
Algorithmic Problem Solving [17ECSE309]
Riddles

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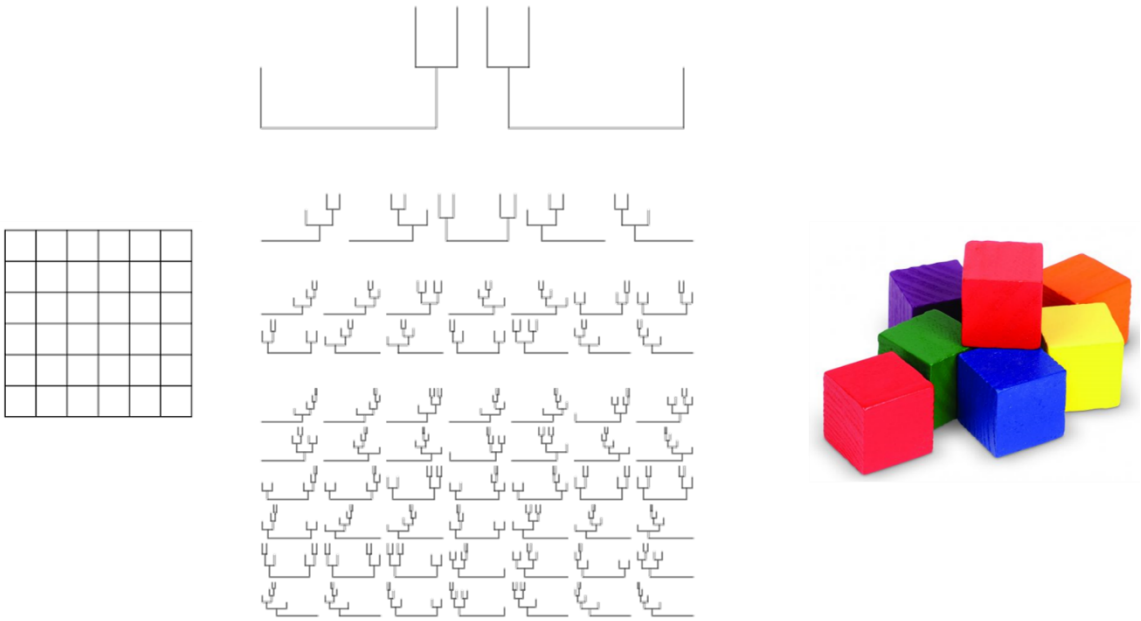
Rules:

- The Riddles are compulsary for APS students. It's also open for all. Anyone interested can submit. ANY ONE.
- A maximum of 10 submisions can be made per person before the deadline. The last submission will be considered ignoring all previous in case.
- A sample Riddle is provided with answer for better understanding.
- Please DO NOT reach out in case of queries and doubts. Solve it yourself.
- The answers will be made availabe in the same github repo where question was available. (after deadline)
- All riddles are math based.
- The first all correct submission wins a prize.
- Prize, yet to be decided. (There sure is an e-certificate)
- This puzzle is hosted in collaboration with Knit Arena Software Research and Services Private Limited.

Deadline: 30 March 2020, EOD
Submit Answers Here: **https://tinyurl.com/aps-2020-riddles**

RIDDLE 0



ONE

Answer: Catalan's Conjecture

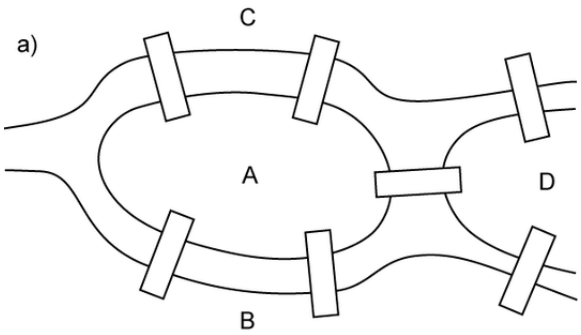
The integers 2^3 and 3^2 are two powers of natural numbers whose values (8 and 9, respectively) are consecutive. The theorem states that this is the *only* case of two consecutive powers.

In the sequence of squares and cubes,
0, 1, 4, 8, 9, 16, 25, 27, 36, 49, 64, 81, 100, 121, 125, . . .
Catalan's Conjecture states that 8 and 9 are the only pair of consecutive numbers in this sequence.

The middle figure is Catalan numbers sequence. Difference of squares and cubes which makes the conjecture is 1. Those are the hints for the solution.

RIDDLE 01

Whatever we are counting here, the number,



Answer: **5**

Two of the seven original bridges did not survive the bombing of Königsberg in World War II. Two others were later demolished and replaced by a modern highway. The three other bridges remain, although only two of them are from Euler's time.

