

Wolfdieter Lang, March 01 2021

Irregular triangle read by rows: Parachute code of NASA Perseverance mars mission 2020– 2021

Data:

0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1,  
0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0,  
0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1,  
1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0,  
0, 1, 1, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 0, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1,  
1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0

Offset:

1

Comments:

The length of each rows  $n = 1$  to  $n = 4$  is 40, 60, 60, 80.

See the figure of the parachute decoding link for the order and coloring of the stripes.

The full disc is a regular 80-gon (each sector 4.5 degrees) coming as a central small white disc and five annuli (with partly zig-zag boundaries), where the fourth annulus, colored white, is irrelevant. Only the three inner annuli, denoted by I, II and III, and the outer one, denoted by IV, are considered. They are numerated by  $n = 1, 2, 3$  and 4.

The vertices  $V_i(n)$  of the outer (imagined) circle of each annulus  $n$ , taken in the positive (counterclockwise) sense, run from  $i = 0$  to  $i = 79 \pmod{80}$ . The  $i = 0$  vertex for each annulus correspond to the one taken for the  $n = 4$  annulus IV as the start vertex of the shape denoted by 34 in the link near the top.

The reading of the binary code, with 1 for each orange annular sector and 0 for each yellow sector, is however in the clockwise sense. Hence negative indices  $i$  will be used, like  $V_{-10}(4)$  for the last vertex of the first decuplet in the outer annulus.

The information comes from septets of annular sectors followed always by a triplet of white 0 sectors used as separator. There are eight such decuplets for each annulus, but not all are relevant: the inner annuli have consecutive red sectors not needed for the decoding.

The vertex intervals for the relevant sectors for the annuli are: I:  $[0, -40) (1/2)$ , II:  $[-40, -100 == -20) (3/4)$ , III:  $[-20, -80 == 0) (3/4)$  and IV:  $[0, -80 == 0) (1)$ .

The inner annuli are decoded using first the  $k$  from the binary representation  $(k)_2$ ,  $k$  a positive integer number, and  $k$  is mapped to the unshifted Caesar code ( $k = 1 \rightarrow A, \dots, k = 26 \rightarrow Z$ ). The outer annulus uses this Caesar code only for the fourth and eighth septet, giving N (for North) and W (for West), respectively, the other septets use  $(k)_2 \rightarrow k$ .

Links:

JPL NASA, Parachute-deployment. See the fourth image there, Credit: NASA/JPL-Caltech.

[\url{https://www.jpl.nasa.gov/news/testing-proves-its-worth-with-successful-mars-parachute-deployment}](https://www.jpl.nasa.gov/news/testing-proves-its-worth-with-successful-mars-parachute-deployment)

Reddit. The official meaning behind the stripes of the parachute on the NASA Mars Perseverance Rover Also shown as fourth image on the JPL NASA Parachute-deployment link.

[\url{https://i.redd.it/fsbu44blj9j61.jpg}](https://i.redd.it/fsbu44blj9j61.jpg)

Theodore Roosevelt quote: Far better it is ...

[\url{http://www.quotationspage.com/quote/1949.html}](http://www.quotationspage.com/quote/1949.html)

**Formula:**

Take  $a(k)$  as the member of the sequence, for  $k = 1, 2, \dots, 240$ :

Row  $n = 1$ , Annulus I:  $T(1, m) = a(m)$ , for  $m = 1, 2, \dots, 40$ ,

Row  $n = 2$ , Annulus II:  $T(2, m) = a(40 + m)$ , for  $m = 1, 2, \dots, 60$ ,

Row  $n = 3$ , Annulus III:  $T(3, m) = a(100 + m)$ , for  $m = 1, 2, \dots, 60$ ,

Row  $n = 4$ , Annulus IV:  $T(4, m) = a(160 + m)$ , for  $m = 1, 2, \dots, 80$ .

$a(i)$  is given by the bit for the relevant sector of the corresponding annulus with vertices  $V_{-(i-1)}(n)$  and  $V_{-i}(n)$  (counted modulus 80).

E.g., the bit for  $T(2, 4) = a(40 + 4) = 1$ , the first 1 in the shape decoded by M in the figure. This is for the sector between vertices  $V_{-43}(2)$  and  $V_{-44}(2)$ .

E.g.,  $T(2, 4) = a(40 + 4) = 1$ , the first 1 in the shape denoted as M in the figure. This is for the sector between vertices  $V_{-43}(2)$  and  $V_{-44}(2)$ .

**Example:**

Row  $n = 1$  (annulus I): 0 0 0 0 1 0 0 | 0 0 0 | 0 0 0 0 0 0 1 | 0 0 0 | 0 0 1 0 0 1 0 | 0 0 0 | 0 0 0 0 1 0 1 | 0 0 0, giving for the four septets: 4 -> D, 1 -> A, 18 -> R, 5 -> E: DARE;

Row  $n = 2$  (annulus II): 0 0 0 1 1 0 1 | 0 0 0 | 0 0 0 1 0 0 1 | 0 0 0 | 0 0 0 0 1 1 1 | 0 0 0 | 0 0 0 1 0 0 0 | 0 0 0 | 0 1 0 1 0 0 | 0 0 0 | 0 0 1 1 0 0 1 | 0 0 0, giving for the six septets: 13 -> M, 9 -> I, 7 -> G, 8 -> H, 20 -> T, 25 -> Y: MIGHTY;

Row  $n = 3$  (annulus III): 0 0 1 0 1 0 0 | 0 0 0 | 0 0 0 1 0 0 0 | 0 0 0 | 0 0 0 1 0 0 1 | 0 0 0 | 0 0 0 1 1 1 0 | 0 0 0 | 0 0 0 0 1 1 1 | 0 0 0 | 0 0 1 0 0 1 1 | 0 0 0, giving for the six septets: 20 -> T, 8 -> H, 9 -> I, 14 -> N, 7 -> G, 19 -> S: THINGS;

Row  $n = 4$ : (outer annulus IV): 0 1 0 0 0 1 0 | 0 0 0 | 0 0 0 1 0 1 1 | 0 0 0 | 0 1 1 1 0 1 0 | 0 0 0 | 0 0 0 1 1 1 0 | 0 0 0 | 1 1 1 0 1 1 0 | 0 0 0 | 0 0 0 1 0 1 0 | 0 0 0 | 0 0 1 1 1 1 1 | 0 0 0 | 0 0 1 0 1 1 1 | 0 0 0, giving for the eight septets: 34, 11, 58, 14 -> N, 118, 10, 31, 23 -> W: for 34° 11' 58" N 118° 10' 31" W, geographic coordinates of NASA JPL Building 249 (Visitor's Center), La Canada Flintridge, CA.

For the complete Theodore Roosevelt quote see the link.

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