

## Fibonacci Flips

There are some methods that are pretty effective at distinguishing a sequence of coin flips generated by a human's imagination from one generated by flipping a fair coin. The idea for one or two of them is contained in the discussion below.

1. Write down a sequence of 100 H's and T's (or 1's and 0's, or any two symbols you like) to simulate flipping a coin 100 times. Then, as you do the problems below, compare the number of times each thing occurs with how often it should occur according to your probability calculations.
2. Out of all the places where the coin comes up heads, what fraction should be immediately followed by heads? By tails? Compare with your sequence.
3. Out of all possible lists of 100 flips, how many never have more than 1 consecutive flip the same?
4. Out of all possible lists of 100 flips, how many never have more than 2 consecutive flips the same?
5. Why is this activity called "Fibonacci Flips"?
6. For those of you who know matrix multiplication, how could you use it to help solve this problem?
7. Out of all possible lists of 100 flips, how many never have more than 3 consecutive flips the same?
8. Generalize: how would you find the probability of never having 6 consecutive flips the same? (Does your sequence that you invented in problem 1 ever have 6 consecutive flips the same?)
9. On average, how many flips does it take before you first get 1 in a row the same? 2 in a row? 3 in a row? Can you generalize? Visit the "Infinity Finite" table if this question interests you.



H			T
HH			TH
HT			TT
HHH			T HH
HHT			T HT
HTH			T TH
HTT			T TT
HHHH	H THH		T HHH
HHHT	H THT		T HHT
HHTH	H TTH		T HTH
HHTT	H TTT		T HTT
HHHHH	H THHH		T HHHH
HHHHT	H THHT		T HHH T
HHHHTH	H THHTH		T HHH TH
HHHHTT	H THHTT		T HHH TT
HHHTHH	H THTHH		T THHH
HHHTHT	H THTHT		T THHT
HHHTTH	H THTTH		T THTH
HHHTTT	H THTTT		T THTT
HHHHHH	H THHHH		T HHHHH
HHHHHT	H THHH T		T HHHH T
HHHHHTH	H THHH TH		T HHHH TH
HHHHHTT	H THHH TT		T HHHH TT
HHHTHHH	H THTHHH		T THHHH
HHHTHHT	H THTHTH		T THHH T
HHHTHTH	H THTTHH		T THTHH
HHHTHTT	H THTTT		T THHTT
HHHTHHH	H TTHHH		T THHHH
HHHTHHT	H TTHTH		T THHH T
HHHTHTH	H TTHTT		T THHTH
HHHTHTT	H TTHTT		T THHTT
HHHTTHH	H TTTHH		T TTHHH
HHHTTHT	H TTTH T		T TTHHT
HHHTTTH	H TTTHH		T TTHTH
HHHTTTT	H TTTH T		T TTHTT
HHHTHHH	H TTHHH		T TTHHH
HHHTHHT	H TTHHT		T TTHHT
HHHTHTH	H TTHHT		T TTHHT
HHHTHTT	H TTHHT		T TTHHT
HHHTTHH	H TTTTH		T TTTTH
HHHTTHT	H TTTTH		T TTTTH
HHHTTTH	H TTTTH		T TTTTH
HHHTTTT	H TTTTH		T TTTTH