Chapter 3: Advanced Combinatorics

Together Chapter 3, Chapter 4, and Appendix A (which supplements Chapter 3) are easily the most dense, technical material in the book. They include a lot of raw data and it is not necessary to read and digest it all at once. Nearly everything here is reference material, and much of it will be used frequently throughout Volume 2. It is important now to become familiar with the content, but it is not necessary to master it.

This chapter presents data generated from a series of projects designed to fully analyze the combinatorics of PLO. The goal is to present the ways in which combinatoric analysis is useful both preflop and postflop through data with three levels of detail, depending on the number of components accounted for simultaneously. The focus of preflop combinatorics is on analyzing the flop possibilities given a particular starting hand in order to evaluate the character of that hand. The two-part focus of postflop combinatorics is on a) analyzing the starting hand possibilities given known board cards in order to evaluate flop texture; b) analyzing the starting hand possibilities given known board cards and a known starting hand in order to evaluate opponent ranges.

Every starting hand and flop texture has three **components – rank, suitedness, and connectedness.**[1] The focus of Chapter 3 is on presenting easily digestible data along with discussing how to interpret it and explaining the contexts in which it is useful. In most cases, this will mean focusing on single-component combinatorics or on high-level summaries of multiple-component combinatorics. Appendix A presents the more detailed multiple-component data.

Card Removal Combinatorics

The first step in this process is to acknowledge what Chapter 1 did not accomplish and study the **card removal combinatorics** of suitedness and rank. Although the baseline 52-card combinatorics provide core flop texture and starting hand data, nearly all interesting decision points or contexts worth studying involve a partially-known deck. The three most fundamental partially-known decks are the 48-card deck generated by subtracting a known starting hand, the 49-card deck generated by subtracting a known flop, and the 45-card deck generated by subtracting a known starting hand and flop. Table 3.1 displays the total number of combinations for various deck sizes and numbers of chosen cards.

Table 3.1: X choose Y

	Y ->				
X	**2**	**3**	**4**	**5**	**7**
52	1326	22100	270725	2598960	**133784560**
49	1176	18424	**211876**	1906884	85900584
48	1128	**17296**	194580	1712304	73629072
47	1081	16215	178365	1533939	62891499
46	1035	15180	163185	1370754	53524680
45	990	14190	**148995**	1221759	45379620
44	946	13244	135751	1086008	38320568
43	903	12341	123410	962598	32224114

Reducing the number of cards does much more than change the number of total combinations. The real significance of removing cards from the deck is that doing so disrupts the symmetry that makes 52-card combinatorics relatively straightforward. When categorizing and counting the possible flops and possible starting hands in terms of rank and suitedness in Chapter 1, we were able to reduce 270725 starting hands to 16432 distinct possibilities and thirteen major categories; similarly, 22100 flops reduced to 1755 distinct possibilities and five major categories. This is

[1] With respect to evaluating the quality of starting hands, "rank" and "high-card strength" will be used interchangeably.