FREE BONUS VIDEO TRAINING COURSE

ESSENTIAL POKER MATH

Fundamental No-Limit Hold'em Mathematics You Need To Know

WITH MORE THAN 150 PAGES OF NEW MATERIAL

EXPANDED EDITION

ALTON HARDIN

Essential Poker Math: Expanded Edition

Fundamental No-Limit Hold'em Mathematics You Need to Know
By
Alton Hardin

Copyright

Published by MicroGrinder Poker School

To request permission to use any part of this book in any way, write to:
support@microgrinder.com

Editing by Brien Miceli and Lauren Whale
Cover Design by Georgi Mihaylov
Cover Photo/Illustration Copyright © Kudryashka/Shutterstock.com Image Modifications by Georgi Mihaylov

ISBN 10: 0-9982945-0-0
ISBN 13: 978-0-9982945-0-6

Disclaimer

This publication contains the opinions and ideas of its author. It is intended to provide helpful and informative material on the subjects addressed in the publication. The information contained within this book is strictly for educational purposes. The strategies outlined in this book may not be suitable for every individual, and are not guaranteed or warranted to produce any particular results. If you wish to apply ideas contained in this book, you are taking full responsibility for your actions. The book is sold with the understanding that the author and publisher are not engaging in rendering any kind of personal professional services in the book.

The author and publisher specifically disclaim all responsibility for any liability, loss or risk, personal or otherwise, which is incurred as a consequence, directly or indirectly, of the use and application of any of the contents in this book. The author and publisher does not assume and hereby disclaims any liability to any party for any loss, damage, or disruption caused by errors or omissions, whether such errors or omissions result from accident, negligence, or any other cause.

Your Free Bonus

As a small token of thanks for purchasing this book, you’re entitled to free enrollment into my *Essential Poker Math* course at MicroGrinder Poker School.

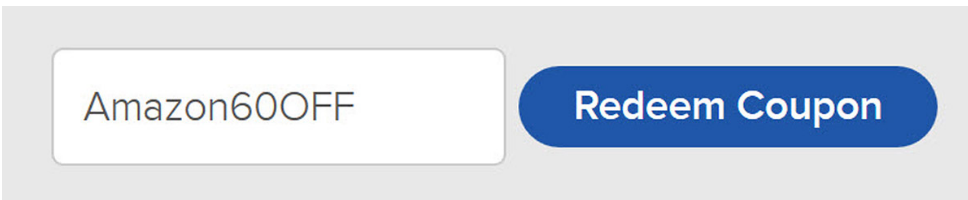
To Claim Your Free Course, Simply Follow the Steps Below:

1. Take a screenshot of your proof of purchase on Amazon
2. E-mail your proof of purchase to support@microgrinder.com
3. I’ll e-mail you your free enrollment code to register into the course for free!

Bonus Discounted Poker Courses

As a special thank you to our customers, we'd like to take this opportunity to offer you all of our poker courses for **60% OFF!**

Simply visit **http://PokerSchool.MicroGrinder.com** and use the following coupon code when enrolling: **Amazon60OFF**



Some of Our Popular Courses

Free Poker Courses

We offer several free poker mini-courses at MicroGrinder Poker School for those on a budget or wanting to see what we have to offer.

Simply visit **http://PokerSchool.MicroGrinder.com** to enroll for free!

Some of Our Popular Free Mini-Courses

About The Author

ALTON HARDIN is a #1 Amazon best-selling author and poker coach. He has published several poker books and courses.

He has been featured on the nationally-syndicated casino and poker industry talk radio show House of Cards.

He is the founder of MicroGrinder Poker School – an affordable online poker school dedicated to both beginner and struggling micro stakes poker players, where he provides a wide array of free and affordable poker resources and poker training, including courses, strategy articles and training video series.

Alton is passionate about helping fellow poker players succeed, that’s why he created his free 6 Steps to Profitable Poker course, which reveals how to become a successful poker player. Sign up now for your chance to replicate his success at http://MicroGrinder.com/poker-fundamentals/.

Outside of poker, Alton is a full-time business and IT professional in the field of cyber security. He has earned two graduate degrees, an M.B.A. and M.S. in IT Network Management. Moreover, he currently holds multiple IT industry certifications.

Visit MicroGrinder.com for free and affordable poker learning resources.

Introduction

An Instant Classic

Just over a year ago, I self-published the original edition of this book with the hopes it would be well received. Being a relatively unknown micro stakes poker coach, I was a bit skeptical of how well it would do in a market dominated by masterful poker pros and authors. To my amazement, it skyrocketed to the top of Amazon's poker book listings to become a #1 best seller. Just over a year later, it has amassed well over 11,000 sales and is still one of Amazon's best-selling poker books.

Expanded, Updated and Greatly Improved

Even as a best-seller, the original edition of this book wasn't without its flaws. While most readers love its brevity as an easily digestible read, geared towards math laymen like myself, some yearned for a lengthier and more comprehensive book, wanting more detailed explanations than the original book offered. Reading through numerous reviews, I took my readers' suggestions to heart, and embarked on the journey of creating this extended edition of the book.

I had originally planned on briefly expanding the current content of the book, providing lengthier explanations and additional examples. The goal was to have my rough draft manuscript ready for editing within one month's time, but that didn't happen. As I started reviewing and re-writing my book, I found lots of holes I wanted to plug with several additional chapters while also expanding all of the book's current chapters. In the end, what I had planned on being a short, 30-day endeavor turned into a multi-month labor of love. I took a 100-page poker book and expanded it to three times the length of the original edition. This edition isn't just an expansion of the original edition, but also an update, with numerous new topics and concepts, making it a vastly improved book!

Why You Should Read This Book

This book is for any poker player, new or experienced, that has either struggled or neglected to implement basic poker mathematics into their No-Limit Hold’em (NLHE) game. This book will teach you the basic poker mathematics you need to know in order to improve and outplay your opponents, and focuses on foundational poker mathematics - the ones you’ll use day in and day out at the poker table; and probably the ones your opponents neglect.

Poker mathematics - which is easy to understand and implement - is often overlooked by many players in No Limit Holdem, causing them to make mathematically incorrect moves. While this may seem somewhat insignificant, over the long run, these incorrect moves can cause both good and bad poker players to win significantly less, and lose significantly more money than they would if they both understood and applied basic poker mathematics.

Trust me, you do not need a graduate degree in mathematics or statistics to understand and implement essential math into your poker game. A basic understanding of arithmetic and algebra is all you will need. I'm excited to have you here, and look forward to taking you on a journey. By the end of this book, you will have a vastly deeper understanding of poker mathematics, and will be a much better poker player as a result.

What this Book Isn't

This book isn’t an advanced book on theoretical poker mathematics and game theory. It doesn’t cover advanced topics such as the Nash Equilibrium and Game Theory Optimum poker play. If you are looking for an in-depth book on poker math and theory, I would recommend *The Mathematics of Poker* by Bill Chen and Jerrod Ankenman or *Applications of No-Limit Holdem* by Matthew Janda.

Additionally, this book isn’t an all-encompassing NLHE poker strategy book. While I’ll do my best to discuss pre-flop and post-flop strategies as they apply to poker mathematics throughout the book, I won't be covering all aspects of the game. If you're new to the game, I highly recommend reading this book alongside a general NLHE strategy book such as *The Grinder’s Manual* by Peter Clarke or *Dynamic Full Ring Poker* by James Sweeney.

Which Edition?

While both the original and expanded edition of Essential Poker Math are designed to teach fundamental poker mathematics, they’re both intended for different audiences.

If you’re looking for a short, quick and easy read that covers the "bare-bone" basics without too many details, the original edition is for you. However, if you’re looking for a more in-depth, comprehensive and detailed book on fundamental poker mathematics, I definitely recommend this extended and updated edition of the book.

Table of Contents

Preface: Book Overview

Introduction

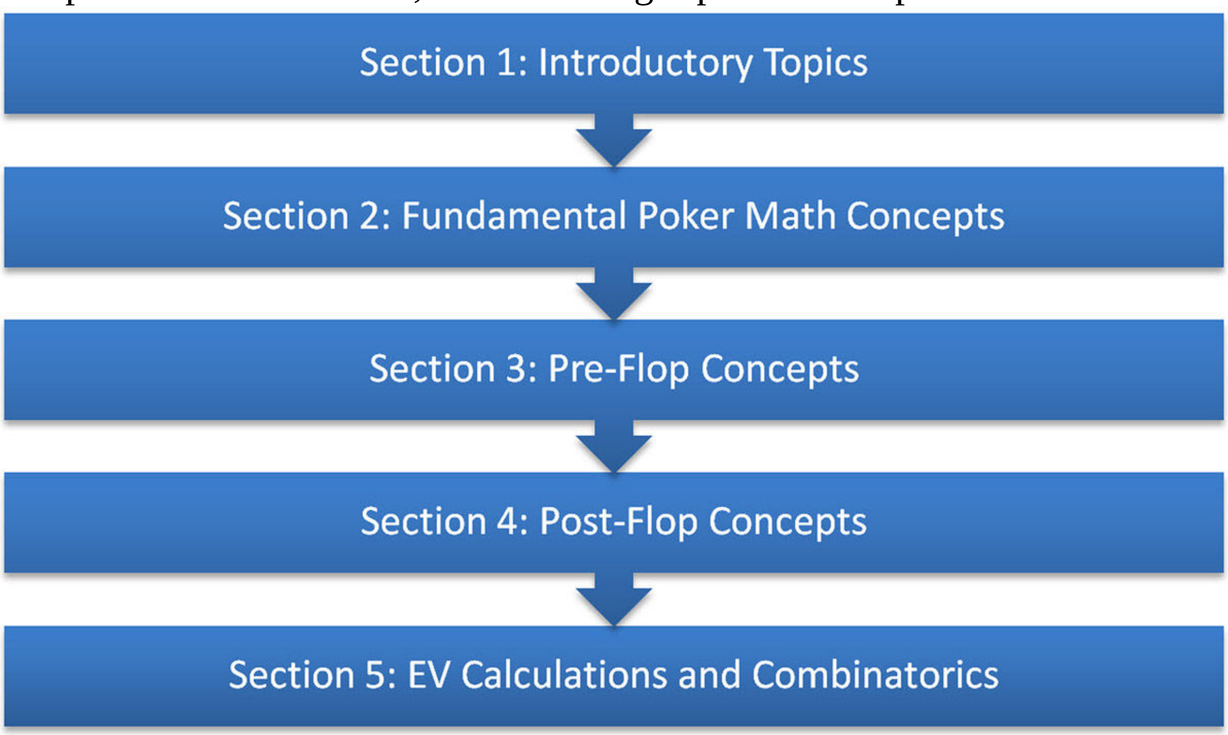
Just like the original edition, this book was written with all poker players in mind, beginner and experienced players alike. In my many years of playing poker, one area that I noticed most poker players lacked experience with, or needed improvement in, was basic poker mathematics. While a lot of good poker players - especially those who play online - are well-versed in poker mathematics, a lot of beginner and live low stakes players are not. Why? It's mainly due to a stigma against mathematics, and an erroneous belief that poker mathematics is difficult to learn.

I'm here to tell you that the essential poker mathematics of No-Limit Hold'em requires nothing more than a fundamental understanding of basic arithmetic and algebra. In this book, I am going to take you on a step-by-step journey that will easily allow you to master fundamental poker mathematics. You'll be able to implement them into your poker game in a fast and painless manner. I will cover everything you need to know to make the mathematically correct and most profitable moves at the poker table, which will, in turn, give you a drastic advantage over those opponents who lack a fundamental understanding of poker mathematics.

By the end of this book, my goal is to enable you to quickly and easily use the mathematical tools I'm about to teach you; both on the table during live poker sessions, and off-the-table to perform analysis of your previous play. Are you excited? I hope so, because I am! Let's go ahead and get started. We'll kick off our journey into the world of poker mathematics with a brief overview of the teaching style this book adopts and some basic terminology, before discussing the importance of mathematics in poker in Chapter One.

Kiss Approach and Teaching Methodology

This book follows a Keep It Simple Student (KISS) approach to teaching the subject of NLHE poker mathematics. Throughout this book, I assume the concepts presented are new to you and teach them in an easy-to-understand manner. I've designed the book to teach in a progressive manner; beginning with the basics, building your foundational knowledge, and then building on them with more complex concepts and topics. I recommend you read this book in a sequential manner, not jumping around from one chapter to another. In fact, it's designed to be read that way. This book itself is comprised of five sections, each covering separate concepts:



Basic Poker Terms

At the end of the book, in Chapter 21, you’ll find a poker glossary of terms. If you come across any poker terms you don’t understand, simply flip to the back of the book for a quick definition. I did my best to include most common poker terms, however, not all terms will be listed in the glossary. If you’re unable to locate a poker term in the glossary, I recommend visiting PokerNews.com’s Poker Dictionary at www.pokernews.com/pokerterms/.

SECTION 1: INTRODUCTORY TOPICS

Section Introduction

In this introductory section, we'll lay the groundwork for the rest of the book. We'll start off by discussing the importance of math in poker. Namely, the evolution of poker from a game primarily reliant on street-smarts and tells to one now deeply entrenched in game theory and mathematics. We'll then discuss a wide array of essential poker topics such as table position and acronyms, hand ranges and range notation, effective stack sizes and so forth. Lastly, we'll learn about basic player types.

Chapter 1. Importance of Math in Poker

The Evolution of Poker

The game of poker has greatly evolved over the years, from a game of street-smarts, reads and tells, to a game heavily entrenched in game theory and mathematics. This is evident not only in modern poker books and training material, but also on television.

In the early 2000s, when we watched televised poker, we would often hear comments such as, “What a great call!” or, “That was a sick bluff!” as well as, “What a great read that was!”, but we would rarely, if ever, hear any discussion about the mathematics behind those calls, bluffs and bets. Naturally, many poker players at the time tended to base their decisions on “tells” and “reads” at the poker table. Today, we see commentators such as Tony Dunst of the World Poker Tour (WPT) regularly citing poker mathematics and game theory on televised poker; highlighting a shift from reads-based poker to mathematics and game theory based poker.

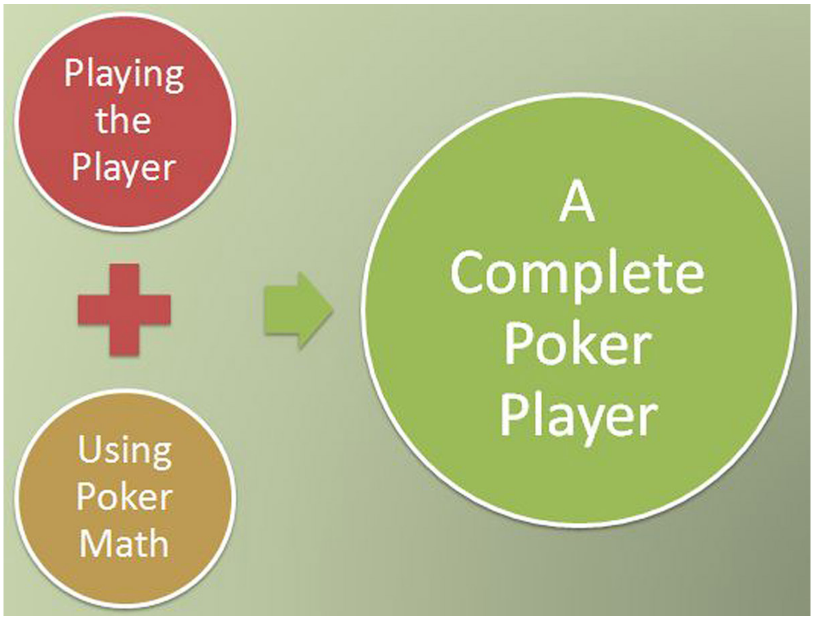
A Common Fallacy: Play The Player, Not The Cards

If you have been playing poker for some time (especially live), you have probably heard someone say, “You play the player, not the cards.” In fact, I've heard this myself time and time again, particularly with beginner and live low-stakes poker players. You rarely hear things such as, “I called because I had good equity against your range and you gave me great pot odds to call,” or, “It was an easy call getting 5:1 pot odds with so many outs and equity in the hand.” Unfortunately, math tends to be the red-headed stepchild to tells and reads in poker, when it is arguably just as important, if not more so, than reads and tells. In fact, the two go together like peas in a pod, which I will discuss further in the section below.

The Two Aspects of Poker

There are two aspects of analysis in poker. The first is reading your opponents, and the second is using mathematics to ensure we make correct mathematical moves based upon our reads and tells. When we read our opponents, we are gaining reads, tells and tendencies that help us to understand the “range” of hands our opponent can have in his hand. This tells us how likely it is that our opponent has a made hand versus a drawing hand, as well as how strong it is.

We then use basic poker mathematics to supplement our reads and tells. When we do this, our goal is to ensure that we are maximizing how often we make profitable moves, while minimizing unprofitable ones. In poker, we call profitable moves positive expected value (+EV) plays, and unprofitable ones negative expected value (–EV) plays. Our goal is to make as many +EV plays as possible at the poker table. Don’t worry if you’re unfamiliar with EV - we’ll be discussing EV and EV calculations in detail in chapters 10 and 17.



As you can see from the image above, a complete poker player is one that can both read their opponents and use math at the poker table to make mathematically correct +EV plays. A poker player that focuses solely on reading their opponents, neglecting math, is an incomplete poker player. Conversely, a poker player that does not read their opponents, but bases all of their moves on math alone, is also an incomplete poker player. The best and most profitable players in the world are both excellent at reading their opponents and well versed in poker mathematics. As you can see, math in poker, when balanced with a good ability to read your opponents, is essential to your long-term success in the game.

A Changing of the Guard

In his seminal work, Super System, which was originally published in 1979, Doyle Brunson stated, “Poker is a game of people…that’s what poker’s all about.” Arguably one of the greatest poker players of his time, Brunson emerged in an era where poker was a game of street-smarts, intuition, reads and tells. In 1979, Brunson had already amassed over one million in winnings by the practice of “playing the player”, or what we commonly refer to today as “exploitative poker”; in which players seek holes in their opponents’ games and exploit them through tells, tendencies, and general weaknesses.

We can contrast Brunson’s style of play with one of the top female poker players in the world, Liv Boeree. Boeree – an astrophysicist and Team PokerStars Pro with over three million in live earnings, according to the Hendon Mob Poker Index – plays a modern style of poker based upon game theory mathematics. In a recent presentation to The Oxford Union Society in 2016 entitled The Science behind Poker, Boeree explains the two primary aspects of the game:

> "Poker is often considered as both an art and a science. The artistic side comes from the creativity and the intuition you feel in a hand. The scientific part is the methodology and logic you use to come up with those creative plays. Both approaches have merit, but these days the strongest players are the ones that approach the game very quantitatively."

Boeree continues by showing how the game has evolved over the years:

> "The game is actually very different to how it used to be 10 years ago. Back then, most of the players that were very good were playing the game based upon street smarts that they had gained from years and years of experience at the tables. Nowadays, the best players are the ones that are taking a very analytical approach, using mathematical analysis and practical application of a branch of mathematics called game theory."

In his 2016 documentary film, *KidPoker*, Daniel Negreanu explains how online poker has changed the game and how he had to re-learn modern theory and strategy:

> "I’m proud of the fact that I’ve been able to put up winning years every year despite the game evolving and changing. Online poker has changed the game immensely, all of the sudden a lot of players got really, really good. What I found fun was just focusing on the fundamentals and the math and the stats and the numbers because I’ve always been a numbers geek. I decided to relearn a lot of the stuff that these kids are learning and adjust."

The Driving Force of poker's Evolution

What does this tell us? The game of No Limit Holdem (NLHE) has greatly evolved to the point where it is no longer just a game of street smarts, reads and tells. The best players in the world utilize a combination of reads and tells along with in-depth math and game theory-based decision making.

The advent and proliferation of online poker – along with a plethora of poker software and tools – have been the driving force behind the evolution of poker. As online poker emerged, software to help assist online poker players emerged as well. These software tools brought with them the ability to better understand the statistical and mathematical aspects of the game. This led to a greater focus on game theory. A wide array of software tools exist, such as artificial intelligence-based training software, equity and range analysis software, tournament independent chip model (ICM) trainers, poker tracking software, heads up displays (HUDs), and much more.

In addition to the multitude of poker software tools available, online poker has given poker players the ability to play upwards of a million hands per year. While a live poker player might play 30 to 40 hands per hour, an online player can easily play anywhere from 200 to 1,000 hands per hour by multi-tabling and playing fast-fold poker. Assuming an average poker session is 3 hours, a live poker player might play 120 hands per session, whereas an online poker can play as many as 3,000 hands in the same amount of time.

The ability to play such a high rate of hands per hour has had some drastic benefits and consequences for NLHE:

- It has drastically reduced the learning curve for online poker players.
- It has made the game much more difficult to beat.
- It has brought a much deeper level of thinking to the game.

Conclusion

As you can see, the game of poker has drastically changed over the years, to the point where it is now a game deeply entrenched in statistical and mathematical analysis. It is no longer a game based purely upon street smarts, reads and tells. Whether you like it or not, math is vitally important to your long-term success in poker. Yes, you can be a very good, and profitable, poker player without using math at the poker table, but by doing so, you'll win less than you should with your best hands, and lose more than you should in marginal spots when you make slightly unprofitable calls.

Moreover, without math, your game and winnings will plateau as you move up the stakes and face tougher and more competent opponents. Remember, a complete poker player is one that has the ability to get reads and tells on their opponents easily, while simultaneously using math at the table to ensure they are making the right mathematical moves as much as possible.

