Problem 1 (How many pentagons?). A golf ball is basically a sphere with a lot of circular dimples. Most of these are arranged in a hexagonal array like this:

But some dimples are pentagonal, surrounded by hexagons like this:

Assume that the golf ball is covered with these hexagonal and pentagonal dimples, and, as in the diagrams, three of these polygons meet at each vertex. If there are 332 hexagons, how many pentagons are there?
Problem 2 (Pascal sums). The 2016th row of Pascal’s triangle begins

1, 2016, 2031120, 1363558560, ....

Let

\[ S_1 = \text{the sum of every 4th number, beginning with } 1, \]
\[ S_2 = \text{the sum of every 4th number, beginning with } 2016, \]
\[ S_3 = \text{the sum of every 4th number, beginning with } 2031120, \]
\[ S_4 = \text{the sum of every 4th number, beginning with } 1363558560. \]

What is the difference between the largest and smallest \( S_i \)? Write your answer in terms of powers of 2.

Problem 3 (Pluses and minuses). A sequence of \( N \) numbers, each \( \pm 1 \), has the property that the sum of all \( N \) terms is 0 but no block of twenty consecutive terms sums to 0. What is the largest possible value of \( N \)?
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Answer 1:

Answer 2:

Answer 3: