Mayan Seasonal Almanac*

milogardner†

2013-03-22 3:54:32

Advanced cultures around the globe created abstract mathematics to model the cycles of planets, and other astronomical events. Several cultures predicted planetary cycles and events in exacting ways. Chinese math, for example, modeled a "string of pearls" event such that planetary alignments focused on Feb. 1, 1951 BCE and other times when fewer planets aligned. Chinese mathematical astronomers birthed the Chinese remainder theorem a generalized indeterminate equation method aligned calendars and predicted astronomical events including solar and lunar eclipses.

This paper introduces math that was independent developed by Mayans in base 13 and modified by base 20. Mayans aligned calendars and predicted astronomical events by recording distance numbers in mod 18 and 20 Olmec long count dates and other cycles. The long count was used by Mayans by 400 BCE recorded mathematical astronomical traditions consistent with North American multple numeration systems (Kroeber, 876-877).

Mayan mathematical astronomy modeled planetary cycles and events in modular and linear ways. The modular math followed implicit features of the CRT within 117, 260, 360, 365, 584, 585, 780 and longer planetary cycles recorded in multiple numeration systems, most often base 13 and base 20.

The linear math followed the sun, equinoxes and solstices across the horizon that began at the summer equinox. Nominal planetary cycles were measured in terms of solar and lunar equinoxes.

In 2012 four super-numbers have been dated to 419 AD. The long count dates were painted on a wall near Tikal, Guatemala, the smallest number:

341640 = 2920(117) = 1312((260) = 949(360) = 936(365)= 585(584) = 439(780)= 18(18980) = 6(56940)

represented modular and linear planetary facts.

The linear door to Mayan time encoded four long count dates as super-numbers and greatest common divisors (GCD)s. Divide each GCD by four or more planetary least common multiples (LCM)s, and a set of quotients and

---

* ⟨*MayanSeasonalAlmanac*⟩ created: ⟨*2013-03-2*⟩ by: ⟨*milogardner*⟩ version: ⟨*42509*⟩ Privacy setting: ⟨*1*⟩ ⟨*Definition*⟩ ⟨*adding Kroeber*⟩ ⟨*01A12*⟩

remainders were discussed. Related linear classes of quotients appeared 800 years later in several Dresden Codex almanacs.

The Dresden Mercury-Venus almanac cited nominal cycles for the planets that considered:

9.9.9.16.0 = 1366560 days = 2340(584) days = 72(18980) days,

and,

2340 = the LCM of 117 and 584

such that

584 = Venus synodic period,

and

18980 days = 73(260) days = 52(365) days

on page 49-50 of the Dresden Codex.

The seasonal almanac reported four lines of mod 20 quotients and day remainders as binary pairs. The Dresden codex reported families of almanacs that captured two to four modular and linear synodic and sidereal cycles of planets. As hort list Mercury (117), 9-moons (260), 405-moons (11960), earth (360, 364, 365), Venus (584, 585), Mars (780), Saturn (376) and Jupiter (399) introduces this topic. Other planetary cycles included LCMs 2340, 2920, 11960, 18980, and 37960. At times nominal sidereal cycles were discussed super-number and serpent-number GCDs. Two of 13 serpent-numbers were parsed by Mayans into super-numbers and planetary cycles were mentioned on pages 61-64 in the Dresden Codex.

For example 4.6.1.9..15.0 = 12,394,740 = 167(74220),

and

12,466,942 = 34156(365) + 2 days

opens a topic best explained on pages 65-69.

To introduce pages 65-68 data that Barbara Tedlock reported as synodic and sidereal lunar cycles in "The Sky in Mayan Literature" (1992), The book was edited by A. Aveni in "The Road of light: Theory and Practice opf Mayan Sky Watching". Tedlock described overlapping A, B, C, and D circular 65 day and 82 day lunar cycles defined one aspect of the modular Mayan 260 day lunar cycle. Per Tedlock, "Simultaneous with a sidereal rhythm these same visits contain a synodic rhythm. For any two successive mountaintop shrines A and B, the phase of the observed at the opening of A will repeat in 147 days later at the closing of B, and yet again when B is opened 178 after it was closed, a total of 325 days after the opening of A. ... Summarizing the arithmetic, we find 147 = 65 + 82 and 325 = 147 + 178 = 4(65) + 65...". Scholars tend to discuss this data in linear ways.

The seasonal almanac is making clear how Mayans thought of this data.

Mayans integrated older Olmec long coun dating and numeration systems within classes of GCDs divided by nominal linear and modular planetary cycles. For example, the lunar 260 day cycle was a divisor of GCD 341640 reported quotient 1314 with zero remainder appears linear. The nominal cycle of Mars 780 days was also a divisor of 341640 found a quotient of 438, with a zero remainder. Knowing that 260 is 1/3 of 780, if a non-zero remainder was calculated the Mayan scribe knew that 260 or 520 days would be reported. In this rational number manner Mayans created GCDs divided by planetary cycles in interesting ways. Mayan almanacs showed off scribal understandings of astronomy and rational numbers in ways that Mayan number theory topics tend to be under valued by math historians and Mayan specialists.

In the 1200 AD Dresden Codex seasonal almanac numerals were recorded mod 13 data as four part (stative words), and four colors representing the four directions. Long count mpd 18, 20, 360, 7200 and 144000 mentioned paired six-digit and longer serpent-numbers. Mayan scribes encoded four line of seasonal almanac mod 13 numerals written across four pages. The quotient and day remainder system referenced black and red serpent-numbers on pages 61-64 that double checked Saturn, Jupiter, Mars and Mercury synodic and sidereal cycles. The planetary synodic data was recorded on pages 65-68 of the Dresden Codex.

A 1988 paper and a 2011 year book written by Victoria Bricker and Harvey Bricker decodes a first level of scribal math reported on pages 65-68 of the Dresden Code. The raw almanac data reported linear and possibly modular eclipse, solstice and equinox cycles are suggested to be valid for 800 years (per 15 reference dates cited on pages 61-64), and longer by serpent-numbers.

Bruce Friedman in 2012 has decoded a second level of the seasonal almanac. Friedman summed four rows to by 1898, 1898, 1924 and 1911 day totals on pages 65-68/ The Brickers' 1988 paper, by contrast, reported the same data by a linear series: 9 5 1 10 6 2 11 7 3 12 8 4 13 an from the [third visible line] bottom of the codex pages.

The constructed line of tzolkinlike coefficients are reasonable.

12 4 5 2 8 10 8 2 5 4 12 3 3

The data does not appear in the Seasonal Table. Reconstruction of the damaged data represents even entries of the missing data.

Reconstructions suggest that the entire top line may have read:

9 12 5 4 1 5 10 2 6 8 2 10 11 8 7 2 3 5 12 4 8 12 4 3 13 3

Following the Bricker and older reconstructions 11 13 11 1 8 6 4 2 13 6 6 8 2 offers entries from the [second visible line] middle of the Codex.

Secondly, 1 1 12 13 8 1 5 7 7 13 6 1 3 shows tzolkin-like coefficients comprised of even alternate entries of the [first visible line] top of the CdX pages. Figure 6's description is a schematic of the upper half of the CdX. We see the "corrected" sixth entry on figure 6's bottom line reads 13 on the CdX and 1 on figure 6. We have also found what appears as an entry that is not in need of correction! To review this in greater detail, one other minor item on Page S36, the near top paragraph, begins with "The sky band" has a misplaced sentence that begins with "appears twice".

The reconstructed first line (summed to 1898) has been replaced on pages 65-68 as one data set:

9 12 5 4 1 5 10 2 6 8 2 10 11 8 7 2 3 5 12 4 8 12 4 3 13

11 1 13 1 11 12 1 13 8 8 6 13 4 5 2 7 13 7 6 13 6 6 8 1

11 11 13 11 11 9 1 10 8 5 6 11 4 2 2 4 13 4 6 10 6 3 8 11

9 9 5 1 1 2 10 12 6 5 2 7 11 5 7 12 3 2 12 1 8 9 4 13

Friedman's second level offers 9 12 = 9(20) + 12 = 192, a new 13-term series that was double checked and extended by paired cross-wise sums (follows Barbara Tedlock's suggestions). The 13-term series recorded base 13 numbers in day distance numbers such that:

274 432 355 163 432 177 167 178 432 163 355 432 274

The new Mayan series requires five explanations. First, the 13-term series contains distance number 432 days four times. By adding in the first line of four lines as a larger context, Mayan scribal math double checks data elements in innovative ways.

Second, Mayans created interlocked 260, 364 and other numbered wheel calendars that aligned lunar, earth and planetary cycles that represented the immediate Mayan universe. For example the paired 376 and 399 day synodic periods of Jupiter and Saturn were linked to three of the 432 days cited in the above series. The details will become available in a formal paper that Friedman is preparing.

Third, Friedman decodes symmetries of the 13-term series. Reference number 178 "appears" where 177 is "expected" without 148 being mentioned related to eclipse cycles. Line two referred an anomaly (namely line 2 on p.65 where 13,11 appears to break a consistent pattern) of 10 day mod 13 additions to alternate entries in all of lines one and two. Clearly 13,10 is "expected" related to the b pattern and would have made the 178 "appears" as 177. The anomaly is a dual term, used in two series.