Chapter 2. Fundamental Concepts

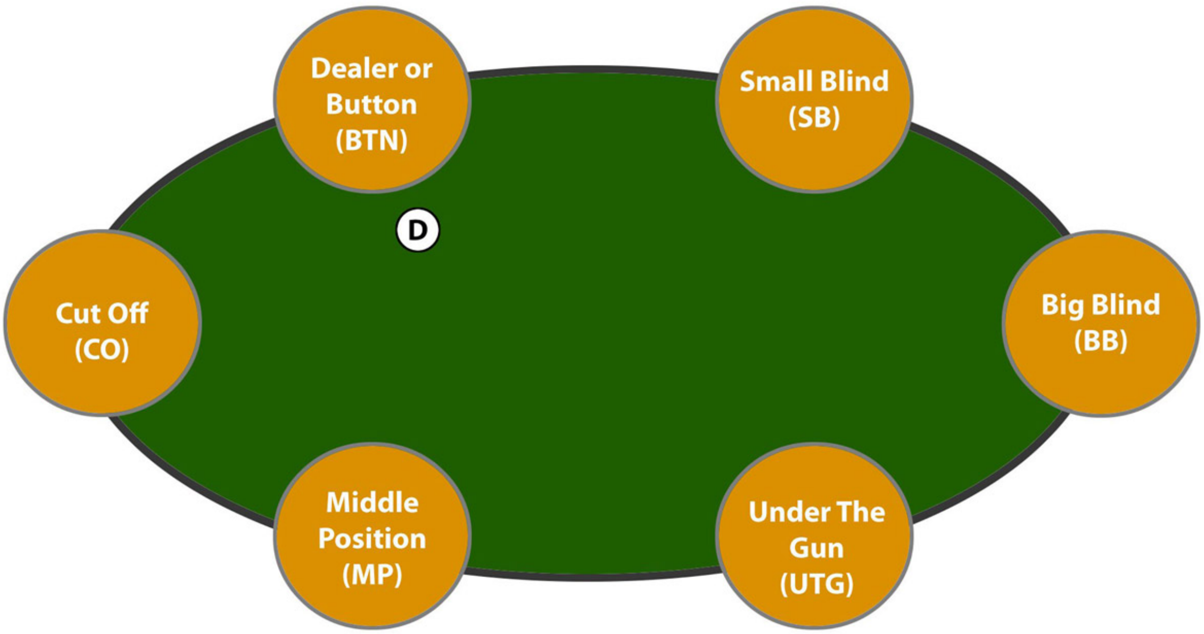
Introduction

Before we dive into the poker mathematics you yearn to know, we need to start with some rudimentary concepts. In this chapter, we'll be covering a wide array of introductory poker topics.

While they aren’t all math-based, they’re important concepts you need to know in order to get the most out of this book, and you’ll utilize many of them on a regular basis whenever you play poker. Also, I’ll often be referring to “we” whenever I’m conveying important information or discussing example and practice hands. We’re working through this together.

Table Positions & Acronyms

When going through hand examples and exercises in the book, I'll often refer to table positions by their respective acronyms. While the concepts that you'll learn in this book apply to both full ring and 6-max NLHE, we'll be using a 6-max table for simplicity.



In the image above, I have listed the names of the 6-max table positions, as well as their associated acronyms.

They are also listed below:

- **SB** = Small Blind
- **BB** = Big Blind
- **UTG** = Under the Gun
- **MP** = Middle Position
- **CO** = Cut Off
- **BTN** = Dealer / Button

Hero and Villain

Going through hand examples and exercises, I may also refer to myself, and you, as hero. When poker players do hand analyses and hand history reviews, we often refer to ourselves as hero. Conversely, we commonly refer to our opponents as villain. I will be using these terms frequently throughout the rest of the book to address you and your opponents.

Suited versus Off-Suited Hands

In this book I will refer to suited hands – such as Ace-King suited – as AKs. Additionally, I will refer to offsuited hands – such as Ace-King offsuit – as AKo. So whenever you see the "**s**" or "**o**" after a hand, it will indicate whether a hand is suited or offsuited:

- **AKs** = A♣ K♣, A♦ K♦, etc.
- **AKo** = A♦ K♥, A♠ K♦, etc.

Hand Ranges & Range Notation

When going through hand examples and exercises, I may talk about hand ranges in addition to specific hands. It's important that you understand what hand ranges are, and that you can easily read hand range notation. A hand range is the set of all possible starting hands a hero or villain can have when playing poker.

When discussing hand ranges, I'll use standard range notation commonly used in the poker world. Let's walk through the basic notation:

- **Any Pocket Pair** : 22+
- **Pocket Jacks or Better** : JJ+
- **KQ or Better** : KQ+
- **AJ suited or Better** : AJs+

Notice the plus (+) symbol in range notation. We use this symbol as shorthand as opposed to writing out every single hand:

- **Any Pocket Pair** : 22+ = 22, 33, 44, 55, 66, 77, 88, 99, TT, JJ, QQ, KK, AA
- **Pocket Jacks or Better** : JJ+ = JJ, QQ, KK, AA
- **KQ or Better** : KQ+ = KQ, AJ, AQ, AK
- **AJ suited or Better** : AJs+ = AJs, AQs, AKs
- **Villain's Hand Range** : TT+, KJs+, AJ+ = TT, JJ, QQ, KK, AA, KJs, KQs, AJs, AJ, AQs, AQ, AKs, AK

Range-Based Thinking & Range Analysis

Range-based thinking is an important concept in poker. We utilize the concept of hand ranges when we are trying to determine which possible hands our opponents can have in any particular poker situation. It's much easier and much more realistic to put our opponents on a spectrum of hands, rather than one particular hand. Why is that? Because poker players do certain things in poker; such as pre-flop raises, isolation raises, squeeze plays, 3-bets, 4-bets, steals, continuation bets, bluffs and so forth, with specific ranges of hands that we can estimate based upon their playing style, tendencies and HUD stats (for online players). Trying to narrow down our opponents' range of possible hands to one single hand is not only much more difficult to do, but also an unrealistic task.

Understanding and being able to visualize hand ranges is an important skill to have in poker, because how our opponents play provides insight into their possible range of hands. Being able to read our opponents' range of possible hands is something you should seek to master.

While I won't be teaching you how to read your opponents and develop realistic ranges for their hands in detail, I will be using range-based thinking in certain examples and exercises throughout this book. The goal is to help you to begin thinking about scenarios with hand ranges, and not just specific holdings.

Bet Sizing by Pot Size

Whether you play poker live in a card room or online, it's a good habit to start thinking about bet sizing based on the size of the pot. It’s universal for every stake of poker. A 1/3 pot sized bet means the same at 2NL through 500NL. A lot of poker strategy articles, videos and books will provide guidance to utilize bet sizing by pot size for this very reason. Moreover, when people give you guidance or feedback on hands you played, they'll also do the same.

In poker, it is universal to talk about bet sizing referring to the size of the bet as it relates to the size of the pot. For example:

- 1/4 pot sized bet
- 1/3 pot sized bet
- 1/2 pot sized bet
- 2/3 pot sized bet
- 3/4 pot sized bet

Additionally, there are standardized bet sizes based upon the size of the pot. You will often hear that you should bet “x” amount of the pot in different situations. For all of these reasons, you should become accustomed to bet sizing by pot size.

Thinking in Big Blinds

Thinking about stack and pot sizes in big blinds (bb) is an important concept because it's commonly used in the poker world via books, videos and forums. This comes into play when people talk about stack sizes, pot sizes and poker strategy. For example, a poker coach might say "It's common to open raise to 3bb pre-flop." or "You should always maintain a 100bb stack when multi-tabling cash games online."

Just like talking about bet-sizing by pot size, talking about hands in big blinds creates a universal terminology for poker regardless of what stakes you're playing. Whether you're playing a $2 buy-in micro stakes game online or a $5-$10 NLHE at your local card room, 100bb means the same in both stakes. To ensure you become accustomed to this terminology, when I provide hand examples throughout the book, I'll sometimes use the actual cash stakes and other times refer to the hands in big blinds.

In poker, the term "big blind" can mean one of two things; either referring to a seat position at the table, or being used as a universal bet sizing terminology.

Since I'll be referring to both throughout the book, I'll utilize a different acronym for each:

- **BB** : Table Seat Position
- **bb** : Bet Sizing Terminology

Effective Stack Sizes

Effective stack sizes are a very important concept to understand in poker because they dictate your strategy in every single hand you play. So what are they? Effective stack sizes are nothing more than the size of the smallest stack between two different players in a hand. This indicates the highest amount of money you can either **win** or **lose** in a hand against any one particular opponent.

Let's do a quick example to explain this basic concept. You and an opponent are both all-in pre-flop. You have $150 at the start of the hand and your opponent only has $40; therefore, with only $80 in the pot the most either you or your opponent can win or lose at the end of the hand is $40.

That was a very simple example, but not every hand you play is heads up instead of multi-ways, so let's do another example in a 3-way pot:

Example

- **Small Blind (SB)** : $80 Stack
- **Big Blind (BB)** : $150 Stack
- **You** : $400 Stack

SB versus BB

The most BB can win or lose from SB is $80, since SB only has an $80 stack. Conversely, the most SB can win or lose from BB is also $80, since SB only has $80 to wager, even though BB has a $150 stack. Therefore, the effective stack size is $80 between SB and BB.

SB versus You

The most you can win or lose from SB is $80, since SB only has an $80 stack. Conversely, the most SB can win or lose from you is $80, since SB only has $80 to wager even though you have a $400 stack. Therefore, the effective stack size is also $80 between SB and you.

BB versus You

The most you can win or lose from BB is $150, since BB only has a $150 stack. Conversely, the most BB can win or lose from you is $150, because BB only has $150 to wager, despite you having a $400 stack. Therefore, the effective stack size is $150 between BB and you.

Multiple Effective Stack Sizes in a Hand

It is important to note that there can be several effective stack sizes in a hand, especially if there are multiple all-in situations. For example, in a 3-handed game with SB, BB and you, there can be 3 effective stack sizes to consider:

- SB versus BB
- SB versus You
- BB versus You

Knowing effective stack sizes is an essential concept in basic poker strategy - how we play a particular hand will vary greatly depending upon our opponents' stack sizes. As good poker players, we'll typically have stack sizes of at least 100 big blinds, but our opponents will have stack sizes ranging from 20bb to 400bb. Because some of our opponents will be playing short-stacked and others deep-stacked, we need to take their stack sizes into consideration for every single hand, the reason for this being that people tend to play drastically diverse strategies with different effective stack sizes. While this book won't go too in depth regarding how to play against varying effective stack sizes, we'll introduce the concept of Stack-to-Pot ratios (SRPs) to help you better understand this concept.

Stack-to-Pot Ratios (SPRs)

Stack-to-Pot Ratios – commonly referred to as SPRs – is another important poker concept you need to understand. It is a fairly straightforward concept, as its name implies, but it has huge implications as to how you should play a hand of poker. Your SPR compares the current pot size to your stack size.

An SPR is the effective stack size divided by the size of the pot. We can easily calculate your SPR with the simple equation below:

- **SPR** = Effective stack size / Pot size

We can think of SPRs as a guide on how committed we are to any particular hand. As a rule of thumb, when SPRs are small, people will tend to be more committed to hands; whereas when SPRs are bigger and stacks are deeper, people will be less committed to hands without the nuts. Another way to look at an SPR is as a “risk-to-reward” ratio, where a person risks his or her effective stack size to win the size of the pot. When effective stack sizes are short, we’re risking less to win the pot, but when effective stack sizes are deep; we are risking a lot to win the pot.

Let’s do some examples to put this into context. In our examples, we’ll assume the pot size is $18, but we’ll utilize different effective stack sizes for each example. In one series of examples, we’ll use $20 effective stacks, then in another we’ll use $80 effective stacks, and in the last we’ll use $175 effective stacks.

$20 Short Stack Example

- **Effective Stack Size** : $20
- **Pot size** : $18
- **SPR** = Effective Stack Size / Pot Size
- **SPR** = 20 / 18 = **1.11 SPR**

$80 Moderate Stack Example

- **Effective Stack Size** : $80
- **Pot size** : $18
- **SPR** = Effective Stack Size / Pot Size
- **SPR** = 80 / 18 = **4.44 SPR**

$175 Deep Stack Example

- **Effective Stack Size** : $175
- **Pot size** : $18
- **SPR** = Effective Stack Size / Pot Size
- **SPR** = 175 / 18 = **9.72 SPR**

Evaluating these example SPRs, we can see that effective stack size and our effective stack depth in relationship to what is in the pot greatly dictates how we should play our hand. This depends upon your hand's relative strength to our opponents' holdings, as well as the board texture.

Leveraging Effective Stack Sizes and SPRs

Leveraging effective stack sizes and SPRs will help guide us in properly playing our hands. While there are a lot of variables in poker, – such as our opponents' playing styles, board texture, and action in the hand – we can use effective stack sizes and SPRs to help us determine how to properly play our hands.

People will play differently based upon their effective stack sizes and SPRs in a poker hand. In general, a short-stacker with a lower SPR will be more likely to commit to a hand with a more marginal holding. Conversely, a deep-stacker with a higher SPR will be less likely to commit to a hand with a marginal holding. To explain this and illustrate what types of hands people will be likely to commit based upon their SPR, I have created the table below as a reference guide:

SPR Guideline Table

SPR	SPR Size	Hands to Commit
Low	0 to 2	Over Pair, Top Pair, Bottom 2 Pair
Medium	3 to 6	Top 2 Pair, Sets, Non-Nutted Flushes & Straights
High	7+	Sets, Nutted Hands

As you can see in the table above, the lower the SPR, the weaker the hand a person will tend to commit to. However, as SPRs and stack sizes increase, our opponents will most likely only be committing to hands with very strong holdings.

The main takeaway from SPRs is:

- **Lower SPRs** = Smaller Effective Stack Sizes (Short Stackers)
- **Higher SPRs** = Larger Effective Stack Sizes (Deep Stackers)
- **Lower SPRs** = Commit with Weaker Hands
- **Higher SPRs** = Commit with Stronger Hands

Effective Stack Sizes & SPR Practice Hands

Practice Hand #1: The Aggressive Short-Stacker

The action has folded around to us and we're on the BTN with A♥ 8♥ with a 162bb stack. There is an aggressive 21bb stack in the SB and a decent regular with a 100bb stack in the BB. We open raise to 3bb and both the SB and BB call. The flop is A♣ T♠ 3♠. SB and BB check, and we bet 5bb into the 9bb pot. SB goes all-in for his remaining 18bb stack and BB folds. Should we call or fold?

Pre-flop, we can see that SB was already very short-stacked. Knowing that he is an aggressive opponent, we must assume he is going to commit on the flop or turn with a wide variety of hands in his all-in range. On this flop, SB's check-jamming range is fairly wide and composed of a lot of mediocre to weaker aces, a possible set of 3's, flush draws, straight draws, and some 2 pair combos: 33, ATs-A2s, KQs, QJs, 42s, ATo-A2o, KQo, QJo, and 42o. We can rule out most of his stronger aces and sets of T's since we would expect him to 3-bet them pre-flop. Against his perceived ranged, we are actually a 60% equity favorite to win the hand by the river – I'll be discussing equity and how to easily calculate it with Equilab later on in the book.

Additionally, his check-jamming SPR is 1.3, so we should assume he will be stacking off very lightly in this spot. Given all of this information, this should be a fairly easy call for us. We are also getting fairly favorable pot odds to a call of approximately 2.5:1. This means we only have to be correct around 29% of the time in this spot – we'll be revisiting pot odds and how to calculate them in detail later in the book. 29% pot odds mean we only have to commit 29% more to the pot, where we expect to win 60% of the time, so this is an easy call for us!

Practice Hand #2: The Deep-Stacked Dilemma

A very good and aggressive opponent with a 380bb stack raises to 3bb in MP. CO calls and we look down and see J♣ J♦ on the BTN. With a 244bb stack we 3-bet to 12bb. MP calls and CO folds. There is 28.5bb in the pot going to the flop; which is T♦ 6♠ 2♦. MP checks, we bet 16bb and MP calls, making the pot 60.5bb. The turn is 8♠, MP again checks, we bet 37bb and MP check-raises to 110bb. What should we do?

Being deep-stacked with 244bb effective stack sizes at the beginning of the hand, this puts us in a bit of a dilemma. On the flop the effective stack SPR was 8.14. Moreover, going to the turn, it was 3.6. With a high SPR on the flop and medium SPR on the turn, we wouldn't expect villain to check-raise us without a strong hand. Additionally, given that both players started with deep stacks and are both good players, we wouldn't expect all-in situations without a very strong hand in a 3-bet pot, where we are showing a lot of strength by 3-betting pre-flop, and continuation betting the flop and turn. Given this information, our J♣ J♦ is nothing more than a bluff catcher at this point in the hand, versus an over pair, sets or the made straight.

MP could easily have QQ in his range; a hand that he would be wary of 4-betting pre-flop out of position with 244bb effective stack sizes. He could just as easily have TT, 88, 66 or 22 as well, giving him a set. Furthermore, he could also have 97s as well – a hand that plays well in deep-stacked 3-bet pots. MP could also have A♠ K♠ or A♠ Q♠, but doesn't really have any other bluff combos in his range. Given this information, MP is a 91% favorite to win this hand; and therefore, this is an easy fold.

Practice Hand #3: Playing against the Unknown

We sit down at a table full of unknown players with a 100bb stack and notice that everybody has at least a 100bb stack. UTG open raises to 3bb, MP calls, CO folds, and we look down at 7♦ 8♦ on the BTN. We call, SB folds and BB calls. The pot is 12.5bb going to the flop, which is 9♣ T♣ K♥. BB checks, UTG continuation bets 8bb, MP calls, we call with the open-ended straight draw (OESD), and BB folds. There is 36.5bb going to the turn. The turn is J♦. UTG bets 22bb and CO raises to 44bb. What do we do?

We end up turning the bottom end of the straight, where we lose to the King-high straight. Our SPR going to the flop was 7.8, giving us a lot of maneuverability on the flop, not wanting to commit lightly without a strong hand. However, our SPR is then reduced to 2.4 going to the turn. This makes our hand more precarious. With the smaller SPR and the made straight, this looks like an easy call based solely upon our SPR. Unfortunately, we cannot fully rely on SPRs, and must look intuitively into our opponents' perceived ranges.

We must ask ourselves what UTG and MP's ranges are most likely to be composed of. Would UTG fire a second barrel on the turn without a Queen into two opponents? Would MP raise without a Queen in a 3-way pot? The odds are that at least one of them has the Queen for a King-high straight.

However, the issue remains that we don't know for sure, because both opponents are complete unknowns. We don't know their playing styles and tendencies, nor do we know whether they are on tilt or not from a previous hand in this session. Yes, we could be folding the best hand a certain percentage of the time to certain types of opponents, but against a majority of opponents we're simply beat in this spot. So, against two unknowns, this is a fold, given our effective stack depth and SPR.

Conclusion

This chapter encompassed a wide range of topics; some of them math-based and others simply prerequisite topics that are important concepts for all poker players to be aware of. We touched base on effective stack sizes and SPRs – concepts you should always be aware of when playing poker – and we briefly discussed range-based thinking.

While this book doesn't focus on range-based thinking and hand-reading as such, I will do my best to instill this methodology into practice and example hands throughout the book. We ended the chapter with a practice hand playing against unknown opponents, which was done purposefully. In the next chapter, we'll be learning about basic player types, their respective playing styles and tendencies.

Chapter 3. Basic Player Types

Know Thy Enemy

To be a good poker player, you must know your opponents. Sun Tzu, the ancient Chinese military general and strategist wrote the following in *The Art of War*:

> "So it is said that if you know your enemies and know yourself, you can win a hundred battles without a single loss. If you only know yourself, but not your opponent, you may win or may lose. If you know neither yourself nor your enemy, you will always endanger yourself."

- Sun Tzu

To be successful in battle, you must not only know yourself, but also your enemy. Every single time you sit down at the poker table, you are in a battle. You must treat your opponents as your enemies, not your friends. To beat them, you must know not only your strengths and weaknesses, but theirs as well. In poker, just like in war, certain strategies will be effective against certain opponents, but not against others. This is at the heart of “playing the player” in poker. You must know what does, and doesn't, work against certain opponent types.

The Complete Poker Player

Earlier in the book, we introduced the concept of the complete poker player: a person that not only utilizes math at the poker table, but also plays the player. While this book focuses on teaching basic poker mathematics, we cannot neglect the importance of gaining reads and tells on our opponents and understanding their tendencies. To make the best decisions possible, just knowing the math isn't always enough. In most situations, we also need to know how our opponents play as well. That's why this chapter is dedicated to understanding basic poker player types.

No HUDS Here

Since this book is designed for live and online players alike, I won't be talking about heads up display (HUD) stats in this chapter, or the book itself. Instead, I will discuss general characteristics, playing styles and player type tendencies that can be used both live and online. For online players, I highly recommend learning about HUD stats as well because utilizing a HUD will help you to quickly gain reads and tells on your opponents. Almost every strategy book dedicated to online poker you'll read will discuss HUD stats.

Tagging Your Opponents

From the first moment you sit down at a poker table – whether it's in a card room or online – it's your job to start observing your opponents and doing your best to try to categorize them as either good or bad poker players.

If you're playing live poker, there are several instant indicators you can use even before playing a single hand of poker to determine if a player is potentially good or bad:

- **Look at their stack sizes.** Typically good poker players will have at least a 100bb stack, whereas bad or purely recreational players will often have random-sized short stacks.
- **Look at how their chips are stacked.** Are they nicely stacked into 20 chip stacks, or erratically into small stacks? If they're erratic small stacks, they're probably a bad or recreational player.
- **Are they performing chip tricks?** Decent regulars will often perform tricks, such as the chip shuffle at the table.
- **Are they listening to music?** Decent regulars will often also listen to music on their cell phones.
- **Are they drinking alcohol or do they appear drunk?** If so, they're probably a bad or recreational player having fun and gambling at the table.

