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How to Cook up a Math Poem in n Easy Steps

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Synopsis

A mathematical poem attempts to distill a mathematical concept and present it in a literary or visually compelling way. This paper presents an outline of my own personal method of composing such poetry. The outline is elucidated via an extended meditation on the composition of one particular poem.

Consider if you will, gentle reader, the following lines of verse. What do they mean? From whence do they come?

> **Pi Remorse**
>
> Meet ere Io, myrtle tied,
> Updates Dante.
> We, in pi, meet Nike, Eros.
> Say that time nixed the exit.
> Zeus near Etna,
> On pioet's side.

An ode etched in ancient pottery shards? Tattered parchment musty with age? Nay, nay, I have dredged these lines today from π. They mean almost nothing.

They comprise a math poem. The following recipe details how this poem was cooked up, and how you might make your own math poem. I suggest you follow this recipe very closely. Though perhaps not as closely as Paul

Schmidt when he sought to translate the complete works of Arthur Rimbaud: "I sought out streets and houses he had lived in. I drank and drugged myself in taverns and in alleys he had known" [14, page *xiv*]. However, should you decide on such a strategy, it will be easier on the liver. I have limited my personal remembrances to tedious domesticity. A math poet's life must be as boring as Rimbaud's was not.

A math poem is crystalline, perfect, dead.

Cubist poet Pierre Reverdy considered his poems as stand-alone objects, "cristaux déposés après l'effervescent contact de l'esprit avec la réalité" [3, page 284]. For a math poem, we must simply substitute "les mathématiques" for "la réalité" and translate into English to achieve:

> Math poems are crystals deposited after the
> effervescent contact of the spirit with mathematics.

Step 1: Find a place where you can sit alone. Bring a pencil and a pad of paper. A pen will do in a pinch, but keep in mind you'll need extra paper.

My clothes stick to my flesh in the steamy warmth beside the SW Community Center's indoor pool; I am watching my wife J and 8-month-old son M's swim class. (He's an 'Angelfish'.) My pad lays on my lap, opened to a fresh blank sheet. The woman next to me leans over and asks "Is it Divide-and-Conquer for you and your wife afterwards?" Being an agreeable sort, I agree, though my mind is elsewhere and I do not fully comprehend her question. Intently, I stare at my pad.

Step 2: Think up a topic. A theorem, definition, or proof will serve nicely. It should be well-known (at least among mathematicians); think Pascal's Triangle, the Intermediate Value Theorem, S_n, or Koch's snowflake.[1] This is important. A math poem is an obscure beast to begin with; there is no point painting zebra-stripes on a unicorn.

Today I am thinking about π. Clearly a well-known topic. I write a big, fancy "π" on my pad. The woman next to me continues, "Yes, that is why my husband and I always both come together. It is too much work for just

[1] Actually you should think up something else, as I've already used these as fodder for my own poems (see [10], [9], [6], and [7].)

one person to get Baby dry and clothed when you yourself need to too." To too two *hums my brain. I pencil in a little '2' on my pad.*

Step 3: Distill the kernel of the topic. And since I'm speaking to mathematicians, I must say—no, you're not calculating the inverse image of the additive identity under a homomorphism. Unless, perhaps, your math poem is about algebra.

The kernel of π? To my experience, a student who avers that π is his favorite number, when asked why, will invariably and inexplicably reply: "Because it goes on forever." (Just as the decimal representation of any real number?) Yet herein lies the kernel of π: its digits. They are intractible, hazy, colorful, swimming, mysterious. Like the first time you see a Sockeye salmon—blood red, sea green—appearing lazily at the river's edge, mouth opening, closing, tail undulating, staring unblinking, fading, disappearing. 3 point 1 4 1 5 9 . . .[2]

Step 4: Make the kernel literarily or visually interesting. Even to a non-mathematician. Even if you only expect mathematicians to grok your poem, this is the part where you try to appeal to the non-mathematical side of them. Trust me, it is there.

3 point 1 4 1 5 9 . . . How is that literary or visual? There is always the pioem*, a poem whose words are of length specified by π's digits in sequence, and the* piaku *(popularized by Mike Rollins), a poem in which the lines contains the number of syllables thusly prescribéd. But a math poet should seek a fresh horse to ride. On my page sits π_2. Hm, hm, . . . π in binary? Lets see,*

$$\text{“}\pi_2 = 11.001...\text{”}$$

Dash, dash, dot, dot, dash. . . Morse code!

Step 5: Do some research. This stage may be as simple as looking up a theorem to make sure you've got the hypotheses right. In one case, it

[2]Wait—you cry—the kernel of π is not its digits, it is π's definition as the ratio of a circle's circumference to its diameter. You, my friend, are correct, and may thus write your own math poem. I should say 'a kernel' and not 'the kernel,' but I won't, as evidenced by the next sentence.

consisted of a mathematician trying to help his poet friend by searching for a graphical problem for which there were exactly 66 solutions [5]. (Upon not finding one, he invented his own—see next step.) What you should *not* do is read other people's math poems about your topic. Your creative spark may thereby be crushed pre-ignition. You might just plain get discouraged.

The next day, I sit quietly at my computer. Very quietly. I hardly dare to type, as M is asleep in the next room, and, given the acrobatic contortions necessary (but not always sufficient) to get him from my rocking arms to his bed, I want to keep it that way. The cursor flashes in the Google search box. "Morse code" yields immediately what I want, as does my second search, "Pi in binary." Indeed, I hit upon a webpage entitled "Binary Pi," [4] which in 1995 earned 4th place in the German magazine FOCUS's Top Ten Most Useless Internet-Addresses of the World Wide Web. The webpage contains 32,768 digits of π *in binary.*

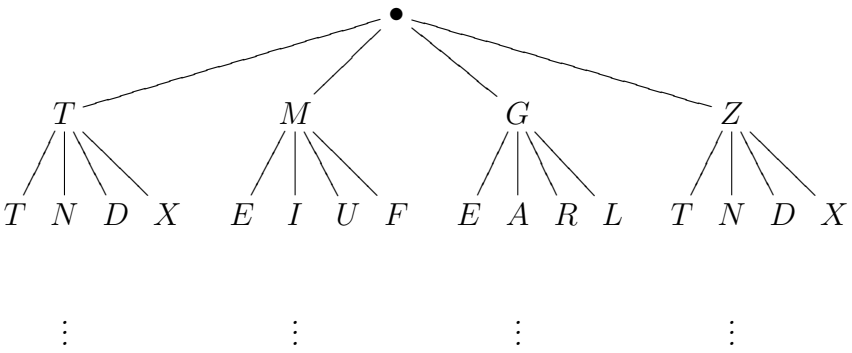
Step 6: Do some work. Maybe use a computer.

A math poet must be a conceited masochist[3]*, I muse to myself as I proudly type the line of code:*

```
for (i = 0; i < 4; i++)
   switcheroo += (bipi[pipos+3-i] == '0' ? 0 : (1 << i));
```

My goal: to consider π *in binary, throw out the decimal point (binary point?), replace every '1' with a 'dash' and every '0' with a 'dot,' and then, by cleverly separating the string into chunks, make a poem in Morse code. Since* $\pi_2 = 11.0010010\ldots$*, my poem must begin with either a 'T' (dash), an 'M' (dash dash), a 'G' (dash dash dot), or a 'Z' (dash dash dot dot). Every time a letter is chosen, that opens up 3 or 4 options for the next letter. For example if you start with 'M,' you chop off the first '11' and the next bit of pi is '0010.' Hence the next letter can be 'E,' 'I,' 'U,' or 'F.' One could make a rooted tree whose traversals give all Morse-encoded poems hidden in* π*:*

[3]Here of course, I'm only talking about myself.



I soon found the work of manually checking out the different traversals too time-consuming, so I'm busy writing a C *program to aid in the composition of my poem.*

Step 7: Write.