As of the year 2000, five bridges exist at the same sites that were involved in Euler's problem.

RIDDLE 02

$$6 = 3 + 3$$
$$12 = 7 + 5$$

Answer: **Goldbach's Conjecture**

It is one of the oldest and best-known unsolved problems in number theory and all of mathematics. It states: Every even integer greater than 2 can be expressed as the sum of two primes. The conjecture has been shown to hold for all integers less than 4×10^{18}

Riddle 03

Not only you and me
Got one eighty degrees
And I'm caught in between

Only prime belonging twice in twin primes

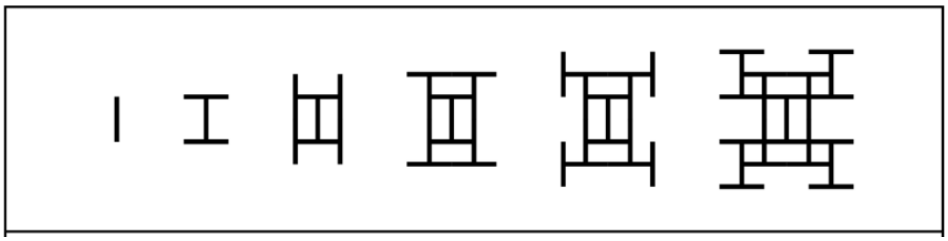
State of AL

The only remaining one.

Answer: **Fermat Primes.**

The primes of the form 2 ^ (2 ^ k) + 1 for some k >= 0
It is conjectured that there are only 5 terms. The five numbers are: 3, 5, 17, 257, 65537

Riddle 04

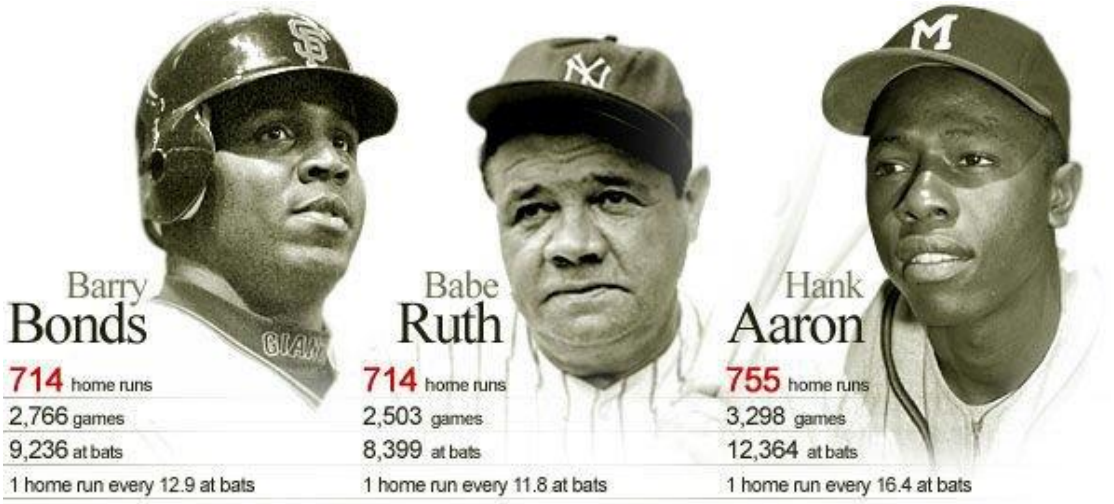


Answer: **35**

The given sequence is a toothpick sequence.
0, 1, 3, 7, 11, 15, 23, 35, 43, 47, 55, 67, 79, 95, 123, 155, 171, 175, 183, 195, 207, 223, 251, 283, 303, 319, 347, 383, 423, 483

The next number is 35.

Riddle 05



24432 and 24880 have this in common.

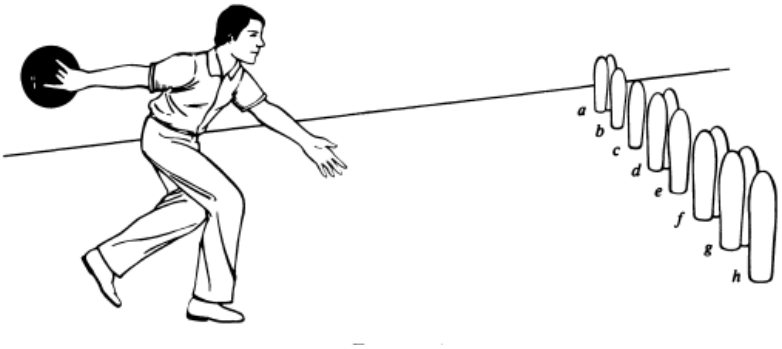
Answer: **Ruth-Aaron numbers**

Ruth-Aaron numbers: sum of prime divisors of n = sum of prime divisors of n+1
5, 24, 49, 77, 104, 153, 369, 492, 714, 1682, ...