These are just a few of the initial indicators you can use to determine if a player is potentially good or bad right when you sit down at the poker table. Online players are limited to chip stack sizes and screen names; which is why HUD stats are so important in online play.

As play commences at the table, take notes on your opponents. If you play live, you'll be limited to mental notes; however, if you play online you have the ability to write down notes into your poker client or HUD, which is something I highly recommend you do. Look for things outside of the ordinary, as well as telling plays, which will help you categorize your opponents as good or bad. If you are very observant, within one to two orbits of hands you should have a good idea of how your opponents are playing.

Introduction to Player Types

As promised, this chapter is an introduction to basic poker player types. We'll talk about both good and bad player types and, most importantly, their tendencies at the poker table. Please note that this is not going to be an in-depth discussion on player types; only an introduction. If you want to learn more about player types, I recommend taking a look at my *How to Implement an Online Exploitative Poker Strategy* book or online course.

Good Player Types

Let's start off our discussion by talking about good player types. There are three basic types of good poker players:

- NITs (Really Tight Players)
- TAGs (Tight Aggressive Players)
- LAGs (Loose Aggressive Players)

NITs

People commonly call really tight opponents NITs. I don’t know where this term originated, but just understand that when we are taking about super tight opponents, we’re commonly referring to NITs.

NITs can be categorized as the scrooges of poker. They are very risk-averse, and only play the very best-of-the-best starting hands pre-flop. Additionally, they will usually only get involved in big pots post-flop with a very strong hand. Most NITs play a very tight and aggressive style of poker, and will play fit-or-fold post-flop. This means that they will only continue with a hand post-flop if they have hit a strong hand or very strong draw. Always be aware of NITs when they are betting or raising; this usually means they have a very strong hand or draw - NITs are not known to bluff.

While NITs are not exceptional players, they are by no means bad. They are more mediocre, because they understand how to play a tight and aggressive poker game - the hallmark of a good poker player - but they let risk-aversion negatively affect their poker game.

TAGs

Tight aggressive opponents – commonly referred to as TAGs – are your typical “good” poker player opponent type. Most poker books, video training series, and coaches advocate a TAG-style approach to the game for beginning poker players. Why? The TAG approach and style of poker is time-tested and works. A TAG will play a tight range of starting poker hands, but not nearly as tight as a NIT. Additionally, a TAG will play their hands pre-flop and post-flop in an aggressive fashion, raising and re-raising against weaker opponents.

Most TAGs are very difficult to play against because they are competent poker players, skilled in all aspects of the game. Unlike most NITs, a TAG is also capable of bluffing in opportune spots. A TAG doesn't need a made or strong poker hand to bet and be aggressive, which makes them difficult to play against.

LAGs

Good loose aggressive opponents – commonly referred to as LAGs – are arguably the toughest type of poker player to play against. The LAG-style of play, when implemented properly, is the most profitable style of poker.

LAGs are tougher to play against than TAGs, because they play a wider range of hands than TAGs and bluff more often. They will fight for most of the pots they are in and are fearless opponents. While NITs are risk-adverse, LAGs do not fear risky situations; rather, they embrace them. When a LAG is in a hand, they put pressure on their opponents and aren't afraid to bluff and re-raise with the worst hand in the right spots.

It's important to note that LAGs don't have uncontrolled aggression at the table, like their bad aggressive counterparts. Actually, the opposite is true. LAGs use controlled aggression to put their opponents into tough spots, knowing how and when to bluff as well as how to effectively value-bet to get maximum value. Famous poker players such as Doug Polk and Andrew Robl use such an approach. If you ever watch *Super High Roller Cash Game* on Poker Central, you'll see them implement that approach to the game very effectively.

Bad Player Types

There are three basic types of bad poker players:

- Loose Passive
- (Loose Passive) Calling Stations
- Bad Aggressive (Maniacs)

Loose Passive

A loose passive opponent type is the stereotypical bad player. As the name indicates, they are quite loose and passive as they play. A loose passive opponent loves to limp in pre-flop to try to see flops for as cheap as possible. However, when facing pre-flop aggression, a loose passive opponent will usually fold. This type of opponent plays in a fit-or-fold manner post-flop, meaning they will fold if they miss out and will often never bluff. A loose passive opponent will only bet or raise pre-flop and post-flop with a strong hand or very strong draw.

When you play against a loose passive opponent, you will see him limping in pre-flop a majority of the time. A passive opponent will only raise pre-flop with the top of his starting hand range. This type of opponent is very common at the online micro stakes and live low stakes.

Calling Station

A calling station is a type of loose passive opponent. They share many of the same characteristics, except for one crucial difference: calling stations hate to fold. Calling stations love to limp and see flops, but tend to not fold to aggression, making them almost impossible to bluff. They will call pre-flop, even to raises and re-raises with a wide range of hands. Post-flop, they will float continuation bets with draws and ace-high hands, but just like their loose passive counterpart, they will usually only become aggressive and bet or raise with a very strong hand.

Bad Aggressive

The bad aggressive opponent, commonly referred to as the maniac is the bad player version of the LAG. While a LAG can control their aggression, bad aggressive maniacs have uncontrolled aggression. They love to gamble by betting and raising relentlessly without any sound strategy in mind. Most bad aggressive maniacs will have a huge stack, be down multiple buy-ins, or bust out of the table very quickly. You will often see huge swings in their chip stacks in a relatively short period of time. Because they have uncontrolled aggression, you can never tell exactly what they have, and they could either be bluffing or value-betting. Moreover, they tend to put people on tilt when they make silly moves and suck out, taking down a huge pot. The great thing about bad aggressive opponents, though, is that they can be easy targets to double up against if you play against them correctly.

Conclusion

While this is a book about poker mathematics, it would not be complete without introducing basic poker player types. With every single decision in poker, we should not only consider the mathematics, but also our opponents' tendencies.

I will continue to consider opponent player types throughout this book as we perform practice scenarios, hand exercises and analyses, but you must remember that it's your job to start identifying and tagging opponents as either good or bad the second you sit down at the poker table.

This chapter concludes Section 1: Introductory Topics. We'll now be moving onto Section 2: Fundamental Poker Math Concepts, beginning with introducing the concept of probability and odds.

SECTION 2: FUNDAMENTAL POKER MATH CONCEPTS

Section Introduction

This section is the mathematical heart of the book. It lays the mathematical groundwork for the entire book and teaches a wide array of essential concepts.

In this section, we'll be discussing and learning about the following topics:

- Probability and Odds
- Understanding Equity
- Pot Odds
- Implied Odds
- Common Draws and Outs
- The Rule of 2 and 4
- Introduction to Expected Value
- Calling with Drawing Hands

Chapter 4. Probability and Odds

Introduction

In this chapter, I'll be providing you with an introductory overview of mathematical probability and odds. It's essential that you have a fundamental understanding of probability and odds before we begin discussing pot odds, implied odds and equity calculations, so let's go ahead and get started.

Probability

Probability is simply the likelihood that something will occur. It's used in many areas of study, including mathematics, science, business finance, and, in our case, gambling. In these disciplines, probability is the number of times something will happen out of the total number of chances of it happening. Moreover, it is commonly expressed as either a fraction (1/3) or percentage (33.3%). For example, if I say there is a 60% chance of rain today, I am saying the probability of it raining today is 60 out of 100, which is the same as 60/100, 6/10, 3/5 or 60%.

Another simple example is a coin flip. The probability of flipping a coin and getting either heads or tails is 1 out of 2, 1/2, or, more simply, 50%. Below are the basic equations for determining probability using our coin flip example:

$$\boldsymbol{Probability} = \frac{\#\text{ of Desirable Outcomes}}{\#\text{ of Possible Outcomes}}$$

$$\boldsymbol{Probability\ of\ Getting\ Heads} = \frac{1}{2}$$

Some Simple Poker Probabilities

Now that you know the basics behind probability, let's perform some simple poker probabilities. There are a total of 52 cards in a deck, with each deck composing four suits (clubs, spades, hearts and diamonds). Additionally, each suit contains thirteen ranked cards from two through Ace.

- 13♣ + 13♠ + 13♦ + 13♥ = **52 Cards**

Knowing this basic information, we can use it to perform some simple poker probability calculations. We'll do a few simple exercises now.

Probability of Being Dealt Pocket Aces

Since there are 4 Aces in a deck (A♣ A♦ A♥ A♠), the probability of being dealt one Ace is 4 in 52. Once we're dealt one Ace, there are now only 3 Aces left in the deck of 51 remaining cards; therefore, the odds of our second card also being an ace is 3 in 51. We combine these two probabilities together, as shown below to get a 0.452% chance of being dealt pocket Aces.

- (4/52) x (3/51) = 0.452% Probability

This probability holds true for any poker pair if you are asking the probability of being dealt a "specific" pocket pair before the hand is dealt by the dealer.

Probability of Being Dealt Any Two Suited Cards

Now let's determine the probability of being dealt any two suited cards. In this scenario, the first card doesn't matter because whatever we're dealt first, we need the second card to match that suit. Therefore, since we're always going to be dealt a random first card, all we need to know is the probability of the second card being the same suit as the first.

We know there are 13 cards per suit in a deck. Since we have already been dealt one card of that suit, there are 12 remaining in the deck. Put simply, since we started with 13 cards and removed 1, there are 12 left of that suit in the 51 available cards, so there is a 12/51 probability that we'll be dealt any two suited cards.

- (12/51) = 23.53% Probability

Probability of Making an Open-Ended Straight Draw on the Turn

A common occurrence in No-Limit Hold'em is flopping an open-ended straight draw (OESD), where we want to know how often we'll hit our draw on the turn. This is a fairly easy probability to determine. When flopping an OESD, 8 cards will complete our straight. Furthermore, there are 47 unseen cards still left in the deck (excluding our 2 hole cards and the 3 flop cards).

- (8/47) = 17.02% Probability

So we will make our straight 17.02% of the time on the turn and miss it the remaining 82.98% of the time. Lots of people tend to erroneously overestimate the probability of making straight and flush draws. While knowing how to estimate your likelihood (equity) of making such draws through simple mathematics is easy, I'll show you a simpler way via the Rule of 2 and 4 later in the book.

Probability of Flopping a Set or Better

For our last example, let's determine the probability of flopping a set or better. Later on in the book I'll be talking about the all-important mathematics behind set-mining, a concept poker players often misapply.

When we set-mine, we are looking to flop a set or better (full house or quads).

Let’s assume we’re dealt 3♣ 3♥ and want to know how often we’ll flop a set of threes. The easiest way to compute this probability is to determine the probability of not flopping a set. Since there are three cards on the flop, the board will flop a card that doesn’t improve our hand to a set in three ways:

- **First Card** : 48 out of 50 remaining cards don’t make our set.
- **Second Card** : 47 out of 49 remaining cards don’t make our set or better.
- **Third Card** : 46 out of 48 remaining cards don’t make our set or better.
- **Probability of Not Making a Set** : [(48/50)*(47/49)*(46/48)] = 88.24%
- **Probability of Flopping a Set** : 1 - 0.882 = **11.76% or 7.5:1 or 1 in 8.5 Times**

So the probability of flopping a set or better is 11.76% or 1 in 8.5 times. We can also express this is 7.5-to-1 odds, usually written as 7.5:1 odds. Odds are another way of expressing probability and we’ll talk about them next.

Odds

Odds are another way of expressing probability. Odds are commonly expressed as ratios, such as 2:1, which is stated as 2-to-1. In poker, odds play two major roles, the first being our odds or probability of making made hands, such as flopping a set or better, which we determined to be 7.5:1. Knowing how to compute the odds of making specific hands and draws is important, but we'll learn the easy way as well, so you won't have to compute everything. You'll learn the Rule of 2 and 4, which will allow you to easily compute such odds in a matter of seconds while playing.

The second is pot odds, which are the odds we offer our opponents when we bet and the odds we are accepting when we call a bet. Pot odds can be seen as reward-to-risk ratios, where we risk a certain amount to be rewarded a certain amount. You'll learn to love pot odds because it's a hallmark feature of poker mathematics that we'll be discussing in detail later in the book.

When it comes to pot odds, we're mostly concerned with the odds as the caller, because when we're calling a bet, we usually have the worst (drawing) hand. So, for example, when you're getting 2:1 pot odds, you are risking 1 to win 2, as seen below. This is just a quick primer on pot odds; we'll be dedicating an entire chapter to it later in the book.

- 2:1 Pot Odds → Reward:Risk Ratio
- You risk 1 to win 2

Understanding how odds work is essential to playing a mathematically correct poker game, because the two go hand in hand, something you'll learn as you progress through this book. You'll often see odds listed as ratios instead of percentages, but you'll also learn how to convert ratios to percentages later in this book.

Let's look at some common reward-to-risk gambling ratios you are most likely familiar with:

- Blackjack pays 3:2, meaning for every $2 you wager, you will win $3 if you get a Blackjack.
- A roulette single number pays 35:1, meaning for every $1 you wager on a single number, you win $35 if your number is hit.
- Poker pot odds are the same and you’ll learn how to calculate them later in this book.

Converting Odds to Percentages

For lots of people, including myself, interpreting odds as a ratio can be a bit cryptic. I have found that converting and viewing odds as a percentage is much more intuitive. This is simply because most people are used to seeing and interpreting percentages on daily basis, so that's what we are going to do in this section.

What does 2:1 really mean?

That's a very good question. Let's convert it into a percentage to help us better understand what 2:1 means. There is a very simple process for doing so, which I will outline below.

Simple Mathematical Relationship

The image below shows a very simple mathematical relationship between a ratio (m:n) and its counterpart fraction, which can be reduced into a percentage.

$$\boldsymbol{m}:\boldsymbol{n} = \frac{\mathrm{n}}{\mathrm{m} + \mathrm{n}}$$

- **m** = Reward
- **n** = Risk
- **m + n** = Reward + Risk
- **Percentage** = Risk / (Reward + Risk)
- **Percentage** = n / (m + n)

Let's Convert 2:1 Drawing Odds

- Given 2:1 → m:n, where m = 2 & n = 1
- Percentage = n / (m + n)
- Percentage = 1 / (2+1) = 1/3
- 1/3 then reduces to 33.3% odds
- So 2:1 drawing odds is equal to 33.3% drawing odds

Let's Convert 3:1 Pot Odds

- Given 3:1 → m:n, where m = 3 & n = 1
- Percentage = n / (m + n)
- Percentage = 1 / (3+1) = 1/4
- 1/4 then reduces to 25% odds
- So 3:1 pot odds is equal to 25% pot odds

Let's Convert 4:1 Pot Odds

- Given 4:1 → m:n, where m = 4 & n = 1
- Percentage = n / (m + n)
- Percentage = 1 / (4+1) = 1/5
- 1/5 then reduces to 20% odds
- So 4:1 pot odds is equal to 20% pot odds

Odds-to-Percentage Table

While it's not very difficult to convert odds to percentages once you get the hang of it, you'll often only have seconds to act at the poker table. Time is increasingly scarce if you're playing online poker. So I've created a simple reference "odds-to-percentage" table that you can use at the poker table instead of having to convert odds to percentages on the fly while you play.

Odds Ratios	Odds Percentages
1:1	50%
2:1	33%
3:1	25%
4:1	20%
5:1	16.7%
6:1	14.3%
7:1	12.5%

Conclusion

In this chapter, we introduced the concept of mathematical probability and odds. We also discussed the important roles probabilities and odds play in poker. You should now be comfortable with understanding these concepts, as well as being able to convert ratios to percentages. These are important core concepts to understand. We’ll be relying on them throughout the rest of this book when discussing pot odds, implied odds and equity, as well as other important mathematical poker concepts. In the next chapter, we'll introduce the concept of equity – another core mathematical concept in poker.

Chapter 5. Understanding Equity

Introduction

In the poker world, you'll often hear the term "pot equity", "card equity" or simply, equity. Well, what does equity mean?

Equity is our share of the pot if a hand is played to showdown. It tells us how much we expect to win in the long-run, based upon how often we should win. Furthermore, it's based upon probability and odds. Since poker is a form of gambling – with money always at stake – we often think of equity as a dollar amount, or more specifically, our long-term rightful share of the pot. Don't worry if this is a bit confusing, it'll all make sense by the end of this chapter.

Understanding equity: Coin Flip Example

Let’s use a simple coin-flip example to demonstrate the concept of equity. When you flip a coin and choose either heads or tails, you expect either heads or tails to hit 50% of the time over the long-run. In other words, if you pick tails and wager on it, you expect to win 50% of the time. Therefore, you have a 50% equity, or chance of winning, in a coin-flipping wager.

So if you wager $1 on a coin flip, you expect to win $0.50 in the long run. Why? Your equity is 50% of the pot:

- **Your Coin Flip Equity** : $1 Wager x 0.50 Probability of Coin Landing on Tails = $0.50

Therefore, your equity can be expressed as a percentage or a dollar amount:

- **Percentage Equity** : 50%
- **Dollar Amount Equity** : $0.50

The Equity Caveat: Variance

There is a caveat to equity; it is a long-term expectation.

What in the world does that mean?

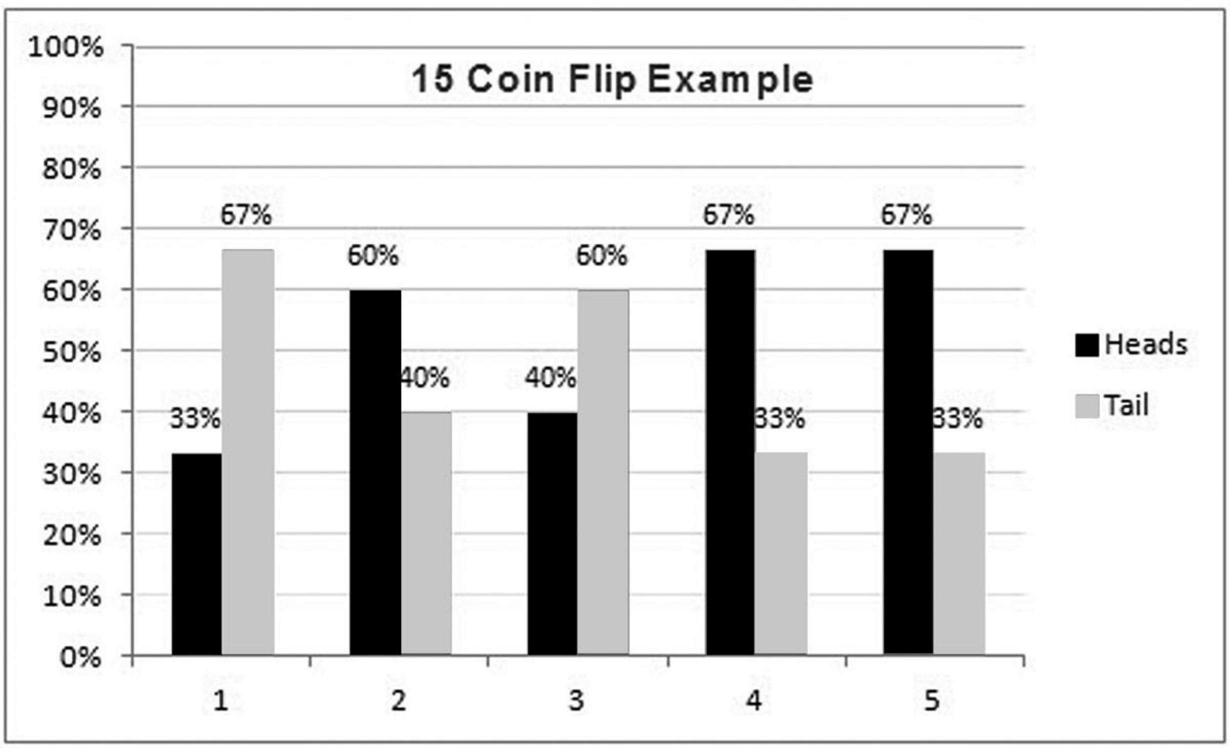
It means that mathematical variance can cause significant, unexpected results in the short-term, where your actual winnings and losses don't match your expected equity outcome. Variance occurs when there are deviations from expected results. For example, you could flip a coin 4 times in a row and have it land on tails 100% of the time. This would be considered short-term variance, since we expect to hit tails only 50% of the time.

We've all run into sessions where we were a huge favorite with pocket Aces or Kings pre-flop only to get sucked out on and lose with them several times in a row. This is a classic example of variance in poker. If you take poker seriously and play tens of thousands to hundreds of thousands of hands per a year, variance will play a huge role in unexpected upswings and downswings. What you'll notice is that variance tends to be magnified over smaller sample sizes and minimized as you play more and more hands.

