564829857275642703 9…,
more, …}

⟨f(i, 0.2)⟩=

40 digits

{1, 6, 4.958(3)per,
2.40731292517006802721088435374149659863 9…,
3.54161419558749089472449596898650567305 0…,
5.30118626765956296679656804105857774512 2…,
3.99899441833878623540228518415383568328 3…,
2.61377482224665694232971297542673059276 7…,
4.21748372624376667399457322438934915032…,
5.39865382622858722080564829857275642703 9…,

3.19713051017341942767292443894633541947 1…,
2.13042322274709343535019121452924353904 4…,
5.87941927399589488911051875930198338614 9…,
6.88869256270099793715839967276028132145 7…,
-7.69373353747506968387860472695199967846 7…,
-8.68922688533660982474206283674119227673 8…,
-16.24610850919355193401935241634885373434…,
-15.22367750873220283998263453840541872125…,
-12.17435723796601644747079228668576459868…,
-13.27028040877786737398587093436195829996…,
-15.22938802258200216020873628495144960730…,}

Execution record for x=1.2

⟨f(i, 1.2)⟩=

20 digits

{1, 1.833333333333333333…,
4.106060606060606060…,
2.617965367965367965 4…,
1.815654713279873742 0…,
0.601590999216159678 29…,
4.477800376541885304 7…,
5.360209791920940152 4…,
6.267709309857196224 7…,
11.55720465984067607 3…,
10.41443138687717191 4…,
9.607414219675371001 8…,
7.973141555936432880 4…,
9.953890987562430777 9…,

10.775094935635419065…,
11.820671907123055946…,
-2.45839079749774581…,
-3.41951443249203053…,
-4.26804636135038401…,
-6.94357170454086516…,
-5.57370116247862823…,…

$\langle f(i, 1.2)\rangle = \{1,$

40 digits

1.83333333333333333333333333333333333333…,
4.10606060606060606060606060606060606060…,
2.61796536796536796536796536796536796536…,
1.81565471327987374200467910352377618102 9…,
0.60159099921615967829061538946006211731 50…,
4.47780037654188530468605076529732334281 7…,
5.36020979192094015243160059813368369340 9…,
6.26770930985719622469237501321031440470 3…,
11.55720465984067607281530660894865686474…,
10.41443138687717191410063538068702030985…,
9.60741421967537100175773375845246180370 5…,
7.97314155593643288038770802966856044738 5…,
9.95389098756243077792013996416410636553 5…,
10.77509493563541906504253129297085502009…,
11.82067190712305594570540038912181769732…,
-2.45839079749774581469695887445719804626 4…,
-3.41951443249203053339958621981259914508 5…,
-4.26804636135038401428561897887428214620 2…,
-6.94357170454086516292574041443463845728 7…,
-5.57370116247862823074055680778458189705 4…,

-4.773543409195260464492809551663658593429…,
-3.474349906398651992877166808017762667132…,
-6.540859872305951179302158034831065936141…,
-7.402162110655751947082923774578517008704…,
-8.339250203034393468279807551328647919298…,
-16.705349929757262166887171688893691774 23…,
-15.622746787909635742089658569996474860 38…,
-14.808394269851429554678954027789859244 6…,
-12.989762099121395191192189713180442730 60…,
-14.749913732021843827563336728854162739 05…,
-15.561850338877963684512539048272250004 10…,
-16.660974855250882260170267567066143373 16…,
-9.510211837249470737340932460245086278468…,
-8.582248933937504947586588071682670248514…,
-7.715179313185509841981801059112969746774…,
-4.450860491295266160247996477128228853446…,
-5.723612889909832051960447308449679462 14…,
-6.524137293877342702399247709704054291179…,
-7.926035384189366538788736763533305152114…,
-5.382792764152200083816024022376494231 18…,}

Divergence for $-2 < x < +2$ (= analogon to „inside a black hole“ [1]).

