Harold tosses a nickel four times.
The probability that he gets at least as many heads as tails is ...

QUICK STATS:

MAA AMC GRADE LEVEL
This question is appropriate for the middle-school grade levels.

MATHEMATICAL TOPICS
Statistics and Probability

COMMON CORE STATE STANDARDS
8.SP.7a Develop a uniform probability model by assigning equal probability to all outcomes, and use the model to determine probabilities of events.

MATHEMATICAL PRACTICE STANDARDS
MP1 Make sense of problems and persevere in solving them.
MP2 Reason abstractly and quantitatively.
MP3 Construct viable arguments and critique the reasoning of others.
MP7 Look for and make use of structure.

PROBLEM SOLVING STRATEGY
ESSAY 7: PERSEVERANCE IS KEY

SOURCE: This is question # 21 from the 2002 MAA AMC 8 Competition.
THE PROBLEM-SOLVING PROCESS:

The best, and most appropriate, first step is always ...

**STEP 1:** Read the question, have an emotional reaction to it, take a deep breath, and then reread the question.

Ooh! This is an innocent looking question, short and sweet. But because it is so short and I am feeling nervous about it! Okay. Harold tosses a coin four times. We want to know the chances that he gets at least as many heads as tails. (So, for example, something like HHTH is good for Harold, but TTTH is not.)

Hmm. Well the chance of tossing a head is $\frac{1}{2}$, and to get at least as many heads as tails, he better have either two, three, or four heads.

There is one way to get four heads: HHHH.

How many ways are there to get three heads? How many ways are there to get two heads? They seem hard to answer.

Hmm.

Maybe I could just list all the possible outcomes Harold could see. Here goes:

(I think I have them all. There is a total count of 16 of them and that seems right.)

Well, I see that there are $1 + 4 + 6 = 11$ of the sixteen that have at least as many heads as tails:

**Extension:** Harold tosses a nickel 5723 times in a row. What is the probability that he will see at least as many heads as tails? (How could we think about this question and avoid doing work?!)
MAA acknowledges with gratitude the generous contributions of
the following donors to the Curriculum Inspirations Project:

The TBL and Akamai Foundations
for providing continuing support

The Mary P. Dolciani Halloran Foundation for providing seed
funding by supporting the Dolciani Visiting
Mathematician Program during fall 2012

MathWorks for its support at the Winner's Circle Level