Sample Size and Variance

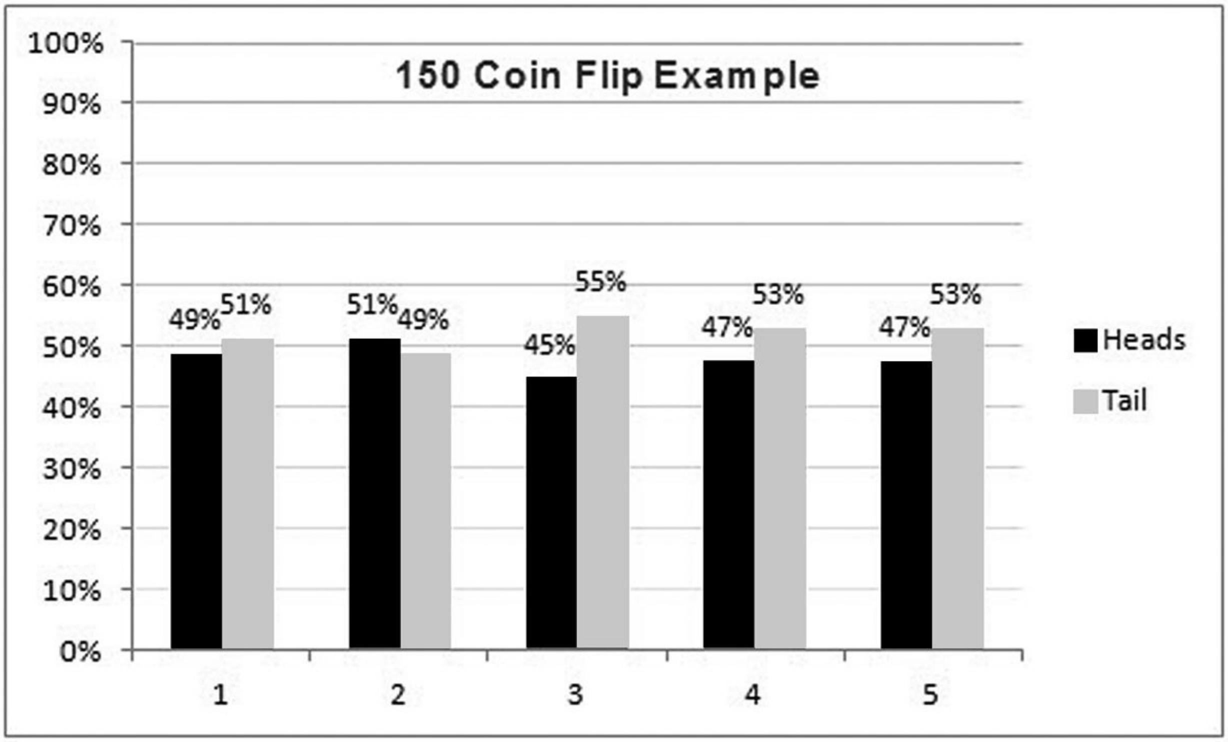
To illustrate how sample size plays a huge role in variance, I completed a simple coin toss scenario using an online coin toss simulator. We can equate a simple coin toss to poker by the stereotypical coin flip situation of AK versus a pocket pair. While this poker/coin-flip situation is not a pure 50/50 scenario, it’s close enough. In the example below, we can assume heads is AK and tails is QQ.

Below is a 15 coin flip example graph where I completed 5 separate 15 coin flip samples and recorded the percentage that heads and tails hit.



What you’ll notice with the 15 coin flip example is a large discrepancy between when heads and tails hits. Either heads or tails lands 60-67%, while the other lands 33-40% of the time in each individual trial. This is short-term variance. While we expect the results to be closer to 50/50, they often aren’t in small sample sizes, and we see the same thing in poker. While we expect QQ to win close to 50% of the time against AK, it might lose four out of five times in a short-term variance downswing session.

Now let's look at the 150 coin flip example below – a sample size that's 10 times greater than the previous. What we notice is that we are getting results closer to a 50/50 expected result. Therefore, as we increase sample size, the effect of variance is greatly diminished.



So what is the takeaway from this?

In small sample sizes, we'll often see unexpected results. In poker, when we have AK versus QQ, we expect QQ to win approximately 55% of the time, and AK ends up winning 10 out of 15 times. However, if we do this scenario over a larger sample size, we will start to see our expected equity results.

So when you are playing poker and see unexpected results, like your Aces getting cracked by a set, two pair, flush, or straight, when you are all-in pre-flop, understand this is short-term variance. Over the long run, your aces will hold up as mathematically expected based upon your equity in the hand.

Understanding Equity: Poker Example

Now that we've explored the concept of mathematical variance and unexpected results, let's take a closer look at the classic all-in poker/coin-flip situation.

Pre-flop all-in situations are a common occurrence in poker, so we'll use a fairly common scenario of QQ versus AK all-in pre-flop. In this situation, QQ is a 55% favorite to win, meaning QQ has 55% equity whereas AK has the remaining 45% equity. Let's assume the all-in pot size is $200 and determine QQ and AK's equity in dollar amounts:

- **Dollar Amount Equity** = % Equity x Pot Size
- **QQ Equity** = 0.55 x $200 = $110 Equity
- **AK Equity** = 0.45 x $200 = $90 Equity

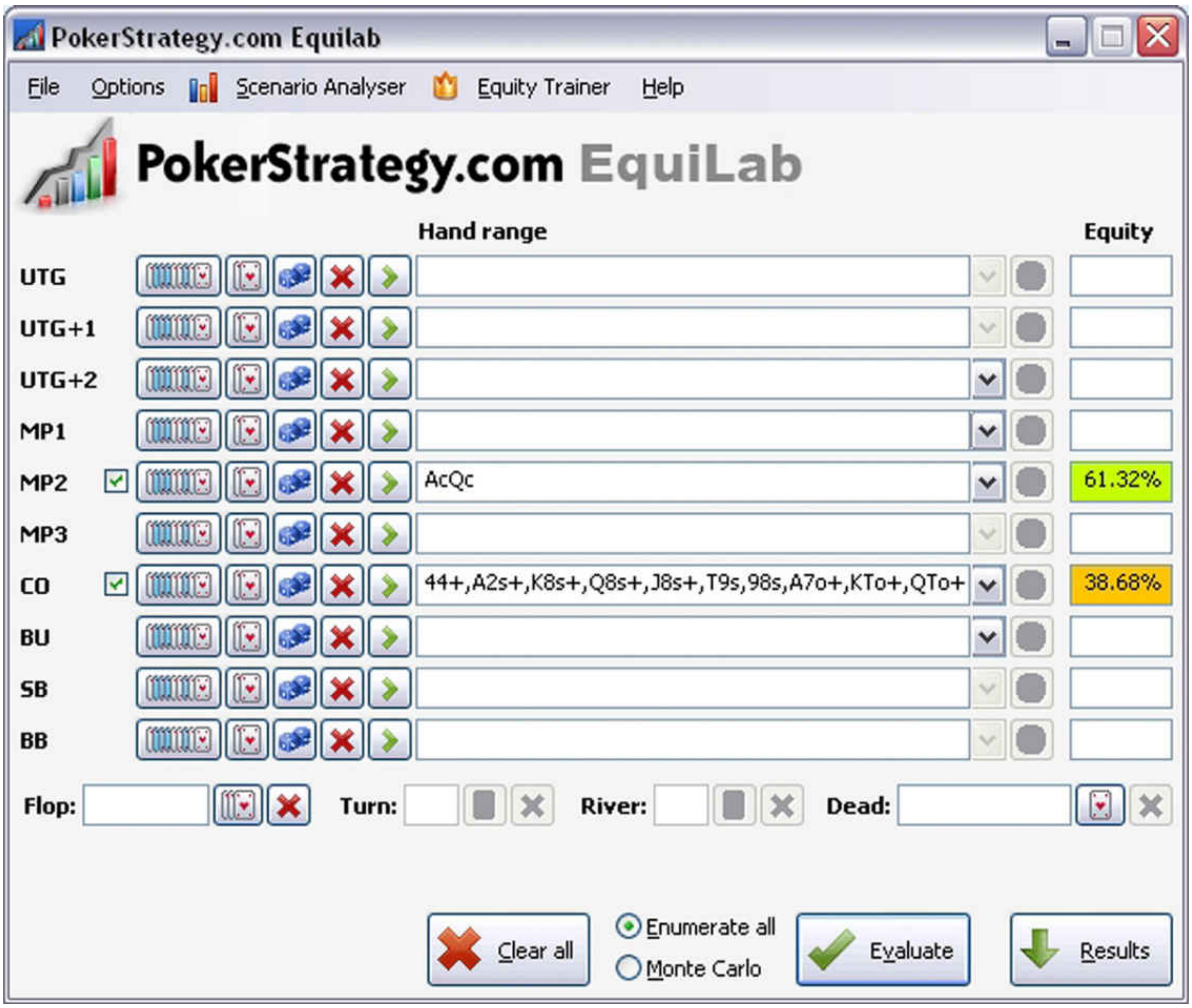
In the long run, QQ's 55% equity share of the pot will yield $110 in this all-in situation, whereas AK's 45% equity will yield only $90. While this is commonly called a "coin flip" scenario, QQ actually wins $10 and AK loses $10 in the long run each time this situation occurs.

Importance of Understanding Equity

Now that you know what equity is, you need to know why it’s important. Equity plays a role in every decision we make in poker. Before we make a call or raise or fold a hand, we need to know our equity share of the hand. All of our decisions revolve around our equity in the hand; i.e., how often and how much we expect to win. With simple poker mathematics, we can evaluate our equity, combined with the pot odds and implied odds we’re being offered, to determine the optimal long term play. Understanding equity and odds is crucial; otherwise we’re less likely to make the correct, profitable play. I’ll teach you the process of evaluating our equity versus pot and implied odds in a methodical manner, broken down into discrete steps throughout several chapters. We’ll be walking through this entire process together as we work our way through this book.

Tools of the Trade: Equilab

PokerStrategy.com has developed a free, invaluable equity calculator software application called Equilab that I recommend all poker players have and use. Equilab gives us the ability to analyze the equity in a poker hand against our opponents' specific hand or range of possible hands. It serves as an invaluable training and hand analysis tool. In addition to its equity calculator, it also includes several other features, such as hand scenario analyzers and an equity trainer.



At its most basic level, you can use it to analyze hands that you previously played in order to determine your pre-flop and post-flop equity throughout an entire hand, from pre-flop to the river. While a full Equilab demonstration is outside the scope of this book, you can view live demonstrations in my *Essential Poker Math* course.

If you don’t have Equilab installed on your computer, I highly recommend you download and install it right now. We’ll be using it throughout this book, and you’ll also find it invaluable in your poker career.

Common Pre-Flop Equity Scenarios

Below are some common pre-flop hand equity scenarios. I used Equilab to calculate which hand is the equity favorite in each scenario. This will give you an idea of your equity in common pre-flop situations, such as AA vs. QQ or AK vs. TT.

Scenario	Example	Equity Favorite
Over Pair vs. Under Pair	AA vs. QQ	AA (81.55%)
Over Cards vs. Pair	AK vs. TT	TT (56.17%)
Dominated Hand	KQ vs. KJ	KQ (73.16%)
Over Cards vs. Under Cards	JT vs. 68	JT (69.69%)

For example, in an over pair versus under pair scenario, the over pair is a huge favorite pre-flop. In another common pre-flop all-in situation of AK over cards versus a pocket pair, we see that the pocket pair is a slight favorite. In poker, AK versus a pair is commonly referred to as a coin flip scenario.

The other two scenarios are not pre-flop all-in situations, but give you an idea of why being out-kicked with top pair can lead to a lot of big losing pots post-flop. In our KQ versus KJ scenario, we see that KQ is expected to win 73.16% of the time. The last scenario shows the value of playing higher cards versus smaller cards for suited and off-suited connectors.

Pre-Flop & Post-Flop Equity

One very important concept to understand when it comes to equity is that equity changes throughout a hand. What does that mean? Our pre-flop equity isn't the same as our post-flop equity. Pre-flop, we don't know what cards are going to hit the flop, turn and river. But as they do, our equity in the hand changes accordingly.

For example, given A♣ A♠ versus Q♦ Q♥, A♣ A♠ is a 81.55% equity favorite pre-flop. However, what happens if the board flops T♥ J♥ 9♥? Q♦ Q♥'s equity increases and A♣ A♠'s decreases.

Hand 1	Hand 2	Action
A♣ A♦ (81.55%)	Q♦ Q♥ (19.14%)	Pre-Flop
A♣ A♦ (40.30%)	Q♦ Q♥ (59.70%)	T♥ 9♥ J♥ Flop

As you can see from the table above, pocket Queens pick up a lot of outs for draws on the flop with a straight flush draw. Consequently, pocket Queens are now the equity favorite to make the best hand by the river.

This simple example shows how pre-flop and post-flop equity aren't the same, and how equity changes from pre-flop to the flop, to the turn, and to the river. You can use Equilab to practice analyzing hand equities on a street-by-street basis as I did with pocket Aces and pocket Queens, comparing pre-flop and post-flop flop equities. Doing so is a great way to better understand how equity changes from pre-flop to post-flop.

Equity Analysis Practice Hands

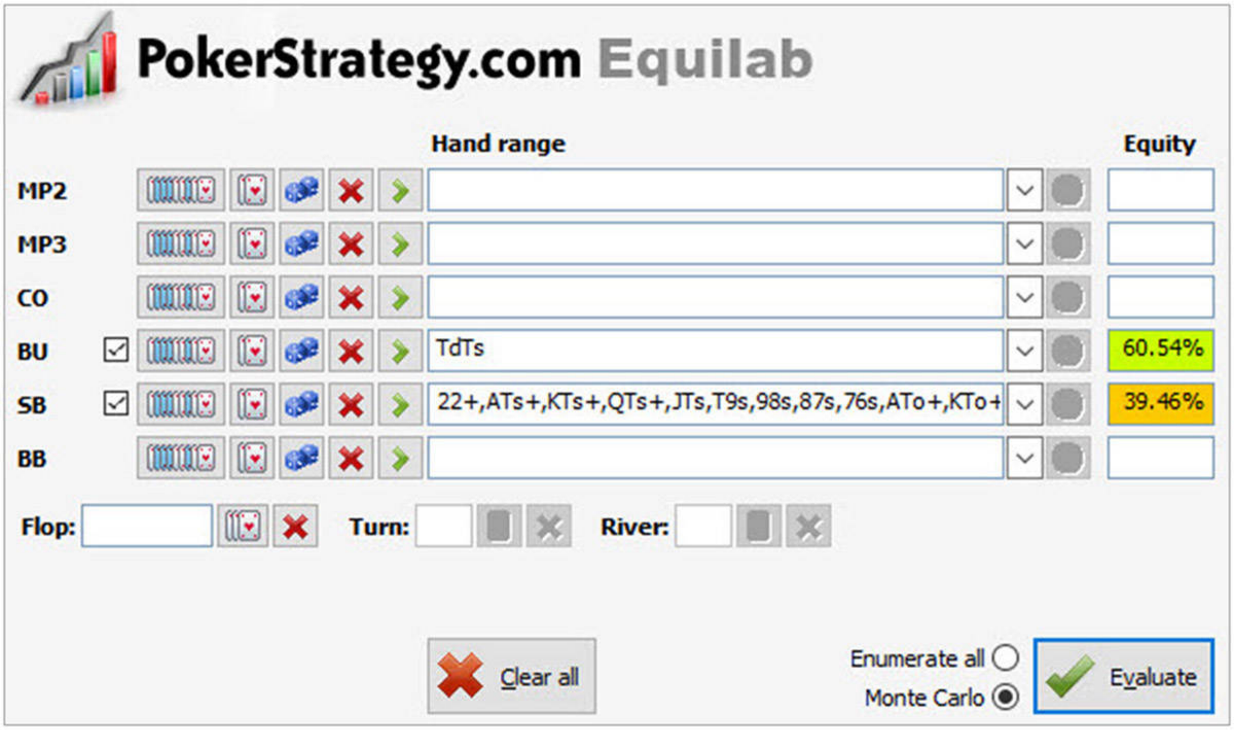
While equity is a fairly basic concept, I want to make sure you understand it. So let's do some practice hands together.

Practice Hand #1: Hand versus Range

We have T♦ T♠ on the BTN. We open raise to 2.5bb, a bad aggressive 20bb short-stacker in the SB 3-bet jams all-in and the BB folds. We have seen the SB open jam with all pocket pairs, stronger suited connectors and all sorts of Broadway cards, so we estimate his all-in jamming range looks like this: 22+, ATs+, KTs+, QTs+, JTs, T9s, 98s, 87s, 76s, ATo+, KTo+, QTo+, JTo. What is our equity against this range?

Using Equilab, we determine that T ♦ T ♠ is a 60.54% equity favorite against the bad aggressive SB's all-in jamming range, which can be seen below. This means that we expect to win 60.54% of the time in the long-run against SB's range of hands in this example. If we call, our rightful share of the 41.5bb pot is 60.54% of the entire pot.

- **Our 60.54% Equity Share** : 41.5bb x 0.6045 = **25.12bb**



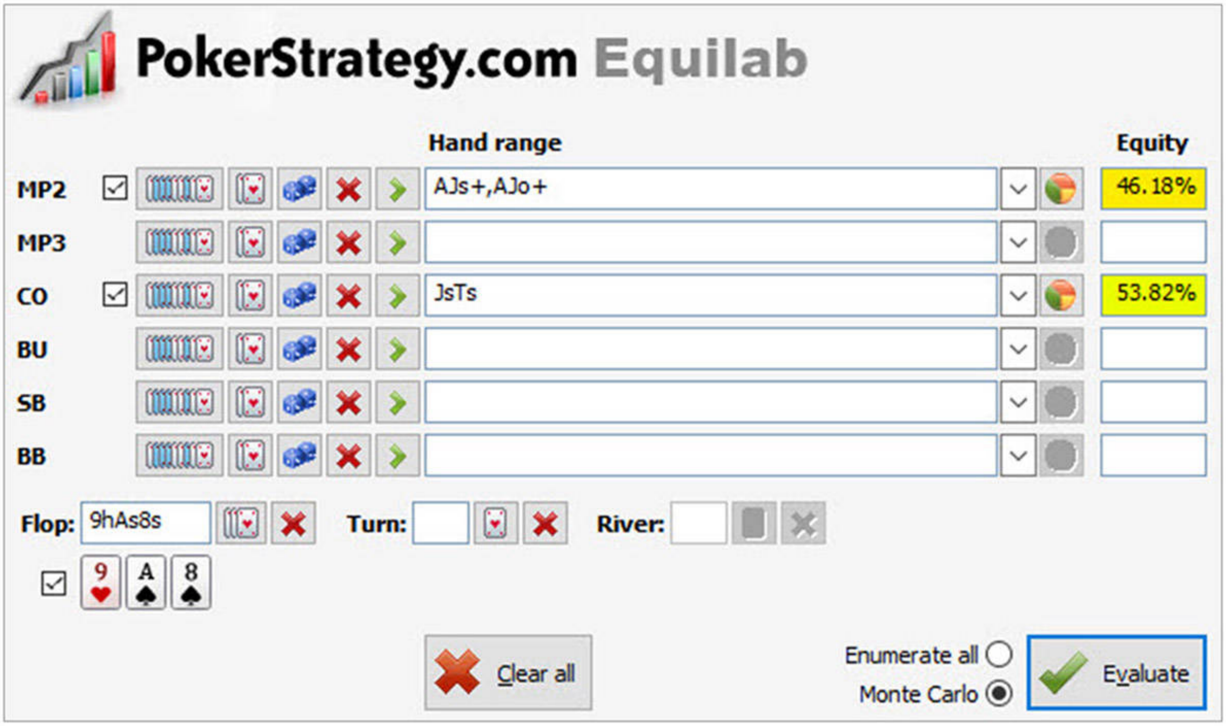
Should We Call?

The bigger question is, "Should we call?" The answer is yes, based upon the pot odds we're being offered combined with our equity chance of winning the hand; however, we haven't learned about evaluating pot odds versus equity yet – which we'll cover later in the book. For the rest of the practice hands in this chapter, we'll just focus on determining our hand's equity and not determining if we should call or not.

Practice Hand #2: Post-Flop Equity

We called a pre-flop raise in the CO with J♠ T♠. The flop comes 8♠ 9♥ A♠. We estimate that our opponent has either AK, AQ or AJ. What is our equity in this situation?

According to Equilab, with both an open-ended straight draw and flush draw, our hand currently is a 53.82% equity favorite to win the hand by the river against AK, AQ or AJ.



Isn't There Any Easier Way?

You're probably thinking that there has got to be an easier way to calculate our equity in post-flop situations such as this. The good news is that there is a way – by counting our outs and using the Rule of 2 and 4, topics you'll learn later in the book. The goal with these exercises is to get you to understand equity and how to calculate it with Equilab.