Fourth, the paired 13-term series data was processed from the first two lines that yielded 163 (twice) and 167 (once at middle), with 163 and 167 possibly acted as an anchor (of some kind). The third line presented the same values that "appear" as a delta from the first and last entries on line 3 p.65 (167 as the delta between 9,9 and 1,2) and the first and last entries of line 3 p.67 (163 as the delta between 11,5 and 3,2). Shelving analysis of these two quantities [163 and 167] in favor of the more peculiar four-time appearance of 432 seems important. To date 4 x 432 is 1728 and trivially

1000 + (2 x 364).

Fifth, line three's 13 quantities total 1911 which are 21 x 91 and if 1728 is deducted 183 as a result. Also look at 432 less one cycle of 260 and find result 172. 172+183 is 355. 355 "appears" above (as I believe it was intended) to be the 177+178 spacing of lunar eclipses. The 432 day number appears four times in a manner that needs to be precisely understood.

The other matrix numbers are associated with well-known lunar eclipse cycles 177 and 178.

Harvey Bricker classified one seasonal almanac anomaly as a scribal error, a conclusion that is incorrect. Additional depth on this topic reveals Mayan planetary cycles that match Saturn and Jupiter, two sisters in Mayan lore. The two planets appear together in the sky in ways that Mayans predicted in terms of solar and lunar eclipses, and other cycles.

RELATED DATA

Four 2012 reported super-numbers were recorded on a wall near near Tikal, Guatemala around 419 AD. The long count distance numbers represented lunar, Mars and Mercury calendars data that may double check great year and universe modeling origins built-in to the Dresden Codex. Did Mayan GCD great year and smaller cycles only consider observational data? Or did Mayans create theoretical representations of planetary cycles recorded in serpent-numbers and super-numbers for general applications? The later approach is pondered in this article.

Mayans used red and black and two other colored numbers (white and green) as qualitative keys. As a passing point red and black was also used in Canary Island 270-moon lunar acano calendar, a diffusion route followed by Columbus in 1492 AD. Diffusion of mathematical astronomy may not have been known to earlier Mayans that connected to the Canary Islands and uses of red and black.

Mayan astronomers may have independently worked from the mid-year season, outwards, denoted by feet icons going forward and back, and year bearers as the Brickers report. The matrix data double checked and proved almanac and other data by several techniques, the details of which are under investigation.

The recent uncovered wall reports four highly composite numbers (super-numbers) with Mars 780 day and other planetary cycles encoded in 419 AD near Tikal, Guatemala. The Mayan super-number 341640 implied 1533, 438, 3130 and 2263 units of 780 days and other nominal planetary information. As important, Mayans may have considered 90 minutes were lost every 780 days with respect to nominally anticipating Mars visibility in terms of 60 x 60 x 24 = 86400/90 seconds = 96 x 780 = 748800 days as:

8400(117) = 2880(260) = 2080(360) = 1280(585) = 960(780) = 748800

as Aveni reported in 1992

a. 8(365) = 5(584) = 2920

b. 146(260) = 104(365) 65(584) = 37960

c. 5256(260) = 3744(375) = 2384) = 1752(780) = 36(37960) = 1366560

and in 2011 Aveni, et al, reported

d. 2920(117) = 1312((260) = 949(360) = 936(365)= 585(584) = 1127(2920)= 438(780)= 341640

and super-numbers 1195740, 1765140 and 2418420.

Mayans reported GCDs divided by planetary cycles in almanacs that sometimes converted nominal data to actual data.

FOOTNOTE: Statives and positional words

In Mayan languages, words were usually viewed as belonging to one of four classes: verbs, statives, adjectives, and nouns.

Stative numbers were predicates of four-part astronomical cycles. The syntactic properties fell between verbs and adjectives in Indo-European languages. Like verbs, statives words and numbers were sometimes be inflected by persons but normally lacked inflections for tense, aspect and other purely verbal categories. This is, very similar to the so-called Japanese "adjectives". Statives words and numbers were adjectives, and positional numerals.

Positional words were a class of root characteristics of, if not unique to, the Mayan languages, form stative adjectives and verbs (usually with the help of suffixes) with meanings related to the position or shape of an object or person. Mayan languages have between 250 and 500 distinct positional roots.

References

[1] Asger Aaboe, *"Remarks on the theoretical treatment of eclipses in antiquity"*,Journal for the History of Astronomy (Cambridge), 1972.

[2] Anthony F. Aveni editor, *The Sky in Mayan Literature*,Oxford University Press, 1992

[3] Victoria Bricker and Harvey Bricker, *"The Seasonal Table of the Dresden Codex and Related Almanacs"*,ARCHAAEASTRONOMY (supplement to the JOURNAL OF THE HISTORY OF ASTRONOMY 19 12:S1-S62), 1988.

[4] Albert Kroeber, *"Handbook of California Indians"*,pages 876-877, 1920.