I'll leave this critical step up to your imagination and instead pause briefly to wax poetic about math poetry in general.

Why math poetry? According to Keith Abbott, "Kenneth Rexroth once opined that poetry functions nobly to ease our passages in and out of love, and that anyone who writes poems for other reasons is out to lunch."[4] [2, page xi] Yet I've already pair-bonded and procreated—plus who picks up chicks with a math poem? I must be out to lunch. Maybe I was seeking a glittering resplendent vision, jewels plucked from amidst the thickly intertwined roots of the primordial tree of knowledge. Maybe. Or maybe I was just trying to get tenure.[5]

I used to write poetry. Real *poetry. (Not math poetry—you see?) It was good stuff, a bit philosophical. But then on July 11th, 2005—I wrote down the date for some reason—my wife-to-be*[6] *said "I don't like to think about unanswerable questions because I don't like to masturbate mentally without*

[4]Though one has to wonder about Abbott's quote, as in Rexroth's 1936 essay 'The Function of Poetry and the Place of the Poet in Society' one finds "We [poets] are conscious of the dangers which threaten what civilization we have. It is our job to awaken this audience to these dangers and to ally ourselves with the common people who have already awakened."[13]

[5]Though now a moot point, having dropped out of academia.

[6]Hi honey! You're the best!

any chance of coming." It was right around that time that I stopped writing real poetry. I'm not sure it was related.

Step "...": Rewrite. Your first attempt needs some work. You might need to scrap the whole thing. This step can also be left off until after you try step $n-1$, and the editor says "Your first attempt needs some work. You might need to scrap the whole thing." This step may bear repeating.

Step $n-1$: Share your creation. Several journals will publish math poems. And if you don't think your poem is good enough to stand on its own, you can bundle it with a bit of meta-analysis.

Step n: Reflect and generalize. Appreciate your work. This might be a good time to see if anyone has done anything similar. If you're in the mood.

While I haven't found anyone combining π in binary and Morse code, certainly interpreting the digits of π as an alphanumeric code is well established. The National Energy Research Scientific Computing Center hosts a website [1] allowing one to search the first four billion binary digits of π for a given hexadecimal string or strings formed of the 26 letters ($a \leftrightarrow 00000$, $b \leftrightarrow 00001$, $c \leftrightarrow 00010$, etc.) plus 6 punctuation marks. I learn that the string "rimbaud," occurs at the binary index 3538670076 of π.

Also online, one can find Keith Lynch warning you not to calculate π in binary, as the conjectured regularity (meaning all bit-strings appear at some point) would imply that you are breaking copyrights, possessing child pornography, defaming Islam, and so forth [12].

Finally, I bow in reverence of Mike Keith. He has really taken literary π-drudgery to an art form. His website [11] *provides a glimpse into this embarras de richesse.*

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[5] Chandler Davis, "Answer in search of a question," *The Mathematical Intelligencer*, **32** (2010).

[6] Caleb Emmons, "$S_{|\{e,s,t,i,n,a\}|}$", *The Mathematical Intelligencer*, **29** (2007).

[7] Caleb Emmons, "Snowflake," *The Mathematical Intelligencer*, **32** (2010).

[8] Caleb Emmons, "Seeing pine trees," *The Journal of Humanistic Mathematics*, **1** (2011), 153–153(1).

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[10] Caleb Emmons, "Dearest Blaise," *Mathematics Magazine*, **80** (October 2007), 307–307(1).

[11] Mike Keith, http://cadaeic.net.

[12] Keith Lynch, *Converting Pi to Binary: DON'T DO IT*, http://www.netfunny.com/rhf/jokes/01/Jun/pi.html, accessed January 27, 2013.

[13] Kenneth Rexroth, *World Outside the Window*, New Directions Books, New York, NY, 1987.

[14] Arthur Rimbaud, *Complete Works*, Harper & Row, New York, NY, 1976, Translated from the French by Paul Schmidt.