Practice Hand #3: Precarious River Spot

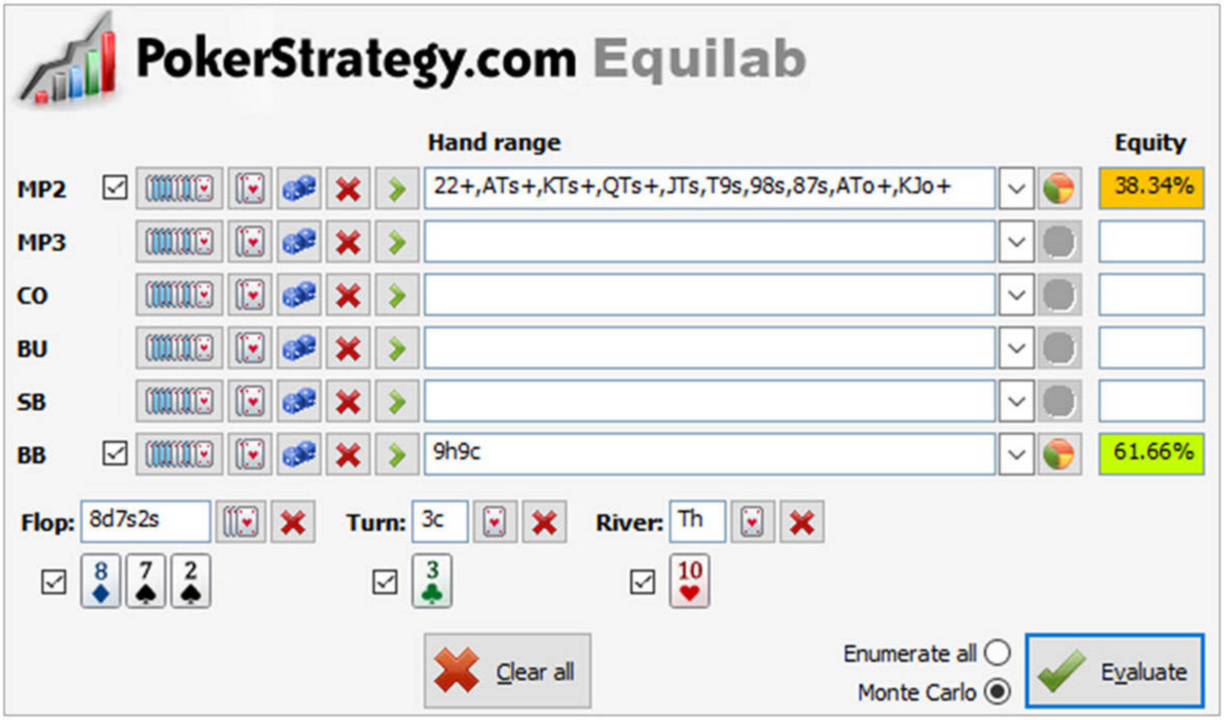
A LAG open-raises UTG for $4 in a $1-$2 No-Limit game at our local card room. It folds around to us in the BB and we call with 9♥ 9♣. The flop comes 2♠ 7♠ 8♦. We check, villain bets a 1/2 pot-sized bet and we call. The turn is the 3♣. Again we check, villain bets a 1/2 pot-sized bet and we call. The river is the T♥, making the final board 2♠ 7♠ 8♦ 3♣ T♥. We check, villain bets a $40 pot-sized bet and the action is on us. What is villain's perceived range and our equity against that range?

This is an interesting spot, especially for beginner poker players. The first thing we need to take into consideration is villain's playing style.

Villain is an aggressive LAG, so we know he'll have a wider UTG open-raising range than most other decent players. He'll also put immense pressure on us post-flop, especially since we're out of position and without the initiative. A good assumption would be around a 16% opening range: 22+, ATs+, KTs+, QTs+, JTs, T9s, 98s, 87s, ATo+, KJo+, QJo.

This range gives villain a plethora of made hands and busted draws to triple barrel into us on the river. The missed draws we'd expect villain to triple barrel into us are missed flush draws, Broadway over cards looking to hit a pair and missed straights. Villain also has a lot of made hands, such as over pairs, top pair, two pair sets and straights. Lastly, villain could be bluffing with a small pair, such as 22-66. Usually we would narrow down our opponent's range on each street of action, but we shouldn't be surprised to see such a good, aggressive opponent bet three streets against us with his entire starting range to put pressure on us. A good LAG knows it will be hard for us to call three streets of bets with a single pair when we have shown weakness by taking a check/call line for three streets post-flop, so the question remains, how are we doing with our 9♥ 9♣ against villain's entire range?

Plugging this information into Equilab, we see that we are actually a 61.66% equity favorite against villain's entire range in this spot. Since our opponent has so many bluffs in his range – as well as missed draws – our measly pair of nines is doing well against his entire range of hands on the river in this spot. If we call, we expect to win 61.66% of the final $80 pot over the long run, which equates into $49.33.


PokerStrategy.com Equilab
Hand range
Equity
MP2
22+,ATs+,KTs+,QTs+,JTs,T9s,98s,87s,ATo+,KJo+
38.34%
MP3
CO
BU
SB
BB
9h9c
61.66%
Flop:
8d7s2s
Turn:
3c
River:
Th
Clear all
Enumerate all
Monte Carlo
Evaluate

Conclusion

Equity is a simple concept in poker, and you definitely need to understand it. It's important in both pre-flop and post-flop play. Most importantly, equity tells us how often we can expect to win or lose a hand, based upon the likelihood that we'll have the best hand at showdown. All in all, equity is our rightful share of the pot and we can use equity tools such as Equilab to perform complex equity calculations off the table. Additionally, concepts such as the Rule of 2 and 4 – which we'll learn in a later chapter to quickly estimate our equity while playing a hand – can assist our strategy.

Later in the book, we're going to discuss equity combined with pot odds and implied odds to determine if we can call with a drawing hand or not. We'll also be learning how much we should bet with the best hand, based on assumptions of our opponents' drawing hands.

If this all seems a bit cryptic and you're unsure if it'll be useful or not, don't worry, it will be. Understanding equity, along with pot and implied odds, lays the foundation behind making correct mathematical plays at the table. We'll be learning about pot odds in the next chapter.

Chapter 6. Pot Odds

Introduction

In this chapter, we’re going to continue our poker mathematics journey by discussing pot odds. In the previous chapter, we talked about equity and how often we expect to make the best hand. Now we need to discuss pot odds, which relates to betting and calling bets in poker. Knowing our pot odds is very important because it allows us to determine if we can profitably call a bet, raise a bet, or simply fold our hand. Let’s get started.

Pot Odds

So what are pot odds? Pot odds are the immediate odds we're being offered when we call a bet in poker. The important aspect of this definition is **immediate**, because with pot odds it's all about how much we stand to win **immediately** in relation to what we are risking by calling a bet. Remember, this relates directly to the reward-to-risk ratios we discussed in a previous chapter.

For example, if our opponent bets "x" amount in a hand on the river, we are given a certain amount of pot odds to make the call on the river in order to potentially win the pot. With our **reward:risk** ratio, we **risk** the amount we have to call in order to win the **reward** of the amount of money in the pot.

A Quick Example

Let's do a quick example to solidify this concept before we explore the mathematics behind it:

There's $10 in the pot going to the river. Villain bets all-in for a total of $10 and the action is on us. We can either call or fold in this spot. If we call, we are risking $10 to win the $20 already in the pot, so our **reward:risk** ratio is $20:$10 or 2:1. Mathematically, we can convert this into a percentage and say we are calling $10 out of a total of $30 ($20 pot + our $10 call), which would mean we have to put 1/3 or 33% more into the pot to get $30 back. So, in this spot, we are getting the following pot odds:

- $20:$10 →2:1 → 1/3 → 33% Pot Odds

Should we call? If we expect to win at least 33% of the time, we should call. Determining if we can profitably call or not is a function of comparing our pot and implied odds to our equity in the hand, which we will discuss in detail in Chapter 5. In this chapter, we'll focus solely on figuring out our pot odds.

How to Calculate Pot Odds as Ratios

Our first task is determining how to calculate our pot odds in **reward:risk** ratios.

- **Pot Odds** = [pot size]:[amount to call] where [pot size] includes any and all bets on the current street (pre-flop, flop, turn, or river) not including our call.

When determining our pot odds, we are concerned with the total [pot size], not including our call, and the [amount to call].

We then put this information into our reward-to-risk ratio where the reward is the [pot size] and the risk is our [amount to call] shown below.

Pot Odds = [reward]:[risk] ratio = [pot size]:[amount to call]

- **Reward** : [pot size]
- **Risk** : [amount to call]

Calculating Pot Odds Ratios Exercises

Exercise Hand #1

The pot is $200 and there is a $100 bet in front of us.

Our first task is to determine the pot size, which is the total amount in the pot not including our call; which would be the initial $200 pot plus the $100 bet.

We then plug the numbers into the ratio, as seen below:

1. **Pot Odds** = [pot size]:[amount to call]
2. = [$200 + $100]:[$100]
3. = $300:$100 = 3:1
4. **Pot Odds** = 3:1

Exercise Hand #2

Going to the river, there is 50bb in the pot, with three people remaining in the hand. UTG bets 25bb, MP calls and the action is on us on the BTN.

What are our pot odds?

The total pot size is the initial 50bb pot size, the 25bb bet and the 25bb call. Our call amount is 25bb.

1. **Pot Odds** = [pot size]:[amount to call]
2. = [50bb + 25bb + 25bb]:[25bb]
3. =100bb :25bb = 4:1
4. **Pot Odds** = 4:1

Exercise Hand #3

On the flop, there is 12bb in the pot, with four people remaining in the hand, SB, BB, UTG, and BTN. Both of the blinds check, UTG bets 8bb, BTN folds, SB raises to 20bb and the action is on BB.

What are BB's pot odds?

The total pot size is the initial 12bb pot size, UTG's 8bb bet and SB's 20bb check-raise. BB's call amount is 20bb.

1. **Pot Odds** = [pot size]:[amount to call]
2. = [12bb + 8bb + 20bb]:[20bb]
3. = 40bb :20bb = 2:1
4. **Pot Odds** = 2:1

How to Calculate Pot Odds as Percentages

Converting pot odds to a percentage is a fairly simple process and there are two ways to do so. The first is to use the simple mathematical relationship of ratios to fractions, which we introduced earlier in the book.

Simple Mathematical Relationship

$$m : n = \frac{n}{m + n}$$

The formula below shows a very simple mathematical relationship between a ratio (m:n) and its fraction counterpart, which can be reduced into a percentage.

- **m** = reward
- **n** = risk
- **m + n** = reward + risk
- **Percentage** = risk / (reward + risk)
- **Percentage** = n / (m + n)

Pot Odds Percentages the Easy Way

The following is the second way to determine pot odds as a percentage:

- **Pot Odds %** = call size / (pot size before call + call size)

When determining our pot odds percentage, we include our call amount into the total pot size, because we’re calculating how much we must call into the total amount that will be returned to us if we win.

Calculating Pot Odds Percentages Exercises

Exercise Hand #1 as Pot Odds Percentage

The pot is $200 and there is a $100 bet in front of us.

Our first task is to determine the pot size, which is the total amount of the pot, not including our call, which would be $200 + $100.

We then plug the numbers into the ratio, as seen below:

Ratio to Percentage Method

1. **Pot Odds** = [pot size]:[amount to call]
2. = [$200 + $100]:[$100]
3. = $300:$100 = 3:1
4. **Pot Odds** = 3:1
5. **Convert Ratio to Percentage** = 3:1 → 1 / (3+1) → 1/4 → **25% Pot Odds**

The Easy Percentage Method

1. **Pot Odds %** = call size / (pot size before call + call size)
2. = $100 / ($300 + $100) → $100 / $400 → 1/4 → **25% Pot Odds**

Exercise Hand #2 as Pot Odds Percentage

Going to the river, there is 50bb in the pot, with three people remaining in the hand. UTG bets 25bb, MP calls and the action is on us on the BTN.

What are our pot odds?

The total pot size is the initial 50bb pot size, the 25bb bet and 25bb call. Our call amount is 25bb.

Ratio to Percentage Method

1. **Pot Odds** = [pot size]:[amount to call]
2. = [50bb + 25bb + 25bb]:[25bb]
3. = 100bb:25bb = 4:1
4. **Pot Odds** = 4:1
5. **Convert Ratio to Percentage** = 4:1 → 1 / (4+1) → 1/5 → **20% Pot Odds**

The Easy Percentage Method

1. **Pot Odds %** = call size / (pot size before call + call size)
2. = 25bb / (100bb + 25bb) → 25bb / 125bb → 1/5 → **20% Pot Odds**

Exercise Hand #3 as Pot Odds Percentage

On the flop, there is 12bb in the pot, with four people remaining in the hand: SB, BB, UTG, and BTN. Both of the blinds check, UTG bets 8bb, BTN folds, SB raises to 20bb and the action is on BB.

What are BB’s pot odds?

The total pot size is the initial 12bb pot size, UTG’s 8bb bet and SB’s 20bb check-raise. BB’s call amount is 20bb.

Ratio to Percentage Method

1. **Pot Odds** = [pot size]:[amount to call]
2. = [12bb + 8bb + 20bb]:[20bb]
3. = 40bb :20bb = 2:1
4. **Pot Odds** = 2:1
5. **Convert Ratio to Percentage** = 2:1 → 1 / (2+1) → 1/3 → **33% Pot Odds**

The Easy Percentage Method

1. **Pot Odds %** = call size / (pot size before call + call size)

2. = 20bb / (40bb + 20bb) → 20bb / 60bb → 1/3 → **33% Pot Odds**

Which method should I use?

It’s really up to you to determine which method you prefer to calculate your pot odds. Some people prefer the ratio method, while others prefer the percentage method. Regardless, both methods will provide you with the same information. That said, I personally prefer the percentage method, because percentages are more intuitive than ratios for me to understand. I’m also going to recommend that you use the percentage method, because when we start comparing pot odds to our equity, we’ll be using the percentage method.

What does pot odds really mean?

So what does 3:1 or 25% pot odds really mean? It means that we have to put 25% more money into the pot if we decide to call a bet. For example, if the pot size is $3 and our opponent bets $1, we have to call an additional $1, which equates into 25% of the total pot of $4. Remember from earlier that pot odds are the immediate gambling odds we’re being offered when we call a bet in poker. Pot odds tell us how much we stand to win **immediately** in regards to how much we’re risking by calling a bet.

Why are pot odds important?

Pot odds are important because we use them in conjunction with implied odds and our equity to determine how we can optimize playing a hand.

We use pot odds to ensure we only call bets when we are getting **good pot odds** or **good implied odds** based upon **our equity** in the hand. In gambling and in poker, there are good odds and bad odds. Good odds favor us in the long-run, whereas bad odds favor our opponent(s). As you probably know, we always want to take good odds and shy away from bad odds. You'll learn as we progress through this book how to determine if you're getting good or bad pot odds. You'll also learn how to leverage implied odds, a concept we'll introduce and discuss in detail in the next chapter.

In short, we compare our pot odds to our equity to tell us if we are getting good or bad pot odds. We'll be discussing how to estimate our equity and use it in conjunction with pot odds to determine whether or not we should call later in the book.

Odds-to-Percentages Table

If you find that pot odds ratio calculations aren’t the easiest for you, you can use this simple table to quickly convert ratios to percentages. So long as you’re able to memorize the most common odds ratios, you’ll be able to quickly convert them to percentages at the table utilizing the reference table below:

Odds Ratios	Odds Percentages
1:1	50%
2:1	33%
3:1	25%
4:1	20%
5:1	16.7%
6:1	14.3%
7:1	12.5%

Pot Odds Exercises

We'll conclude this chapter by doing more pot odds exercises to ensure you understand this concept and can apply it with speed while at the tables.

<u>Exercise Hand #4</u>

Villain bets $10 into a $20 pot and it is our turn to act.

What are our pot odds ratio and percentage?

Pot Odds Ratio Calculation

1. **Pot Odds** = [pot size]:[amount to call]
2. **Pot Size** = $20 Pot + $10 Bet = $30
3. = $30:$10 = 3:1 Pot Odds Ratio
4. **3:1 Pot Odds**

Pot Odds % Calculation

1. **Pot Odds** = call size / (pot size before call + call size)
2. **Pot Size + Call** = $20 Pot + $10 Bet + $10 Call = $40
3. = $10 / $40 = 1/4 = 25%
4. **25% Pot Odds**

<u>Exercise Hand #5</u>

Villain bets $50 into a $50 pot and it's our turn to act.

What are our pot odds ratio and percentage?

Pot Odds Ratio Calculation

1. **Pot Odds** = [pot size]:[amount to call]
2. **Pot Size** = $50 Pot + $50 Bet = $100
3. = $100:$50 = 2:1 Pot Odds Ratio

4. **2:1 Pot Odds**

Pot Odds % Calculation

1. **Pot Odds** = call size / (pot size before call + call size)
2. **Pot Size + Call** = $50 Pot + $50 Bet + $50 Call = $150
3. = $50 / $150 = 1/3 = 33%
4. **33% Pot Odds**

Exercise Hand #6

Villain bets $10 into a $40 pot, an opponent calls and it's our turn to act.

What are our pot odds ratio and percentage?

Pot Odds Ratio Calculation

1. **Pot Odds** = [pot size]:[amount to call]
2. **Pot Size** = $40 Pot + $10 Bet + $10 Opponent Call = $60
3. = $60:$10 = 6:1 Pot Odds Ratio
4. **6:1 Pot Odds**

Pot Odds % Calculation

1. **Pot Odds** = call size / (pot size before call + call size)
2. **Pot Size + Call** = $40 Pot + $10 Bet + $10 Opponent Call + $10 Call from Us = $70
3. = $10 / $70 = 1/7 = 14%
4. **14% Pot Odds**

Exercise Hand #7

UTG open-raises to 3bb, SB calls and the action is on us in the BB with K♣ K♠. We 3-bet to 10bb and the action is on UTG. If UTG decides to call, he will need to commit 7bb more to the pot.

What pot odds are we offering UTG with our 3-bet?

Pot Odds Ratio Calculation

1. **Pot Odds** = [pot size]:[amount to call]
2. **Pot Size** = 3bb UTG open + 3bb SB call + 10bb BB 3-bet = 16bb pot
3. = 16bb:7bb = 2.3:1 Pot Odds Ratio
4. **2.3:1 Pot Odds**

Pot Odds % Calculation

1. **Pot Odds** = call size / (pot size before call + call size)
2. **Pot Size + Call** = 3bb UTG open + 3bb SB call + 10bb BB 3-bet + 7bb call from UTG = 23bb
3. = 7bb / 23bb = 30.4%
4. **30.4% Pot Odds**

Exercise Hand #8

UTG calls our pre-flop 3-bet and we are going heads up to the flop with 23bb in the pot. We bet 14bb on the flop and the action is on UTG.

What pot odds are we offering UTG with this continuation bet?

Pot Odds Ratio Calculation

1. **Pot Odds** = [pot size]:[amount to call]
2. **Pot Size** = 23bb pot + 14bb bet = 37bb pot
3. = 37bb:14bb = 2.64:1 Pot Odds Ratio
4. **2.64:1 Pot Odds**

Pot Odds % Calculation

1. **Pot Odds** = call size / (pot size before call + call size)
2. **Pot Size + Call** = 23bb pot + 14bb bet + 14bb call from UTG = 51bb
3. = 14bb / 51bb = 27.5%
4. **27.5% Pot Odds**

Rounding Up or Down

You’ve probably noticed that a lot of the numbers we’ve come up with in these examples aren’t easily divisible and seldom convert into whole numbers. The same goes in real-life poker, where we’ll rarely encounter situations where we have exactly 3:1 or 4:1 pot odds that convert nicely into 25% or 20% pot odds respectively. To make life easier, we can simply round up or down to numbers that are more easily divisible.

For example, if we estimate that there is $77 in the pot and the bet is $38 to us, we can simply round the pot up to $80 and the bet up to $40, or round down to $75 and $35 respectively to make the our pot odds calculation easier to compute. Yes, our pot odds estimation won’t be 100% correct, but it’ll be close enough for most situations.

- **Actual Pot Odds** : 24.8%
- **Rounding Up Pot Odds** : 25%
- **Rounding Down Pot Odds** : 24.1%

Educated guesses and estimations are a major aspect of poker, so we’re bound to make erroneous decisions. Because of this, minor errors committed by rounding up or down in our pot odds estimations will be okay in most situations.

Conclusion

In this chapter, we discussed pot odds. You should now know how to calculate pot odds as a ratio and a percentage, as well as understand the importance of pot odds in poker. While we did perform numerous pot odds exercises in this chapter, I highly recommend reviewing hands you have previously played and using them to calculate pot odds on your own. Your goal should be to be able to quickly calculate your pot odds at the table (with a calculator if you need one). Now that you know about equity and pot odds, we'll turn our attention to implied odds in the next chapter.

Chapter 7. Implied Odds

Introduction

You can think of implied odds as an extension of pot odds. While pot odds are considered our most direct and immediate odds when calling a bet, implied odds are our indirect odds. Recapping on the previous chapter, with pot odds, it's all about how much we stand to win immediately in relationship to what we're risking by calling a bet. In contrast, implied odds consider how much we stand to win not only immediately, but also on later rounds of betting after we make the best hand.

Implied odds state that we can call a bet now, even if we are not getting good direct pot odds, if we expect to make up for it on later streets (turn or river) of betting if we hit our draw. What this means is that we can call a bet now, getting bad direct pot odds with a drawing hand, if we expect our opponent to pay us off nicely when we hit our draw. So, implied odds reflect how much we expect to win on later streets when we hit our drawing hand.

Comparing and Contrasting Pot and implied Odds

Pot Odds

- Only concerned with how much we’ll win immediately by calling a specific bet.
- We need a good direct pot odds price to call a bet based upon our equity in order for that call to be profitable.
- Typically used in end-of-action spots, such as all-in and river bet situations.

Implied Odds

- Concerned with how much we will win now, as well as how much we stand to win on later streets of betting action when we make a drawing hand.
- We don't need a good direct pot odds price to call a bet based upon our equity if we expect to get paid off nicely on later streets of action after we make the best hand.

Good versus bad Implied Odds

Understanding the difference between good and bad implied odds is essential before you try to utilize this concept in live play. When we’re calling a bet with bad direct pot odds, we’re committing more money to the pot than our equity dictates we should. At minimum, our implied odds should make up for the extra money we committed to the pot that we mathematically shouldn't have. Ideally, we would like for our implied odds to yield us much more than this bare minimum.

Therefore, we can loosely define both good versus bad implied odds in the terms below:

Good Implied Odds

- If we expect to win a lot more money from our opponent on later streets of betting after we make our draw, we have good implied odds.

Bad Implied Odds

- If we expect to win little or no more money from our opponent on later streets of betting after we make our draw, we have bad implied odds.