Execution record for x=3.2

init s=1

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 1 \\ 3.2 \end{pmatrix}$$

**2 $s = 1 + \frac{1}{3.2} = 1.3125$

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 3.2 \end{pmatrix} \begin{pmatrix} 1 \\ 3.2 \end{pmatrix} = \begin{pmatrix} 3.2 \\ 9.24 \end{pmatrix}$$

**3 $s = 1.3125 + \frac{1}{9.24} = 1.420725108 \ldots$

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 3.2 \end{pmatrix} \begin{pmatrix} 3.2 \\ 9.24 \end{pmatrix} = \begin{pmatrix} 9.24 \\ 26.368 \end{pmatrix}$$

**4 $s = 1.420725108 + \frac{1}{26.368} = 1.458649865 \ldots$

$$\begin{pmatrix} u \\ v \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -1 & 3.2 \end{pmatrix} \begin{pmatrix} 9.24 \\ 26.368 \end{pmatrix} = \begin{pmatrix} 26.368 \\ 84.36836 \end{pmatrix}$$

**5 ….

$\langle f(i, 3.2) \rangle$={1, 1.3125, 1.420725108 ...,
1.458649865 ...,
1.4719587814156073441…,
1.4766300999681413662…,
1.4782697296227613809…,
1.4788452400705099089…,
1.4790472444586569857…,
1.4791181480793565291…,
1.4791430352785886486…,
1.4791517706954812139…,
1.4791548368303074363…,
1.4791559130448588750…,
1.4791562907965972605…,
1.4791564233876086555…,
1.4791564699271067340…,
1.4791564862624891903…,

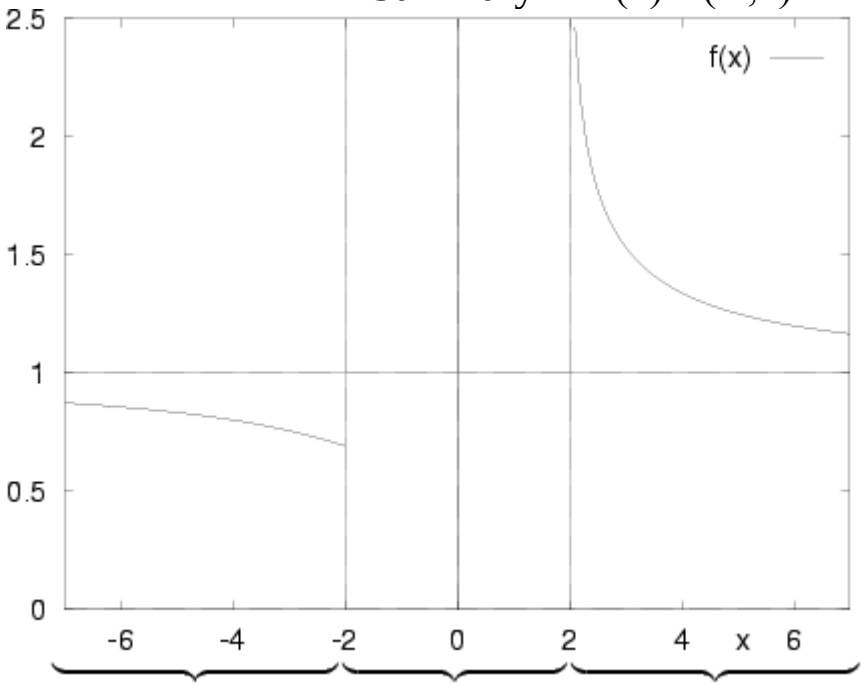
1.47915649199621497 18…,
1.47915649400875501 65…,…}

Execution record for x=10.2

⟨f(i, 10.2)⟩={1, 1.098039215686274509 8…,
1.107744184630373888 7…,
1.108704976630435379 4…,
1.108800095133632350 3…,
1.108809511874957955 6…,
1.108810444133290675 5…,
1.108810536426958822 0…,
1.108810545564041196 0…,
1.108810546468613264 6…,
1.108810546558165989 8…,
1.108810546567031718 5…,
1.108810546567909426 6…,
1.108810546567996319 7…,
1.108810546568004922 2…,
1.108810546568005773 8…,
1.108810546568005858 1…,
1.108810546568005866 5…,
1.108810546568005867 3…,
1.108810546568005867 4…,
1.108810546568005867 4…,…}

Convergence for abs(x)> 2 („outside the black hole“).

