Straights and Flops: Part 1

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This article is the first part of a look at making straights in hold'em and Omaha. Unlike flushes, for which the calculations are straightforward, straights present a more complicated situation because boards that allow straights come in many flavours. We examine the flop first.

There are $C(52,3) = 22,100$ possible flops. In order for the flop to allow a straight, there must be three distinct ranks. However, many of the choices of three ranks do not allow a straight. A choice of ranks such as 4-5-6 allows three completions to straights: a 2-3 or 3-7 or 7-8 makes a straight. It is not difficult to see that there is no flop that allows more than three ways to make a straight with two additional cards. In fact, the only choices of three ranks that allow straights in three different ways are 3-4-5, 4-5-6, 5-6-7, 6-7-8, 7-8-9, 8-9-10, 9-10-J, and 10-J-Q. There are four choices of suit for each of the ranks so that there are 512 flops allowing straights in three different ways.

Rank sets that allow straights in two different ways come in two forms: x,x+1,x+3 and x,x+2,x+3, where x runs from 2 through 10. The rank sets 2-3-4 and J-Q-K also allow straights in two ways and are exceptional cases. This gives 1,280 flops allowing straights in two different ways.

Rank sets that allow straights in only one way have one of the forms x,x+3,x+4 or x,x+2,x+4 or x,x+1,x+4, where x runs from ace through 10. The rank sets A-2-3, A-2-4, A-3-4, J-Q-A, J-K-A and Q-K-A also allow straights in one way and are exceptions from the preceding subcases. From the four choices of suit for each rank, we obtain 2,304 flops allowing a straight in one way.

Altogether, 4,096 flops allow someone to have a straight after the flop. Thus, about 18.5% of the time, the flop allows a straight. Given that the flop allows a straight, the natural question is what are the chances that someone has flopped a straight under the assumption all players see the flop?

Of course, the answer to the preceding question depends on how many ways the flop allows a straight. For hold'em, if the flop allows a straight in just one way, the probability is .13101 that someone has flopped a straight. If the flop allows a straight in two ways, the probability is .24908 that someone has flopped a straight. Finally, if the flop allows a straight in three different ways, the probability is .35156 that someone has flopped a straight.

For Omaha, if the flop allows a straight in one way, the probability is .57266 that someone has flopped a straight. If the flop allows a straight in two different ways, the probability is .81876 that someone has flopped a straight. Travel and submission deadlines prevent me from having time to perform the calculation for Omaha when the flop allows straights in three different ways. It will be fairly close to 1.

Does this information help at all in actual play? Thoughtful readers will see that the answer is yes. If the flop is 10-Q-K, then straights are allowed in two ways (an A-J or J-9 gives a player a straight). If the composition of the players and the preflop betting is such that there is a good chance players holding either of these hands would have stayed for the flop, then the probability of 1/4 gives a reasonable estimate that someone has flopped a straight. On the other hand, if one thinks there is only a 50% chance that a J-9 would have seen the flop, then there is only about a 3/16 probability someone has flopped a straight. A flop like 3-5-6 also allows straights in two possible ways, but in most cases players holding 4-2 or 6-4 will have folded so that one can assign a very low probability that one is facing a straight.

The numbers for Omaha are interesting, especially in the context of high-low. A board that allows a straight in two different ways gives a probabilty of more than 4/5 that someone has flopped a straight. However, many flops that are not dangerous in hold'em, with respect to straights, become very dangerous in Omaha high-low. For example, a flop of 3-5-6 invites straights in Omaha because many players will keep hands with low cards or closely sequenced cards. It is no surprise that flopped sets frequently lose in Omaha high-low.

Next time I shall concentrate on flops and straights for an individual player.