When Implied odds Work Well

There are many situations in which implied odds work well, as well as many situations in which they don't. Factors such as our opponents' playing style and tendencies, draws, and in-game dynamics all come into play when determining if a situation is ideal or not for implied odds. In this chapter, we'll cover six situations in which implied odds work well:

- Against Aggressive Opponents
- Against Calling Stations
- When You’re in Position
- In Multi-Way Pots
- When You’re Deep-Stacked
- With Hidden Draws

Against Aggressive Opponents

Against aggressive opponents, we can call flop and turn bets with bad direct pot odds when we expect our aggressive opponent to pay us off when we hit our draw. Implied odds are higher with aggressive opponents because they will usually tend to bet on later streets for value, and as a bluff even when we hit our draw. These types of opponents will put immense pressure on us post-flop, doing their best to try to make us fold the best hand. Since they aren’t afraid to bluff, these types of opponents – especially bad aggressive maniacs – typically yield us good implied odds.

Against Calling Stations

Loose passive calling stations are great opponents to get paid off on later streets when we make the best hand. Since they hate folding post-flop and will call river bets with as little as bottom pair, we can look to extract implied odds value when our drawing hands hit on the turn or river. Moreover, when a loose passive calling station takes the lead in a hand by raising pre-flop and continues betting the flop, we can easily put them on a strong range of made hands that they’ll commit to on the turn or the river.

While we don't want to try and bluff raise or bluff bet them out of a hand, we can profitably look to take a check/call line to try to hit the best hand on the turn or river.

When you are in Position

It's always easier to extract value when we're in position, because we're last to act in each round of betting. Being last to act ensures us the ability to wager a bet when we hit our draws. Accordingly, this allows us to get paid off more often than when we're out of position. For example, if we're out of position, hit our draw, and check to our opponent, our opponent may check behind for pot control. However, if we're in position, we can fire out a value bet and hope to get called by our opponent. Because of this, it makes much more sense to play implied odds, drawing hands more often in position than out of position because of this opportunity to act last post-flop.

In Multi-Way Pots

Multi-way pots with multiple opponents in a hand often yield good implied odds. Hands that can hit hidden monster draws such as sets or hidden straight draws in multi-way pots are a great way to extract enormous amounts of implied odds winnings. The reason for this is fairly straight forward. The more people there are in the hand, the more likely our opponent(s) will make a strong made hand or strong draw. This increases the likelihood that we'll get paid off with our very strong holdings.

When We're Deep-Stacked

When effective stack sizes in a hand are deep-stacked, we're also more likely to get paid off in implied odds situations. The main reason is that when SPRs are large, we have a lot of room for post-flop maneuverability with large chip stacks compared to the size of the pot. Situations such as 3-bet pots are ideal to play starting hands that can make monsters such as sets, straights and flushes against an opponent who's showing tremendous pre-flop strength for this very reason.

When you have a Hidden Draw

What is a hidden draw?

It's typically a set or straight using one-gapper connectors. These are draws that are very difficult to detect; therefore, we can expect to yield a lot of value when we hit them. Here are some examples:

- We have 6♣ 8♣ and the Flop is 5♣ 7♦ K♥
- We have 9♥ 9♣ and he Flop is K♣ 2♠ 8♦

If we hit the straight on the turn with a 9 with 6♣ 8♣, it will be very difficult for our opponent to see the straight. If our opponent has top pair, he will definitely continue to bet for value on the turn. The same goes for the second example. If we turn a set of 9's, our opponent will never see it coming and will continue to value bet top pair. These are classic examples of hidden draws that have a lot of implied odds value because they are so difficult to spot. With hands like these, we can expect to extract maximum value when they hit.

Good Implied Odds Example Situations

Now that we've briefly discussed the factors that commonly yield us good implied odds situations, I'll walk you through some example situations to solidify this concept.

Example Hand #1: The Aggressive Maniac

A bad aggressive opponent, who has been playing wildly throughout the session, bluffing relentlessly, open-raises to 5bb in MP. With 100bb effective stack sizes and 7♥ 8♥ in the CO, we make the call. Everyone else folds and the pot is 11.5bb going to the flop. The flop is 6♣ T♦ A♥ and UTG continuation-bets a pot-sized 11.5bb bet.

With only a gut-shot straight draw getting 2:1 pot odds, we don't have nearly enough equity to call MP's continuation bet purely off of 33% pot odds alone. Making a call off of pot odds alone would be an unprofitable play. However, our opponent's playing style and tendencies provide us with the possibility to get paid nicely if we hit our draw. With 100bb effective starting stacks, our opponent has 83.5bb left behind in his stack after his pot-sized flop continuation bet. Moreover, if we call MP's flop bet, there will be 34.5bb in the pot going to the turn. Assuming MP either has an Ace or is purely bluffing, a relatively blank card such as a 9 will not slow him down from firing a second barrel. Since MP open-raised to 5bb pre-flop, a fairly large pre-flop raise size, we can also assign him a fairly strong range that includes a lot of Ax hands such as AK, AQ, and AJ.

With that being said, this situation can yield very nice implied odds profits on the turn and river against a bad aggressive opponent. If he has an Ace, we can expect him to fire out a large bet on the turn. On the other hand, if he is bluffing, we can also expect him to bluff a high percentage of the time to put pressure on us to fold. With 83.5bb left in his stack, this is a good implied odds situation to try to hit our straight on the turn and stack our opponent.

Example Hand #2: The Multi-Way Limped Pot

UTG, CO, BTN and SB limp in pre-flop. We're in the BB with 2♠ 2♦ and limp in behind. The flop comes A♥ 2♣ 6♣.

Our implied odds in this situation are a bit different than in the previous situations. Hitting a hidden draw, such as a set on a coordinated flop with lots of draws, will not only yield us immediate profits on the flop, but additional profits on the turn and river. With four opponents in the hand, it's very likely at least one of them has an Ace and another either has a straight or flush draw. Given this information, our set of 2's will provide us with at least two streets of profits.

This situation is a combination of a hidden draw and a multi-way pot, which both increase our implied odds with a hand. What makes this different is that we flopped the best hand and our implied odds come from our opponents calling down with worse made hands and draws that often miss. Our job with a hand as strong as this on a very coordinated flop is to bet all three streets for maximum value.

Example Hand #3: Deep-Stacked Play

The action folds around to us on the BTN. We bet 2.5bb with 9♥ T♥ as a steal attempt with a 250bb stack. SB folds and a good, competent TAG with a 218bb stack in the BB 3-bets to 9bb. Being deep-stacked with 218bb effective stack sizes at the beginning of the hand, and also being in position, we make the call. There is 18.5bb in the pot going to the flop. The flop is 9♠ 9♣ 5♣, BB continuation bets 11bb, and we call. There is 40.5bb in the pot going to the turn. The turn is the 2♦, and BB fires a second bullet for 25bb, again we call, and the pot is now 90.5bb going to the river. The river is the 6♥ making the final board 9♠ 9♣ 5♣ 2♦ 6♥, BB fires a third bullet for 50bb, we raise to 100bb. BB thinks for a while and calls. We turn over 9♥ T♥ for trip 9's, BB mucks A♠ A♥ and we scoop a 290bb pot, while BB loses a total of 145bb in the hand.

This is a stereotypical situation where deep-stacked effective stack sizes can yield us a lot of money via implied odds. The only reason we called this pre-flop 3-bet was because of the 218bb effective stack sizes between us and BB. We’re aware we’re far behind BB’s pre-flop 3-betting range a majority of the time, so calling pre-flop isn’t a profitable play alone.

Our profits come from post-flop implied odds and the money we make after hitting a strong made hand. While we hit trip 9’s on the flop, we can also flop straights, flushes and two pairs that will get paid off by strong over pairs. Additionally, we can flop straight and flush draws that can suck out on the turn as well. In addition to being deep-stacked, we also have position on BB, allowing us to act last and ensure money goes into the pot when we have the best hand. All of these details combined makes this a very profitable implied odds situation.

Example Hand #4: The Calling Station

We open raise to 3bb in MP with K♣ Q♣ with a 135bb stack, it folds around to a 69bb stack calling station in the SB that calls and we go to the flop heads up. The pot is 7bb going to the flop. The flop is A♣ 7♣ 2♥, SB bets 8bb, and the action is on us.

This is an interesting spot and how we play it greatly depends upon our opponent. In this situation, our opponent is a loose passive calling station. This type of opponent is very passive, meaning he will only bet with a very strong made or drawing hand. Since we hold the nut flush draw, SB most likely has top pair, two pair or a set. Given this information, calling for implied odds depends on if we think we’ll get paid off or not when we hit our draw. Most calling stations are unaware of anything other than their own holding; therefore, they’ll be unlikely to see that we hit a flush on the turn or the river and will only be playing their own hand. Knowing this, we have decent implied odds in this situation. While effective stacks aren’t deep, we do have position on our opponent and are likely to get paid off if we hit our flush.

When Implied Odds Don't Work

While there are a lot of situations in which implied odds work well, there are also several in which they don't. In this section we'll discuss five different situations in which implied odds don't work too often:

- Against Tight Opponents
- Against Short-Stackers
- End of Action Spots
- When You Are Out of Position
- With Obvious Draws

Against Tight Opponents

Tight opponents such as NITs that shut down at any sign of a draw hitting, will tend not to pay you off. Some will even lay down top pair against a turn or river bet when an obvious flush or straight draw hits. So try not to play drawing implied odds hands against weak, tight, passive opponents. Focus purely on your direct pot odds instead.

Against Short-Stackers

Implied odds rely on our ability to extract money on multiple streets of action, not just the street where we are calling with bad pot odds. This inherently requires our opponents to have a healthy chip stack; otherwise our implied odds are minimal. Therefore, playing for implied odds versus short-stackers isn't an ideal situation, and is rather one we should avoid.

End of Action Spots

End of action spots occur when there's no more action past the current bet. This is when our opponent is betting all-in, or is facing a final river bet. When our opponent is all-in, there are no implied odds and our decision is based solely upon pot odds. Additionally, when the river card comes, we have either made or missed our draw. There are no more cards to try to suck out on our opponents with a draw. Accordingly, implied odds do not apply to end of action spots.

When You Are out of Position

Being out of position doesn't mean we won't be able to extract implied odds value out of our opponents, it just isn't ideal. When we're out of position, we sometimes have to rely on our opponents to put in a bet in order for us to extract implied odds value. Unfortunately, sometimes our opponents will check instead of bet and eliminate our implied odds value. Being in position is always much more preferable than being out of position for all aspects of poker, including implied odds.

With Obvious Draws

Obvious draws, such as flush and straight draws, that your opponent can easily identify, are terrible hands for implied odds. Flush draws are horrendous for implied odds because even bad players will know that a flush completing on the turn or river is bad for them a majority of the time. Obvious straight draws on the board are also very bad. Therefore, obvious straight and flush draws should be played based upon pure pot odds, and not implied odds.

Bad Implied Odds Example Situations

Now that we've briefly discussed the factors that commonly yield poor implied odds, I'll walk you through some example situations to solidify this concept.

Example Hand #5: The NIT

A NIT open-raises to $6 in MP in a $1-$2 No-Limit Hold'em game. We call with K♦ Q♦ in the CO. The BTN folds, SB folds and BB calls. There is $19 in the pot going to the flop. The flop is A♦ 9♦ 2♠. BB checks, MP fires out a $15 continuation bet, we call and BB folds making the pot $49. The turn is the 7♦ giving use the Ace-high flush. MP checks and we check back for deception. The river is the T♣, again MP checks, so we bet $30 for value and MP folds.

While the NIT in MP won't always fold to this river bet, we can expect this type of player to shut down at any sign of a strong draw completing. We'll sometimes get paid off with some implied odds value when we make our draw, but in most cases it won't be much. In this situation, if we bet a small amount, such as 1/3 to 1/2 pot-sized bet, MP might call, although the flush will often scare the NIT away.

Example Hand #6: All-In Situation

We're on the BTN with A♣ Q♣ and open-raise 2.5bb as an attempt to steal the blinds. An 18bb short-stacker in the SB calls and a full stacked TAG in the BB calls as well, making the pot 7.5bb going to the flop. The flop is K♣ 9♣ 5♦. SB open-jams all-in for his remaining 15.5bb stack, BB decides to fold and the action is on us.

This is a situation in which our decision should be based upon the pot odds price we are being offered, compared to the likelihood of making our draws by the river. If we assume SB is jamming all-in with a pair of Kings, we can win by hitting a pair of Aces, the flush or the backdoor straight draw. We must remember that we can only call if we're getting a favorable pot odds price. If we aren't, we should simply fold because implied odds are non-existent in end of action situations such as this.

Example Hand #7: Out of Position Dilemma

An unknown opponent open-raises to $6 in the CO in a $1-$2 No-Limit Hold'em game. The action folds around to us in the BB, where we call with K♠ J♥. The flop is Q♣ T♠ 8♠, giving us an open-ended straight draw. We check, CO continuation bets $9 into a $13 pot and we call, making the pot $31. The turn card is the 9♦, completing our straight and putting a four-straight on the board. We check again and CO checks back. The river is the A♥, improving our straight further. Should we bet or check with the intention of raising CO's potential bet?

With the best possible hand, our only objective on the river is to maximize getting value with the Ace-high straight. Should we bet first on the river or check with the intention of raising a bet from CO?

Unfortunately, CO showed weakness by checking back the turn when the four-straight hit the board. Furthermore, the Ace is a further scare card for CO if he only has a pair of Queens. Being out of position, we cannot rely on CO betting the river after showing weakness on the turn. However, if we lead out and bet the river, CO will most likely fold to most of our bets. Given all of this information, both being out of position and having an obvious draw limits our potential implied odds value in this situation.

Quantifying Implied Odds

Knowing how much implied odds we can extract from our opponents when we make the best hand will allow us to make the most optimal decision possible when we call an initial bet getting a bad pot odds price. Lots of inexperienced poker players will simply look at their opponent's stack size and declare to themselves that they'll be able to stack their opponent if they hit their draw. This is an erroneous conclusion, as we never fully know how much money we'll be able to extract from our opponents when we hit our drawing hands. Furthermore, a lot of factors feed into how much we'll be able to extract to determine if we're getting good or bad implied odds.

If you scour the Internet, you'll find complex mathematical equations that demonstrate how to estimate our implied odds. The problem with such equations is they assume we know exactly how our opponents' will react in specific situations when we hit our draw; but the truth is that we won't. We'll be able to make an educated guess based upon all of the criteria we discussed in this chapter, but we'll never fully know.

However, it's important to remember that the very factor of the unknown in every single situation is what makes poker such a great game, and drives people toward it.

That isn't to say that our educated guesses can't be close to correct. My recommendation is to utilize the information available to you, following the criteria that make for good and bad implied odds situations, and use it to your advantage.

Conclusion

We discussed the important concept of implied odds in this chapter. We talked about what implied odds is, as well as the criteria for both good and bad implied odds situations. We also went through several example scenarios in order to highlight both good and bad implied odds situations. You should now understand the role implied odds play in poker, and how you can properly leverage them to make bad direct pot odds calls with the expectation of earning a lot of implied odds money on later streets of betting when you make the best hand.

At this point in the book, you know about equity, pot odds and implied odds. In the upcoming chapters, you'll also learn how to count outs and use the nifty Rule of 2 and 4 to quickly estimate your card equity at the poker table. So, let's jump to the next chapter, where we'll be talking about draws and counting outs.

Chapter 8. Common Draws and Outs

Introduction

In this chapter, we’re going to be talking about drawing hands and outs. When we have a drawing hand to a flush or a straight, we have a certain number of outs to hit our draw. Our outs are the number of cards that will allow us to make our draw. However, sometimes our draws will also improve our opponents’ draws to better made hands. Being able to quickly identify our draws, as well as our opponents’ draws, is an essential aspect of the game that all competent poker players should be able to utilize effectively. The goal of this chapter is to help you master this essential concept.

Importance

Understanding draws and outs is critical in poker. It’s one thing to know that we have a flush or straight draw, but an entirely different task to be able to quickly identify how many outs make our draw, as well as those of our opponents’ draws. This is a very important concept, because knowing our outs gives us the ability to know our equity in the hand. Using the simple Rule of 2 and 4, which we’ll discuss in the next chapter, also gives us the ability to know when we can profitably call a bet.

Outs You Should Memorize

Below are some common draws you'll often see. You should memorize their corresponding outs:

- Flush Draw: **9 Outs**
- Open-Ended Straight Draw (OESD): **8 Outs**
- Over Cards 2-Pair Draw: **6 Outs**
- Gut-Shot Straight Draw: **4 Outs**

Discounting Outs

Sometimes certain outs that complete our draw also complete our opponents’ draw to a better made hand. Furthermore, sometimes our opponents will have some of our potential outs in their possible range of hands. When this occurs, we should discount those outs, meaning we should not include them in our outs calculation. Whenever we think our outs to a draw are already taken by one of our opponents, or if we don’t expect to win the hand if we hit our out, we should discount them.

Here’s a simple example situation where we would need to discount our outs:

Straight Draw Also Improves Opponent’s Flush Draw

We have K♠ Q♠ and flop an open-ended straight draw on a J♥ T♥ 2♠ board texture. In this situation, we should, at minimum, discount the A♥ and 9♥, because while these two cards make our straight, they also make a potential flush for our opponent. Furthermore, if we think our opponent has a lot of Ax hands in his range, including non-heart Aces such as AQ, AJ and AT, we should discount additional Aces from our potential outs to make our straight.

Dirty Outs

When evaluating board textures, we need to be able to identify when an out is a **dirty out**, meaning it completes a better draw for one of our opponents. When we identify a **dirty out**, we should err on the side of caution and discount it. Many poker players fail to discount **dirty outs**, which leads them to **overestimating** their drawing hand equity and making bad, unprofitable calls.

Let's Practice

In this section, we'll practice identifying outs associated with our drawing hands, as well as discounting dirty outs.

Exercise Hand #1

We have Q♦ J♠ and the flop is 4♥ 7♠ 4♦.

Our Draws

On this flop board texture, our only draw is a pair of Queens or Jacks on the turn or the river with our over cards. We don't have any other draws.

Our Outs

We don't have to worry about discounting any of our outs with our over card pair draw. We have a total of 6 combined outs:

- 3 Queens
- 3 Jacks

Exercise Hand #2

We have A♠ T♣ and the flop is Q♠ J♣ 6♣.

Our Draws

On this flop board texture, we have a gut shot straight draw to the nut straight and an over card draw to a pair of Aces.

Our Outs

Since there is a flush draw on this flop board texture, we must first eliminate all clubs from our potential outs, because if any club hits, it will complete a flush that will beat our straight or pair of Aces. So, how many outs do we have to make our straight or pair of aces?

- **Straight Draw** : K♦, K♥, K♠
- **Pair of Aces** : A♦, A♥
- **Discounted (Eliminated Outs)** : K♣, A♣
- **Total Outs** : 5 Outs

Exercise Hand #3

We have 7♣ 7♥ and the flop is T♦ 5♠ 2♠.

Our Draws

If we assume our opponent has a pair of tens, we are only drawing to a set of sevens.

Our Outs

Although there are two sevens left in the deck, we don’t want to see a spade because our opponent could also have a flush draw. We should eliminate the 7♠ from our outs, leaving us with **one out**; the 7♦.

Exercise Hand #4

We have A♠ 5♠ and the flop is 7♠ 7♣ T♠.

Our Draws

We have a draw to the nut flush and if we assume our opponent doesn’t have trip sevens or a full house, we also have a draw to a pair of Aces. However, if our opponent does have trip sevens, then our only draw is the flush. If our opponent flopped the full house, we are drawing dead, meaning we cannot win the hand.

Our Outs

We don’t have to discount any outs, since none of our outs improve our opponent’s draw unless our opponent has a stronger Ace. Let’s assume our opponent rarely has trips or the full house. With that in mind, we have the following outs:

- **Flush Draw** : 9 Outs
- **Pair of Aces:** A♦, A♥, A♣
- **Total Outs** : 12 Outs

Exercise Hand #5

We have K♦ J♣ and the flop is J♦ 5♦ A♦.

Our Draws

We have a plethora of draws in this hand if we think our opponent has a pair of Aces. So what are our draws? We have the nut flush draw, trip jacks draw, and a two-pair draw.

Our Outs

Let’s discuss our outs for each draw:

- **Flush Draw** : 9 Outs
- **Trip Jacks** : J♥, J♠
- **Two-Pair Draw** : K♣, K♥, K♠

Do we need to discount any outs?

We don’t need to discount outs for the nut flush draw. However, if it’s likely our opponent flopped a smaller flush, a set, or AJ for top two pair, we need to discount our trip jacks and two-pair draws. We shouldn’t assume our opponent has such a strong hand all of the time, so we don’t need to discount our outs for trips and two-pair completely.

It would be safe to discount them by approximately 50% and assume we only have 2 or 3 outs instead of 5 for those two draws. So, with discounting our outs, we can conservatively assume we have **11 or 12 outs** rather than the initial 14 outs we calculated.

Conclusion

This was a relatively short chapter because the concept of identifying draws and counting outs is a fairly easy one to master. Your goal with identifying draws and counting outs is to be able to do so within a matter of seconds, because you'll have limited time to do so while playing. If you play online, this could be as little as 15 to 30 seconds.

Hopefully, you can now easily identify your draws, and count your corresponding outs; at the same time knowing when you need to discount dirty outs as well. In the next chapter, we'll be discussing the Rule of 2 and 4 – using our knowledge of identifying our draws and properly counting our outs to quickly estimate our equity in a poker hand with very simple math.

Chapter 9. Rule of 2 and 4

Introduction

The Rule of 2 and 4 is a very easy way to estimate our equity while we're playing a hand without any complicated math or equity calculators. It involves basic arithmetic and nothing more. In this chapter, I'll teach you how to use the Rule of 2 and 4, then we'll practice using it together by going through several exercise hands.

How does it work?