Summary f(x)=f(∞,x)



convergence divergence convergence
„black hole“

Infernal machine 2

Input: x, accuracy ε

$s := 1; \begin{pmatrix} u \\ v \end{pmatrix} := \begin{pmatrix} 1 \\ 4x - 2 \end{pmatrix}$; i:=1 g(1,x):=1

$s := s + \frac{1}{v}$

$\begin{pmatrix} u \\ v \end{pmatrix} := \begin{pmatrix} 0 & 1 \\ -1 & 4x - 2 \end{pmatrix} \begin{pmatrix} u \\ v \end{pmatrix}$

i:=i+1

$\frac{1}{v} \leq \varepsilon$ (in case of convergence)

g(i,x) := s →

Output: $\langle g(i, x) \rangle$

Execution record for x=0.55

$\langle g(i,x)\rangle = \{1, 6,$
4.958333333333333333…,
2.407312925170068027 2…,
3.5416141955874908947…,
5.301186267659562966 8…,
3.998994418338786235 4…,
2.613774822246656942 3…,
4.217483726243766674 0…,
5.398653826228587220 8…,
3.197130510173419427 7…,
2.130423222747093435 4…,
5.879419273995894889 1…,
6.888692562700997937 2…,
-7.693733537475069683 9…,
-8.689226885336609824 7…,
-16.24610850919355193 4…,
-15.22367750873220284 0…,
-12.17435723796601644 7…,
-13.27028040877786737 4…,…}

Divergence for $0 < x < 1$ (= „inside a black hole“).

Execution record for x=1 („event horizon“)

$\langle g(i,x)\rangle = \{1, 1.5,$
1.833333333333333333…,

2.083333333333333333…,
2.283333333333333333…,
2.450000000000000000…,
2.592857142857142857…,
2.717857142857142857…,
2.828968253968253968…,
2.928968253968253968…,
3.019877344877344877…,
3.103210678210678210…,
3.180133755133755133…,
3.251562326562326562…,
3.318228993228993228…,
3.380728993228993228…,
3.439552522640757934…,
3.495108078196313490…,
3.547739657143681911…,
3.597739657143681911…,
3.645358704762729530…,
3.690813250217274985…,
3.734291511086840202…,
3.775958177753506869…,…}

Discussion!

Execution record for x=3.05

$\langle g(i,x)\rangle = \{1, 1.098039215686274509…,$

1.10774418463037388…,
1.10870497663043537…,
1.10880009513363235…,
1.10880951187495795…,
1.10881044413329067…,
1.10881053642695882…,
1.10881054556404119…,
1.10881054646861326…,
1.10881054655816598…,
1.10881054656703171…,
1.10881054656790942…,
1.10881054656799631…,
1.10881054656800492…,
1.10881054656800573…,
1.10881054656800581…,
1.10881054656800586…,
1.10881054656800587…,
1.10881054656800587…,…}

Convergence for $x > 1$ („outside the black hole“).

Check the **im 1** and the **im 2** for $\mathbf{x} \in \mathbb{C}$.

Check the following extension „Hermite“ [2] for $\mathbf{x} \in \mathbb{R}$ and $\mathbf{x} \in \mathbb{C}$.
Input: x, accuracy ε

$s := 1; \begin{pmatrix} u \\ v \end{pmatrix} := \begin{pmatrix} 1 \\ x \end{pmatrix}; i := 1; h(1, x) := 1$

$s := s + \frac{1}{v}$

$\begin{pmatrix} u \\ v \end{pmatrix} := \begin{pmatrix} 0 & 1 \\ -i & x \end{pmatrix} \begin{pmatrix} u \\ v \end{pmatrix}$

i := i+1

$\frac{1}{v} \leq \varepsilon$ (in case of convergence)

h(i,x) := s $\rightarrow$

Output: $\langle h(i, x) \rangle$

Execution record for x=0.55

$\langle h(i, x) \rangle = \{1, 2.8181818181818181818,$
2.2290801981523631008,
1.8420271234995013271,
2.0282813302253735498,
2.0912890208456411430,
2.0487085495148326423,
2.0406449612486059734,
2.0490011552330842181,
2.0498472162464137839,
2.0480178779656132274,
2.0479427017614415009,
2.0466206426669213035,
2.0466264393972892693,
2.0466359207110906100,
2.0466355254005491982,

2.046635200603012607 1,
2.046635224809755794 4,
2.046635237607285367 0,
2.046635236259446071 5,…}

More, discussion!

References

[1] https://en.wikipedia.org/wiki/Black_hole

[2] Weisstein, Eric W. "Hermite Polynomial." From *MathWorld*--A Wolfram Web Resource. http://mathworld.wolfram.com/HermitePolynomial.html

Some further extensions

**1 Truncated „black holes“

**2 Periodically repeated „black holes“, x∈ ℝ

**3 Periodic array of „black holes“, x∈ ℂ

**4 Find other „black hole“ generating algorithms, x∈ ℝ and x∈ ℂ

**5 Discuss applications.

**6 More in Unit 15, part 76.4 .

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