On April 8, 1974, Hank Aaron of the Atlanta Braves hit his 715th career home run breaking the record set by Babe Ruth back in 1935. Nelson, Penney, & Pomerance call these "Aaron numbers" because 714 is Babe Ruth's lifetime home run record, Hank Aaron's 715th home run broke this record, and 714 and 715 have the same sum of prime divisors.

Riddle 06

151 wears alternate dress



Answer: **Padovan sequence (or Padovan numbers)**

a(n) = a(n-2) + a(n-3) with a(0) = 1, a(1) = a(2) = 0
The first few numbers in the sequence are: 1, 0, 0, 1, 0, 1, 1, 1, 2, 2, 3, 4, . . .

151 binary is 10010111

Referred to as N0102 in R. K. Guy's "Anyone for Twopins?"

RIDDLE 07

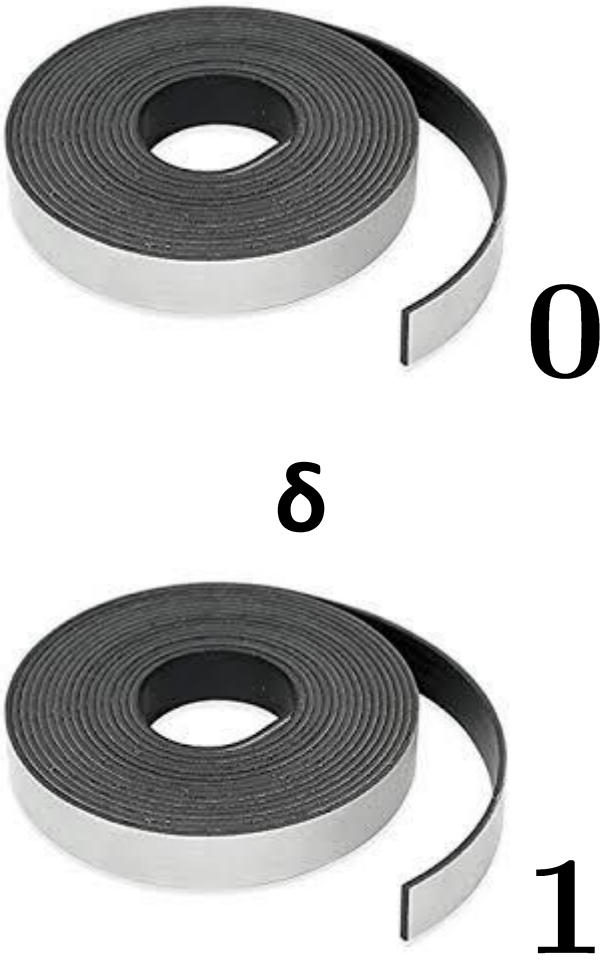
When tie, one of the name in the game is spelled back.

Answer: **Tic Tac Toe**

Games played on three-in-a-row boards can be traced back to ancient Egypt. Such game boards have been found on roofing tiles dating from around 1300 BC. An early variation of tic-tac-toe was played in the Roman Empire, around the first century BC.

A tie game of Tic-Tac-Toe called "Cat's game" (tac → cat)

Riddle 08



(q, s, q+, s+, d+)

Answer: **Busy Beaver Sequence**

Busy Beaver sequence or Rado's sigma function: maximal number of 1's that an n-state Turing machine can print on an initially blank tape before halting. Busy beaver game consists of designing a halting binary-alphabet Turing machine which writes the most 1s on the tape, using only a given set of states. The rules for the 2-state game are as follows: The machine must have two states in addition to the halting state, and the tape initially contains 0s only. A player should conceive a transition table aiming for the longest output of 1s on the tape while making sure the machine will halt eventually.

Riddle 09

19 = 

347 = 

b

Answer: **Happy Base**

A b-happy number is a natural number in a given number base b that eventually reaches 1 when iterated over the perfect digital invariant function for p=2. A happy base is a number base b where every number is b-happy.

19 is 10-happy

347 is 6-happy

Riddle 10

You can do better!

Answer: **Sieve of Atkin**

The sieve of Atkin is a modern algorithm for finding all prime numbers up to a specified integer. Compared with the ancient sieve of Eratosthenes, which marks off multiples of primes, the sieve of Atkin does some preliminary work and then marks off multiples of squares of primes, thus achieving a better theoretical asymptotic complexity.