The Rule of 2 and 4 is very simple and involves two simple steps:

Step 1: Count our outs for our draws

Step 2: Multiply our draws by 2 or 4 based upon the criteria below:

- Multiply Outs x 2 on the **flop** if we're <u>not</u> being put all-in or calling an all-in.
- Multiply Outs x 4 on the **flop** if we're being put **all-in** or are calling an **all-in**.
- Multiply Outs x 2 on the **turn** no matter the circumstance.

On the flop, we're either multiplying our outs by 2 or 4. If we aren't calling an all-in or being put all-in on the flop, we would multiply our outs by 2. If *we* are calling an all-in or going all-in on the flop, we would multiple our outs by 4. Lastly, we always multiply our outs by 2 on the turn, regardless of whether we are all-in or not.

So why do we multiply by 4 or 2 in different instances?

- **Multiply by 2** : Paying to See 1 Card (Turn or River Card)
- **Multiply by 4** : Paying to See 2 Cards (Flop All-In Situation)

Let's break this down even further:

- **Multiply by 4 on the Flop**: When we're calling an all-in or going all-in on the flop, we get to see 2 cards – the turn and the river cards – without putting any more money into the pot.
- **Multiply by 2 on the Flop**: Conversely, when we aren't calling an all-in or being put all-in on the flop, we only get to see one card without having to put more money into the pot. Because we only get to see the turn card without contributing more money to the pot, our equity calculation is approximately half of what it would be if we were in an all-in situation. Put another way, we pay to see only the turn card; and if our opponent bets on the turn, we have to pay another bet to see the river card.

- **Multiply by 2 on the Turn**: The same goes with calling a turn bet, regardless of its nature as an all-in or not. We get to see the river card after calling a turn bet, whether we're all-in or not.

Now let's take a simple example of 4 outs to see how the Rule of 2 or 4 works:

Outs	Multiply By	Equity
4	4	16%
4	2	8%

When we multiply our outs by 4, our equity is double what it is when we multiply our outs by 2. The reason for this is that we get to see two cards instead of just one; therefore, our equity is twice as much in an all-in situation than when we are not in an all-in situation.

Now let's do some more realistic examples:

Draw	Outs	Flop Not All-In	Flop All-In	Turn
Flush Draw	9	9 x 2 = 18%	9 x 4 = 36%	9 x 2 = 18%
Open-Ended Straight Draw	8	8 x 2 = 16%	8 x 4 = 32%	8 x 2 = 16%
Over Cards 2-Pair Draw	6	6 x 2 = 12%	6 x 4 = 24%	6 x 2 = 12%
Gut Shot Straight Draw	4	4 x 2 = 8%	4 x 4 = 16%	4 x 2 = 8%

The above table shows us the different equity percentages we have with our common draw scenarios when we are:

Proofing the Rule of 2 and 4

We can easily proof the Rule of 2 and 4 by doing some basic equity probability calculations. First, we must understand why the Rule of 2 and 4 works. On the flop, any 1 in the remaining 47 cards equals 2.13% equity. Additionally, on the turn, any 1 in the remaining 46 cards equals 2.17% equity.

- 1 Out on the Flop: (1/47) = **2.13% Equity on Turn Card**
- 1 Out on the Turn: (1/46) = **2.17% Equity on River Card**

Rule of 2

What this tells us is that each possible out equates to approximately 2% equity on either the flop or the turn. From the above calculations, we can see that it's not exactly 2%, but close enough for our estimations. This is why we multiply by two in non-all-in situations.

Rule of 4

In all-in situations, the Rule of 4 equates each out into 4% equity (turn + river card combined). In all reality, the turn + river card would be 2.13 + 2.17 = 4.3%, but again, 4% is close enough for our needs.

Proofing a Gut Shot Straight draw

Let’s expand our proof a bit further with a gut shot straight draw example.

Making Gut Shot Straight Draw on the Turn

Given a deck of 52 cards, 47 remain unseen after the flop. Furthermore, 4 of those remaining 47 cards will improve our hand to a straight on the turn.

- Probability of Improving to a Straight on the Turn: (4/47) = **8.5% Probability**
- Rule of 2 Calculation: 4 outs x 2 = **8% Probability**

Making Gut Shot Straight Draw on the River

If we don’t improve on the turn, we can still improve our straight by the river. Given the same deck of 52 cards, 46 now remain unseen after the turn. Furthermore, 4 of those remaining 46 cards will improve our hand to a straight on the river.

- Probability of Improving to a Straight on the River: 4/46 = **8.7% Probability**
- Rule of 2 Calculation: 4 outs x 2 = **8% Probability**

Making Gut Shot Straight Draw on the Turn or River

If we’re in a flop all-in situation, we get to see both cards. Therefore, we want to determine the probability of making our straight on either the turn or the river. The probability that we make our straight on the turn or the river is equal to 1 minus the probability that we don’t make our straight on the turn or the river:

- Probability of Not Improving on the Turn or River = (43/47) x (42/46) = 83.5% Probability
- 43 of the remaining 47 cards left in the deck on the flop won’t improve our hand on the turn.
- 42 of the remaining 46 cards left in the deck on the turn won’t improve our hand on the river.
- Probability of Improving on the Turn or River = 1 – 0.835 = **16.5% Probability**
- Rule of 4 Calculation: 4 outs x 4 = **16% Probability**

Rule of 2 and 4 Accuracy

If we compare our equity calculations to the Rule of 2 and 4, we'll see that our Rule of 2 and 4 estimations are close to the actual equities. In the table below, we compare the Rule of 2 and 4 estimations to the actual equity calculations for a gut shot and open-ended straight draw with 4 and out 9 respectively.

The Rule of 2 and 4 is not 100% accurate, with some minor deviations from the actual equity calculations, but in this example, the largest deviation we see is -1.4%, which is not large enough to have any major consequences on our decisions. While the Rule of 2 and 4 isn't perfect, it's definitely close enough for our purposes.

Scenario	Rule of 2 & 4	Actual	Difference
Gut Shot Straight Draw			
4 Outs on Flop	4 x 2 = 8%	(4/47) = 8.5%	-0.5%
4 Outs on Turn	4 x 2 = 8%	(4/46) = 8.7%	-.07%
4 Outs on Flop All-In	4 x 4 = 16%	1 – [(43/47)x(42/46)] = 16.5%	-0.5%
Open Ended Straight Draw			
8 Outs on Flop	8 x 2 = 16%	(8/47) = 17.0%	-1.0%
8 Outs on Turn	8 x 2 = 16%	(8/46) = 17.4%	-1.4%
8 Outs on Flop All-In	8 x 4 = 32%	1 – [(39/47)x(38/46)] = 31.5%	0.5%

Rule of 2 and 4 Caveats

As you begin to use the Rule of 2 and 4 and compare your estimated equities to actual equities, you'll see that our shortcut method becomes less and less accurate as your outs increase. When we reach 10 or more outs, our estimates will be off anywhere from 1-3%. While this may seem like an issue, it's actually a moot point.

Why?

Because when we're estimating our equity, we're simply providing an educated guess. We don't actually know what hands our opponents are holding, nor do we really know if we're ahead or behind in every single situation.

Accordingly, our educated guesses will be error prone from time-to-time. When we put our opponents on specific ranges of hands, we'll sometimes be correct and other times incorrect, causing errors in our equity estimations. However, having minor deviations in our equity calculations won't affect us adversely in the long run. Understanding that poker is a game of unknowns allows for minor errors in our estimates and calculations, without major long-term consequences.

Outs to Equity Chart

You can use the table below while you’re playing poker to quickly estimate your equity if you don’t want to do the arithmetic behind the Rule of 2 and 4. Simply identify the number of outs and find the corresponding equity percentage based upon the scenario.

# of Outs	% Flop Not All-In	% Flop All-In	Flop All-In Odds	% Turn	Turn Odds
1	2.1%	4.3%	22.5:1	2.1%	45:1
2	4.3%	8.4%	10.9:1	4.3%	22:1
3	6.4%	12.5%	7:1	6.4%	14.3:1
4	8.5%	16.5%	5.1:1	8.5%	10.5:1
5	10.6%	20.3%	3.9:1	10.6%	8.2:1
6	12.8%	24%	3.1:1	12.8%	6.7:1
7	14.9%	27.8%	2.6:1	14.9%	5.6:1
8	17%	31.5%	2.2:1	17%	4.8:1
9	19.1%	35%	1.9:1	19.1%	4.1:1
10	21.3%	38.4%	1.6:1	21.3%	3.6:1
11	23.4%	41.7%	1.4:1	23.4%	3.2:1
12	25.5%	45%	1.2:1	25.5%	2.9:1
13	27.7%	48.1%	1.1:1	27.7%	2.6:1
14	29.8%	51.2%	.95:1	29.8%	2.3:1
15	31.2%	54.1%	.8:1	32.3%	2.1:1

Simple Practice Exercises

In this section, we'll practice using the Rule of 2 and 4 using a few of the same hands we discussed in the previous chapters. We know the draws and outs; and will now determine our corresponding equity in each hand.

We'll use the Rule of 2 and 4 to list the following equities:

- Flop All-In Equity
- Flop Not All-In Equity
- Turn Equity

We'll then compare the Rule of 2 and 4 estimations to exact equities.

Exercise Hand #1

We have Q♦ J♠ and the flop is 4♥ 7♠ 4♦.

Draw(s): Pair of Queens or Jacks

Outs: 6 Outs

Rule of 2 & 4

- Flop All-In Equity: 6 x 4 = **24% Equity**
- Flop Not All-In Equity: 6 x 2 = **12% Equity**
- Turn Equity: 6 x 2 = **12% Equity**

Exact Equity (Using Equity Odds Chart)

# of Outs	% Flop Not All-In	% Flop All-In	% Turn
6	12.8%	24%	12.8%

You'll notice that the Rule of 2 and 4 is very accurate. The difference between our estimation of our equity in the hand (how likely we'll hit our draw) versus the exact equity using the chart I included earlier in the chapter is negligible.

Conversely, it is worth noting that this won't always be the case. The Rule of 2 and 4 becomes more inaccurate as our outs increase.

Exercise Hand #2

We have A♠ T♣ and the flop is Q♠ J♣ 6♣.

Draw(s): Gut shot straight draw and pair of aces. We must discount all clubs due to the flush draw as well.

Outs: 5 Outs

Rule of 2 & 4

- Flop All-In Equity: 5 x 4 = **20% Equity**
- Flop Not All-In Equity: 5 x 2 = **10% Equity**
- Turn Equity: 5 x 2 = **10% Equity**

Exact Equity (Using Equity Odds Chart)

# of Outs	% Flop Not All-In	% Flop All-In	% Turn
5	10.6%	20.3%	10.6%

Again, the Rule of 2 and 4 is very accurate here, which is why it's such a great tool to use when we're playing poker. In a matter of seconds, we can quickly estimate (with a very low level of error) our equity in a hand.

Exercise Hand #3

We have A♠ 5♠ and the flop is 7♠ 7♣ T♠.

Draw(s): The nut flush draw and a pair of Aces, assuming our opponent doesn't have trips or a full house.

Outs: 12 Outs

Rule of 2 & 4

- Flop All-In Equity: 12 x 4 = **48% Equity**
- Flop Not All-In Equity: 12 x 2 = **24% Equity**
- Turn Equity: 12 x 2 = **24% Equity**

Exact Equity (Using Equity Odds Chart)

# of Outs	% Flop Not All-In	% Flop All-In	% Turn
12	25.5%	45%	25.5%

Now that we have a lot of outs in this example hand, we see that the Rule of 2 and 4 is a bit inaccurate. Multiplying by 2, we slightly underestimate our equity; and multiplying by 4, we slightly overestimate it. It's still okay to use the Rule of 2 and 4 when we have a lot of outs, as long as you are aware that after **10 outs**, you can expect its inaccuracy to be +/- 1-3%.

More Complex Practice Exercises

Exercise Hand #4

A NIT open-raises to 3bb from UTG. A loose passive opponent in MP calls, CO folds and the action is on us with T♠ 9♠ on the BTN. We call, both of the blinds fold and the pot is 10.5bb going to the flop. The flop is A♦ T♦ 2♣, UTG fires out a 2/3 pot-sized continuation bet, MP calls and the action is on us once more.

What do we estimate our outs and equity are in this situation, taking into consideration our opponents' ranges?

Given that the initial raiser is a NIT open-raising from UTG, we would expect this opponent to have a very strong UTG opening range. Furthermore, we wouldn't expect a NIT to fire out a continuation bet into two opponents without a strong made hand or a draw to the nuts. Therefore, we should weigh UTG's range as being heavily composed of strong Aces, such as AK, AQ and AJ, sets of Aces and Tens, as well as the nut flush or nut straight draw.

MP on the other hand, being a loose passive opponent, will not have nearly as strong a range, either pre-flop or on the flop, and therefore we expect MP to call with a very wide range of hands pre-flop. Accordingly, we would expect MP to have a wide variety of Aces, such as AQ-A2, straight draws and flush draws on the flop.

Given this information, our outs to improve to the best hand are very minimal in this situation. If we assume that our opponents only have top pair, then non-diamond tens and nines will improve our hand to trips or two pair: T♣, T♥, 9♣, 9♥, giving us a total of 4 outs. If we then assume our opponents will have 2-pair or better a small percentage of the time (approximately 25% or less), we should discount one of our outs, effectively giving us 3 outs to potentially win the hand.

Our Draws & Outs

- **Draw(s):** Trips and Two-Pair.
- **Outs:** 3 Outs

Rule of 2 & 4

- Flop Not All-In Equity: 3 x 2 = **6% Equity**

Exact Equity (Using Equity Odds Chart)

# of Outs	% Flop Not All-In	% Flop All-In	% Turn
3	6.4%	12.5%	6.4%

Exercise Hand #5

A TAG open-raises to 3bb from the CO position, BTN folds, SB calls, and we call from the BB with 8♦ 8♥, making the pot 9bb going into the flop. The flop is 9♣ 4♠ 2♥, SB checks, we check, and CO continuation bets 5bb. SB folds, we call and the pot is now 19bb going to the turn. The turn card is J♦, we check again, CO bets 12bb and the action is on us.

What do we estimate our outs and equity are in this situation, taking into consideration our opponents' ranges?

We expect a good tight aggressive opponent to open a fairly wide range of hands pre-flop from late position. So when villain fires out a continuation bet on the flop on a 9-high board, we shouldn't give him too much respect. Many times, he's bluffing with over cards, trying to get us to fold better hands. With a pair of 8's, we're fairly certain we have the best hand a decent percentage of the time on this flop board texture, so we easily make the call.

The turn is where things get a bit dicey. When we call villain's flop continuation bet, he must assume we have a pair or Broadway over cards. Given this information, we shouldn't expect a TAG to double-barrel bluff the turn too often. When the Jack hits the turn and villain fires out a second bet, we no longer feel so great about the prospects that we have the best hand. It's possible villain has a pair and is betting for value, specifically a pair of

9’s, T’s, J’s or better. It’s also possible that villain has a hand such as KT or QT with the straight draw.

Given this information, we expect to be behind a lot, with the worst hand. If this is the case, the only way for us to win this hand is to improve to a set of 8’s on the river.

Our Draws & Outs

- **Draw(s):** Sets
- **Outs:** 2 Outs

Rule of 2 & 4

- Turn Equity: 2 x 2 = **4% Equity**

Exact Equity (Using Equity Odds Chart)

# of Outs	% Flop Not All-In	% Flop All-In	% Turn
2	4.3%	8.4%	4.3%

Exercise Hand #6

A TAG open-raises to 3bb from the BTN, SB folds, and we 3-bet to 11bb with A♣ A♠ from the BB. BTN calls our 3-bet, and the pot is 22.5bb going to the flop. The flop is A♥ J♥ T♥, we bet 18bb, and BTN raises to 45bb.

What do we estimate our outs and equity are in this situation, taking into consideration our opponents’ ranges?

This is a very interesting spot. Given the way the hand is playing out, we are either way ahead with the best hand or way behind with the worst hand. Pre-flop, when we 3-bet a good tight aggressive opponent’s BTN steal attempt from the BB, BTN will assume we are potentially defending our blinds with a polarized range composed of strong value and bluff hands. Given this, we should expect BTN to call pre-flop with a fairly wide range, excluding hands he would 4-bet: JJ-33, AQs-ATs, KTs+, QTs+, JTs, T9s, 98s, 87s, 76s, 65s, ATo+, KTo+, QTo+, JTo.

Against this range, we're an equity favorite. However, against a flop raise range, we aren't doing so well. Hands we'd expect BTN to raise the flop with are the nut flush draw, nut flush + nut straight combo draws, smaller made flushes, made straights and sets. Furthermore, we would also expect BTN to call with all other hands, including 2-pair combos.

Given this information, and for the sake of this exercise, let's assume we're behind to the following range (even though realistically BTN will have a combination of hands that are losing to us as well as those he'll raise, such as sets and the nut flush draw):

- **Medium to Small Made Flushes** : 9♥ 8♥, 8♥ 7♥, 7♥ 6♥, 6♥ 5♥
- **Made Straights** : KQo

If we assume that we're behind made flushes and straights, we're only drawing to a full house or better to win the hand. Assuming BTN doesn't have sets in his range, then only an Ace, Jack or Ten will improve our hand: A♦, J♦, J♠, J♣, T♦, T♠, T♣. This gives us a total of 7 outs.

Our Draws & Outs

- **Draw(s):** Full House or Quads
- **Outs:** 7 Outs

Rule of 2 & 4

- Flop All-In Equity: 7 x 4 = **28% Equity**
- Flop Not All-In Equity: 7 x 2 = **14% Equity**

Exact Equity (Using Equity Odds Chart)

# of Outs	% Flop Not All-In	% Flop All-In	% Turn
7	14.9%	27.8%	14.9%

Conclusion

As you can see, the Rule of 2 and 4 is a simple, yet very powerful tool in poker. Using it makes estimating our equity an easy task. While it's not 100% accurate, it's more than accurate enough for our needs. Remember, players that aren't estimating their equity in a hand and calling bets without any consideration of the likelihood that they'll make the best hand are simply guessing with drawing hands. When we use the Rule of 2 and 4, we gain a major skill advantage over many of our opponents that play by "feel" alone.

We've now talked about pot odds, implied odds, equity, draws and outs, and the Rule of 2 and 4. In Chapter 11, we are going to bring all of this information together. I'm going to show you how to use everything we've learned so far to determine if we can bet call or not with a drawing hand based upon our equity, pot odds and implied odds combined.

However, before we get to that, in the next chapter I'm going to introduce the concept of Expected Value (EV). It ties into all of our mathematical decisions at the poker table, and will also be the foundation for EV calculations, a topic we'll be discussing in Chapter 17.

Chapter 10. Introduction to Expected Value (EV)

Introduction

Expected value, commonly referred to as EV in the poker world, is a very important mathematical concept that you should understand. I’m going to introduce EV in this mini-chapter, and in a later chapter I’ll show you how to perform various EV calculations to quantitatively evaluate your poker game.

What is EV?

EV is how much we expect to win or lose **on average**, **over the long run** based upon a specific scenario in poker. Every single situation and scenario in poker has an expected value associated with it, with certain situations being profitable (**+EV**) while others being unprofitable (**–EV**). Some plays will win us money, while others will lose money.

- **+EV** = A profitable long-term play
- **–EV** = A unprofitable long-term play

Long-Term Focus

It’s important to note that EV is concerned with how well a certain play will do over the long-run, and not the outcome of a single hand. For example, if we were evaluating the EV of calling a pre-flop all-in with pocket Aces against an opponent that has pocket Queens, we know that this is a long-term profitable play, regardless of whether we lose that hand or not. We may get unlucky and lose the hand, but we know that, over the long-run, it’s a +EV profitable play.

Why it is important?

Solid poker strategies revolve around making profitable poker plays and decisions, aka, +EV decisions. Fundamental poker math is at the core of maximizing our winnings and minimizing our losses. In short, winning poker is +EV poker, whereas losing poker is –EV poker. In poker, we want to strive to make as many long-term profitable plays as possible, and EV will help us do so.

How do we use EV?

We can use EV both on the table while we’re playing a hand, and off the table in analyzing previous hands we’ve played. When we’re in a hand, we can use our knowledge of poker math to enhance our likelihood of making profitable +EV poker plays. By implementing simple math into our poker game and understanding pot odds, implied odds, equity, the Rule of 2 and 4, and other math topics, we maximize the chances that we’ll make profitable +EV plays. Conversely, poker players that don’t know poker math or choose not to implement it into their game are unknowingly making unprofitable –EV plays.

We can also use EV and EV calculations – which I’ll discuss later in this book – to analyze hands we’ve played, in order to determine if they were +EV or –EV. EV calculations are simple mathematical formulas that help us determine if a particular play is a long-term profitable +EV play, or unprofitable -EV play. EV calculations will not only tell us if a play is profitable or not, but will also quantify exactly how profitable or unprofitable it is overall.

Conclusion

Whenever we're making a poker play, we should be asking ourselves, "Is this a profitable +EV play or an unprofitable –EV play?" You should use your newfound knowledge of poker math to maximize your likelihood of making the profitable play and folding if a call or a raise is –EV. This will make much more sense in the next chapter, where we'll bring everything we have discussed so far in this book together to determine whether or not we can profitably call bets with a drawing hand.

Chapter 11. Can We Call?

Introduction

Almost everything we have covered so far in this book was designed to be a lead up to this chapter. In this chapter, we'll be using our knowledge of basic poker mathematics to determine whether we can profitably call a bet or not with a drawing hand. Using our knowledge of equity, pot odds, implied odds, draws, outs, and the Rule of 2 and 4, along with other important concepts such as basic player types and effective stack sizes, we'll determine if a call is profitable (+EV) or not profitable (-EV).

Remember, our goal with this chapter along with all poker decisions, is to make the correct mathematical +EV decision.

