**Exploring Coin Flipping**



**Problem: What is the probability of getting a string of 7 heads OR 7 tails in 100 coin flips?**

**Two Important Strategies in Problem Solving:**

* Start with a baby (simpler) problem
* Find the answer to the inverse problem

**Finding the probability of NOT having a string of two tails**

1. If you flip a coin one time, here’s the sample space:

H, T How many of these do not have two tails?\_\_\_\_\_

1. If you flip a coin two times, here’s the sample space:

TT, TH, HT, HH How many of these do not have two tails?\_\_\_\_\_

1. If you flip a coin three times, here’s the sample space:

TTT, TTH, THT, THH, HTT, HTH, HHT, HHH How many of these do not have two tails?\_\_\_\_\_

1. If you flip a coin four times, here’s the sample space:

TTTT THTT HTTT HHTT

TTTH THTH HTTH HHTH

TTHT THHT HTHT HHHT

TTHH THHH HTHH HHHH

How many of these do not have two tails?\_\_\_\_\_

1. If you flip a coin five times, here’s the sample space:

TTTTT THTTT HTTTT HHTTT

TTTTH THTTH HTTTH HHTTH

TTTHT THTHT HTTHT HHTHT

TTTHH THTHH HTTHH HHTHH

TTHTT THHTT HTHTT HHHTT

TTHTH THHTH HTHTH HHHTH

TTHHT THHHT HTHHT HHHHT

TTHHH THHHH HTHHH HHHHH

How many of these do not have two tails?\_\_\_\_\_

**Look at your answers for the questions above: Do you see a pattern?**

**Finding the probability of NOT having a string of three tails**

1. If you flip a coin one time, here’s the sample space:

H, T How many of these do not have three tails?\_\_\_\_\_

1. If you flip a coin two times, here’s the sample space:

TT, TH, HT, HH How many of these do not have three tails?\_\_\_\_\_

1. If you flip a coin three times, here’s the sample space:

TTT, TTH, THT, THH, HTT, HTH, HHT, HHH How many of these do not have three tails?\_\_\_\_\_

1. If you flip a coin four times, here’s the sample space:

TTTT THTT HTTT HHTT

TTTH THTH HTTH HHTH

TTHT THHT HTHT HHHT

TTHH THHH HTHH HHHH

How many of these do not have three tails?\_\_\_\_\_

1. If you flip a coin five times, here’s the sample space:

TTTTT THTTT HTTTT HHTTT

TTTTH THTTH HTTTH HHTTH

TTTHT THTHT HTTHT HHTHT

TTTHH THTHH HTTHH HHTHH

TTHTT THHTT HTHTT HHHTT

TTHTH THHTH HTHTH HHHTH

TTHHT THHHT HTHHT HHHHT

TTHHH THHHH HTHHH HHHHH

How many of these do not have three tails?\_\_\_\_\_

1. If you flip a coin six times, here’s the sample space:

TTTTTT TTHTTT THTTTT THHTTT HTTTTT HTHTTT HHTTTT HHHTTT

TTTTTH TTHTTH THTTTH THHTTH HTTTTH HTHTTH HHTTTH HHHTTH

TTTTHT TTHTHT THTTHT THHTHT HTTTHT HTHTHT HHTTHT HHHTHT

TTTTHH TTHTHH THTTHH THHTHH HTTTHH HTHTHH HHTTHH HHHTHH

TTTHTT TTHHTT THTHTT THHHTT HTTHTT HTHHTT HHTHTT HHHHTT

TTTHTH TTHHTH THTHTH THHHTH HTTHTH HTHHTH HHTHTH HHHHTH

TTTHHT TTHHHT THTHHT THHHHT HTTHHT HTHHHT HHTHHT HHHHHT

TTTHHH TTHHHH THTHHH THHHHH HTTHHH HTHHHH HHTHHH HHHHHH

How many of these do not have three tails?\_\_\_\_\_

**Look at your answers for the questions above: Do you see a pattern?**

**One last baby problem and we might be ready to generalize…..**

**Finding the probability of NOT having a string of four tails**

1. If you flip a coin one time, here’s the sample space:

H, T How many of these do not have four tails?\_\_\_\_\_

1. If you flip a coin two times, here’s the sample space:

TT, TH, HT, HH How many of these do not have four tails?\_\_\_\_\_

1. If you flip a coin three times, here’s the sample space:

TTT, TTH, THT, THH, HTT, HTH, HHT, HHH How many of these do not have four tails?\_\_\_\_\_

1. If you flip a coin four times, here’s the sample space:

TTTT THTT HTTT HHTT

TTTH THTH HTTH HHTH

TTHT THHT HTHT HHHT

TTHH THHH HTHH HHHH

How many of these do not have four tails?\_\_\_\_\_

1. If you flip a coin five times, here’s the sample space:

TTTTT THTTT HTTTT HHTTT

TTTTH THTTH HTTTH HHTTH

TTTHT THTHT HTTHT HHTHT

TTTHH THTHH HTTHH HHTHH

TTHTT THHTT HTHTT HHHTT

TTHTH THHTH HTHTH HHHTH

TTHHT THHHT HTHHT HHHHT

TTHHH THHHH HTHHH HHHHH

How many of these do not have four tails?\_\_\_\_\_

1. If you flip a coin six times, here’s the sample space:

TTTTTT TTHTTT THTTTT THHTTT HTTTTT HTHTTT HHTTTT HHHTTT

TTTTTH TTHTTH THTTTH THHTTH HTTTTH HTHTTH HHTTTH HHHTTH

TTTTHT TTHTHT THTTHT THHTHT HTTTHT HTHTHT HHTTHT HHHTHT

TTTTHH TTHTHH THTTHH THHTHH HTTTHH HTHTHH HHTTHH HHHTHH

TTTHTT TTHHTT THTHTT THHHTT HTTHTT HTHHTT HHTHTT HHHHTT

TTTHTH TTHHTH THTHTH THHHTH HTTHTH HTHHTH HHTHTH HHHHTH

TTTHHT TTHHHT THTHHT THHHHT HTTHHT HTHHHT HHTHHT HHHHHT

TTTHHH TTHHHH THTHHH THHHHH HTTHHH HTHHHH HHTHHH HHHHHH

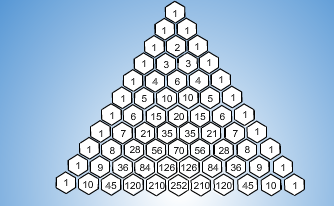
How many of these do not have four tails?\_\_\_\_\_

**Look at your answers for the questions above: Do you see a pattern?**

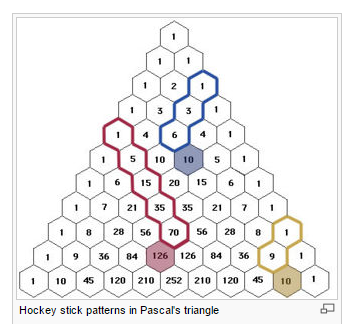
**What would be the generalized formula that would allow us to say for n coin flips, there will not be a run of k tails where n=the number of coin flips and k=the number of tails in a row?**

**What would be the generalized formula that would allow us to say for n coin flips, there WILL be a run of k tails where n=the number of coin flips and k=the number of tails in a row?**

**Relating Coin Flipping to Pascals Triangle**



**How does each row relate to flipping coins and the probability of finding combinations of heads and tails?**



**This is called a Hockey Stick Pattern. What do you notice?**