Three Simple Steps

We'll follow three simple steps that you can easily implement into your game to determine whether or not you can profitably call a bet with a drawing hand:

1. First, we determine our pot odds and implied odds.
2. Second, we determine our equity in the hand.
3. Third, we compare our pot and implied odds with our equity to determine if calling is +EV or –EV.

Step 1: Determine Pot Odds and Implied Odds

Our first step is to determine the pot odds price we are being offered using the methodologies we learned in Chapter 6. In addition to determining our pot odds, we also want to determine if our hand meets the criteria for potentially good implied odds, as discussed in Chapter 7.

Step 2: Determine Our Equity

Once we determine our pot and implied odds, our next task is to determine our equity based upon our draw(s), outs and the Rule of 2 and 4, as discussed in Chapters 8 and 9.

Step 3: Compare Pot and Implied Odds to Our Equity

After determining our pot odds, implied odds and equity, we must then determine if calling a bet is +EV or -EV. If we're either getting a good direct pot odds price in relationship to our equity, or being offered good implied odds, we can profitably call a bet. Otherwise, we should fold.

Comparing Pot Odds & Equity

Being able to quickly compare our pot odds to our equity is essential to making +EV plays. There are two different ways we can do so. The first is the ratio method; and the second is the percentage method. We'll focus on the percentage method throughout this book, but I'll show you how both methods work.

With either method, our goal is always to call when our equity chance of making our hand exceeds how much additional money we have to put into the pot by calling a bet.

Ratio Method : We can call if the pot odds are greater than our equity odds (odds of completing our draw):

- **Call** : Equity Odds Ratio **Less Than** Pot Odds Ratio
- **Fold** : Equity Odds Ratio **Greater Than** Pot Odds Ratio

- **Call Example** : 2:1 Equity and 3:1 Pot Odds
- **Fold Example** : 5:1 Equity and 2:1 Pot Odds

Percentage Method: We can call if the % chance of making our hand is greater than the % of the pot we have to call:

- **Call** : Equity % **Greater Than** Pot Odds %
- **Fold** : Equity % **Less Than** Pot Odds %

- **Call Example** : 33.3% Equity and 25% Pot Odds
- **Fold Example** : 16.7% Equity and 33.3% Pot Odds

Evaluating Calling and Fold Examples

In the call and fold examples, I simply converted the ratios to their percentage counterparts:

- 2:1 = 33%
- 3:1 = 25%
- 5:1 = 16.7%

Profitable Calls

We can profitably call when our equity chance of making our hand is greater than the pot odds amount we must commit to the pot. In our previous example, 33.3% equity is greater than 25% pot odds. Since we expect to make our drawing hand 33.3% of the time and only have to commit an additional 25% chips to the pot, this is a +EV call.

Mandatory Folds

Conversely, when the amount we have to commit to the pot is greater than our chance of making our hand, we have to fold if we also have poor implied odds.

In our previous example, we have to commit an additional 33.3% to the pot to see the next card, but only expect to make our hand 16.7% of the time. The maximum pot odds we can call in this situation with poor implied odds is 16.7%. Since 33.3% exceeds the maximum pot odds price we can call by 16.6%, this is a mandatory fold without good implied odds.

Implied Odds Stipulation

Remember, we can call getting a bad pot odds price if we’re in a good implied odds situation. Implied odds allow us to make up for our bad call on later streets of action when we hit our hand and get paid off.

Let’s Practice

Now that we've covered the three simple steps, as well as the ratio and percentage method for comparing pot odds and equity, we'll put our newfound knowledge to the test with several practice hands. Our goal with these hands is to go through the outlined steps to determine whether or not we can profitably call with a drawing hand.

Exercise Hand #1

We have A♣ T♣ and the flop is 5♣ K♣ 8♥. Villain bets $10 into a $50 pot.

Can we call based on pot odds alone?

What are the pot odds?

For our first exercise hand, I’ll show the pot odds ratio method, pot odds ratio-to-percentage conversion, and pot odds % method as a refresher.

Pot Odds Ratio Method = [pot size]:[amount to call]

- **Pot Size** = $50 Pot + $10 Bet = $60
- **Pot Odds Ratio** = $60:$10 = **6:1 Pot Odds**
- **Pot Odds Ratio to % Conversion** = 1/(6+1) = 1/7 = **14% Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = $50 Pot + $10 Bet + $10 Call from Us = $70
- **Pot Size %** = $10 / $70 = **14% Pot Odds**

How many outs do we have?

We have 9 clubs for our Ace-high flush draw. Additionally, if we put our opponent on a pair of Kings, we have an additional 3 outs to make a pair of Aces. This gives up a total of 12 outs.

- **Draw(s):** Flush Draw and Pair of Aces

- **Outs:** 12 Outs

What is our estimated equity?

Using the rule of 2 and 4, we multiply our outs by 2, since we are not calling an all-in on the flop:

- **12 outs x 2** = approximately **24% Equity** (actual equity is 25.5%)

Should we call?

Yes! We have approximately 24% equity in the hand and only have to put 14% more into the pot. Since our equity % chance of hitting our draw is greater than the pot odds % we have to call - this is a +EV call.

<u>Exercise Hand #2</u>

Let’s use the same exact hand, but change villain’s bet size and pot odds. We have A♣ T♣ and the flop is 5♣ K♣ 8♥. Villain bets $40 into a $50 pot.

What are the pot odds?

Pot Odds Ratio Method = [pot size]:[amount to call]

- **Pot Size** = $50 Pot + $40 Bet = $90
- **Pot Odds Ratio** = $90:$40 = **2.25:1 Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = $50 Pot + $40 Bet + $40 Call from Us = $130
- **Pot Size %** = $40 / $130 = **31% Pot Odds**

How many outs do we have?

We have 9 clubs for the flush draw & 3 Aces for an over pair draw, giving us a total of 12 Outs.

- **Draw(s):** Flush Draw and Pair of Aces

- **Outs:** 12 Outs

What is our estimated equity?

Using the rule of 2 and 4, we multiply our outs by 2 and 4:

- 12 outs x 2 = approximately **24% Equity** (actual equity is 25.5%)
- 12 outs x 4 = approximately **48% Equity All-In** (actual equity is 45%)

Should we call?

It depends on our implied odds, or if we're willing to raise all-in on the flop. Based upon direct pot odds, we should fold, since we have to put 31% more money into the pot and only expect to make our draw 24% of the time. Based upon direct pot odds alone, this would be a –EV call.

However, if we consider raising all-in on the flop, we ensure that we get to see both the turn and river card without putting additional money into the pot. Raising all-in as a semi-bluff improves our equity to 45%; while simultaneously providing additional benefits. If villain only has a pair of Kings, we can make him fold better hands by forcing him into a tough all-in decision. By semi-bluff raising, we can now win the hand by either making our opponent fold, or making the best hand on the river.

Let's now consider implied odds. If we think that villain will pay us off if we hit our Ace or flush, then we can call, because we have good implied odds. However, if we think he'll shut down and not put any more money in the pot when we hit the winning hand, we should just fold, or go all-in on the flop, since we have bad implied odds. Calling or raising all-in is villain-dependent in this situation, and we should only call if we think we have good implied odds.

Exercise Hand #3

We have Q♦ J♠ and the flop is 4♥ 7♠ 4♦. Villain bets $50 into a $50 pot making the pot size $100.

What are the pot odds?

Pot Odds Ratio Method = [pot size]:[amount to call]

- **Pot Size** = $50 Pot + $50 Bet = $100
- **Pot Odds Ratio** = 100:50 = **2:1 Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = $50 Pot + $50 Bet + $50 Call from Us = $150
- **Pot Size %** = $50 / $150 = **33% Pot Odds**

How many outs do we have?

With our two over cards, we are only drawing to an over pair of Queens or Jacks.

- **Draw(s):** Pair of Queens or Jacks
- **Outs:** 6 Outs

What is our estimated equity?

- **Rule of 2 & 4:** Flop Not All-In Equity: 6 outs x 2 = **12% Equity** (actual equity is 12.8%)

Should we call?

We should fold because this is a –EV call. We only have a 12% equity chance of hitting our hand and we have to call 33% more into the pot. We have to call more than our equity share in the pot, so it’s an easy fold.

Exercise Hand #4

We have K♦ J♣ and the flop is J♦ 5♦ A♦. Villain bets $3 into a $3 pot, making the pot size $6.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = $3 Pot + $3 Bet = $6 Pot
- **Pot Odds Ratio** = 6:3 = **2:1 Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = $3 Pot + $3 Bet + $3 Call from Us = $9
- **Pot Size %** = $3 / $9 = **33% Pot Odds**

How many outs do we have?

We have a plethora of outs in this example hand. We have 9 outs to hit the nut flush, 2 additional outs to make trip Jacks, and 3 more outs to hit two pair.

Discounting our outs depends largely upon our opponent's playing style and range of hands. If we assume he could have a smaller flush, top two pair, and sets a percentage of the time, we should discount our trip Jacks and two-pair draw. Since this will happen from time to time, we should discount some of our outs.

That said, we shouldn't assume our opponent has such a strong hand all of the time. We don't need to completely discount our outs for trips and two-pair. It would be safe to discount them by approximately 50%and assume we only have 2 or 3 outs instead of 5 for those two draws.

So, with discounting our outs, we can conservatively assume we have **11 or 12 outs** rather than the initial 14 outs we calculated.

- **Flush Draw** : 9 Outs
- **Trip Jacks Draw** : 2 Outs (J♥, J♠)
- **Two-Pair Draw** : 3 Outs (K♣, K♥, K♠)
- **Discounted Outs** : 2 Outs
- **Clean Outs** : 12 Outs

What is our estimated equity?

- **Rule of 2 & 4:** Flop Not All-In Equity: 12 outs x 2 = **24% Equity** (actual equity is 25.5%)

Should we call?

It depends on several factors. First, it depends on the range of made hands we put our opponent on, and if we have to discount our outs or not. If we feel we don't need to discount our outs, calling would be okay because our 28% equity based upon 14 outs is very close to the 33% pot odds we're being offered. We would be able to make up for this slightly –EV call with very minimal implied odds value on later streets of action.

If we believe we need to discount some of our outs, we should then base our decision upon our implied odds alone. If we feel we have decent implied odds, then we should definitely call.

If we don't feel we have decent implied odds, then we should consider folding or going all-in, since we're in a very similar situation equity-wise as exercise hand 2. Moving all-in with so many outs is always a good option, because we'll make the best hand close to half of the time, and also put the pressure on our opponent to make a tough all-in decision.

Exercise Hand #5

We have 7♦ 9♦ and the turn is 6♦ 8♠ A♦ 2♣. Villain goes all-in for $3.50, making the pot now $7.50.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = $7.50
- **Pot Odds Ratio** = 7.50:3.5 = **2.14:1 Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = $7.50 Pot Size + $3.50 Call from Us = $11.00
- **Pot Size %** = $3.50 / $11.00 = **32% Pot Odds**

How many outs do we have?

Assuming our opponent is going all-in on the turn with a pair of Aces, two pair or a set, we're drawing to either a flush or straight to win the hand on the river.

- **Flush Draw** : 9 Outs
- **Open-Ended Straight Draw** : 6 Outs (2 outs for this draw are accounted for in the flush draw, 5♦ and T♦)
- **Outs:** 15 Outs

What is our estimated equity?

Rule of 2 & 4: Turn Equity: 15 outs x 2 = **30% Equity** (actual equity is 31.9%)

Should we call?

Yes, we should call. We are getting 32% pot odds and expect to hit our draw just under 32% of the time, so we're getting the correct pot odds to call here with both a flush and open-ended straight draw. Remember that since this is an all-in situation, there are no implied odds.

Exercise Hand #6

We have K♠ Q♠ and the flop is A♠ 9♠ 3♥. Villain bets $2.00 into a $2.50 pot, we raise to $6.50 and villain re-raises all-in for a total of $10.00. The pot is now $19.00 and we have to call an additional $3.50 with our draw if we want to continue.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = $19.00
- **Pot Odds Ratio** = 19:3.50 = **5.42:1 Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = $19.00 Pot Size + $3.50 Call from Us = $22.50
- **Pot Size %** = $3.50 / $22.50 = **15.6% Pot Odds**

How many outs do we have?

At minimum, villain is going all-in in this situation with at least a pair of Aces, so we're drawing to get only the nut flush draw to win this hand.

Draw(s) : Flush Draw

Outs: 9 Outs

What is our estimated equity?

Rule of 2 & 4: Flop All-in Equity: 9 x 4 = **36% Equity** (actual equity is 35%)

Should we call?

Yes, this is an easy call. We're getting excellent pot odds to call. We only have to put 15.6% more into the pot and expect to win 36% of the time versus villain's all-in jam on the flop. Folding here would be a huge mistake.

Exercise Hand #7

We have K♠ T♥ and the flop is A♥ Q♣ 4♣. Villain bets $5.00 into a $4.00 pot.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = $4.00 Pot + $5.00 Bet = $9.00
- **Pot Odds Ratio** = 9:5 = **1.8:1 Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = $9.00 Pot Size + $5.00 Call from Us = $14.00
- **Pot Size %** = $5.00 / $14.00 = **36% Pot Odds**

How many outs do we have?

When our opponent over-bets a flop board texture like this, it's indicative of a scared recreational player over-betting a pair of Aces – or better, trying not to get sucked out by the flush or straight on the turn. With a bet like this, their goal is to usually bet us out of the hand to protect their made hand and scoop the current pot. They aren't looking to extract value. Instead, they're purely looking to protect their hand.

Knowing this, we really shouldn't be afraid of the flush draw in a heads up pot in this particular situation, so we don't really need to discount the J♣. This gives us a total of 4 outs to the straight.

- **Draw(s)** : Gut shot Straight Draw
- **Outs:** 4 Outs

What is our estimated equity?

- **Rule of 2 & 4:** Flop Not All-in Equity: 4 x 2 = **8% Equity** (actual equity is 8.5%)

Should we call?

It depends. We only have 4 outs to hit the nut straight. This gives us 8% equity, but we're being forced to put 36% more into the pot. This is a –EV pot odds call. So, based purely upon pot odds, this is a clear fold. But, if we suspect we have excellent implied odds, we might consider making the call.

Let's evaluate our implied odds. Clearly our opponent is afraid of the obvious flush draw hitting the turn. Based on our assumptions of villain, we can assume that if the J♣ comes on the turn, we won't get paid off, because it's an obvious scare card for our opponent. However, if a non-club Jack comes on the turn, it's not nearly as much of a scare card for villain. If villain has a two-pair, a pair of Aces with a good kicker, or a set, he's likely to continue with his aggression on the turn. The benefit of our inside straight draw is that it’s a hidden draw. With that being said, if effective stack sizes are deep enough and a non-club Jack hits the turn, we have good implied odds.

So, calling based upon pot odds alone is a –EV play. But, if we assume our implied odds are excellent, then we can consider calling in this spot.

Re-Examining Interesting Implied Odds Hands

The next three hands are ones we introduced when discussing implied odds. However, we did so without evaluating our exact equity in the hand. We'll now re-evaluate these hands, knowing our equity, in order to determine if we should call or not based upon implied odds.

Example Hand #8: The Aggressive Maniac

A bad aggressive opponent, who has been playing wildly throughout the session, bluffing relentlessly, open-raises to 5bb in MP. With 100bb effective stack sizes and 7♥ 8♥ in the CO, we make the call. Everyone else folds and the pot is 11.5bb going to the flop. The flop is 6♣ T♦ A♥ and UTG continuation-bets a pot-sized 11.5bb bet.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = 11.5bb Pot + 11.5bb Bet = 23bb
- **Pot Odds Ratio** = 23bb:11.5bb = **2:1 Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = 23bb Pot Size + 11.5bb Call from Us = 34.5bb
- **Pot Size %** = 11.5bb / 34.5bb = **33% Pot Odds**

How many outs do we have?

We are drawing to a gut-shot straight draw, giving us 4 outs.

- **Draw(s)** : Gut-Shot Straight Draw
- **Outs:** 4 Outs

What is our estimated equity?

- **Rule of 2 & 4:** Flop Not All-in Equity: 4 outs x 2 = **8% Equity** (actual equity is 8.5%)

Should we call?

With only a gut-shot straight draw and 8% equity, we don't have nearly enough equity to call MP's continuation bet purely off 33% pot odds alone. Making a call off pot odds alone would be an unprofitable play. However, our opponent's playing style and tendencies provide the possibility of getting paid nicely if we hit our draw.

With 100bb effective starting stacks, our opponent has 83.5bb left behind in his stack after his pot-sized flop continuation bet. Moreover, if we call MP's flop bet, there will be 34.5bb in the pot going into the turn. Assuming MP either has an Ace or is purely bluffing, a relatively blank card such as a 9 will not slow him down from firing a second barrel. Since MP open-raised to 5bb pre-flop, a fairly large pre-flop raise, we can also assign him a fairly strong range that includes a lot of Ax hands such as AK, AQ, and AJ.

With that being said, this situation can yield very nice implied odds profits on the turn and river against a bad aggressive opponent. If he has an Ace, we can expect him to fire out a large bet on the turn. If he's bluffing, we can also expect him to bluff a high percentage of the time to put pressure on us to fold. With 83.5bb left in his stack, this is a good implied odds situation to try and hit our straight on the turn and stack our opponent.

Example Hand #9: The Calling Station

We open-raise to 3bb in MP with K♣ Q♣ with a 135bb stack, it folds around to a 69bb stack calling station in the SB that calls, and we go to the flop heads up. The pot is 7bb going to the flop. The flop is A♣ 7♣ 2♥, SB bets 8bb, and the action is on us.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = 7bb Pot + 8bb Bet = 15bb
- **Pot Odds Ratio** = 15bb:8bb = **1.88:1 Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = 15bb Pot Size + 8bb Call from Us = 23bb
- **Pot Size %** = 8bb / 23bb = **35% Pot Odds**

How many outs do we have?

We're drawing to a flush in this situation in order to beat our opponent's potential pair of Aces.

- **Draw(s)** : Flush Draw
- **Outs:** 9 Outs

What is our estimated equity?

- **Rule of 2 & 4:** Flop Not All-in Equity: 9 x 2 = **18% Equity** (actual equity is 19.1%)

Should we call?

This is an interesting spot and how we play it greatly depends upon our opponent. In this situation, our opponent is a loose passive calling station. This type of opponent is very passive, meaning he or she will only bet with a very strong made hand or drawing hand. Since we hold the nut flush draw, SB most likely has top pair, two pair, or a set.

We clearly cannot call this bet purely off pot odds alone, given that we only have an 8% equity chance of hitting our flush on the turn with a 35% pot odds bet. With this information, calling for implied odds depends on if we'll get paid off if we hit our flush.

Most bad recreational calling stations are unaware of anything other than their own holdings. They are not likely to see that we hit a flush on the turn or the river, and they'll only be playing their own hand. When they hit any piece of the board, they'll often put a lot of money into the pot – that's why we love calling stations.

With a hand that villain is willing to bet into us on the flop where he wasn't the pre-flop aggressor, we can expect villain to have a very strong made hand. This, combined with a calling station's inability to fold, skyrockets our implied odds. Knowing this, we have great implied odds in this situation. While effective stacks aren't deep, we do have a position on our opponent and are likely to get paid off if we hit our flush.

What about re-raising all-in on the flop? While this is a decent option in the correct circumstances, re-raising is a semi-bluff in this situation. When we re-raise all-in as a semi-bluff, we need two components. The first is decent fold-equity, i.e., the high likelihood that our opponent will fold to our raise. The second is strong all-in equity. In this situation, our fold equity isn't great against a calling station, nor do we have amazing all-in equity. We only have approximately a 36% equity chance of making our flush by the river when we're all-in on the flop. We would prefer to have closer to 50% when we jam all-in on flop situations. Given this information, this isn't an ideal all-in situation.

Example Hand #10: The NIT

A NIT open-raises to $6 in MP in a $1-$2 No-Limit Hold'em game. We call with K♦ Q♦ in the CO. The BTN folds, SB folds and BB calls. There's $19 in the pot going to the flop. The flop is A♦ 9♦ 2♠. BB checks, MP fires out a $15 continuation bet, and the action is on us.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = $19 Pot + $15 Bet = $34
- **Pot Odds Ratio** = $34:$15 = **2.27:1 Pot Odds**

Pot Odds % Method = Call Size / (Pot Size + Call Size)

- **Pot Size + Call** = $34 Pot Size + $15 Call from You = $49

- **Pot Size %** = $15 / $49 = **31% Pot Odds**

How many outs do we have?

We are drawing to the nut flush.

- **Draw(s)** : Nut Flush Draw
- **Outs:** 9 Outs

What is our estimated equity?

- **Rule of 2 & 4:** Flop Not All-in Equity: 9 outs x 2 = **18% Equity** (actual equity is 19.1%)

Should we call?

Since we are being offered 31% pot odds and have an 18% equity chance of making our flush on the turn, this would be a –EV pot odds call; therefore, based upon pot odds, we should fold. Implied odds, in this situation, are poor as well. Playing against a NIT who will shut down at any sign of the flush completely negates our implied odds possibilities on the turn or river. Accordingly, calling this flop bet would be a mistake based upon pot and implied odds combined – making this an easy fold.

Conclusion

In this chapter, we pulled together everything we have learned thus far to determine whether or not we can profitably call a bet with a drawing hand. This is a simple process that you should be able to easily implement into your poker game with a bit of practice:

- **Step 1** : Determine your pot odds & implied odds.
- **Step 2** : Estimate your equity in the hand.
- **Step 3** : Compare your pot and implied odds with your equity to determine if calling is +EV or –EV.

While this is a simple process, practice makes perfect. In this chapter, we worked through nine different hand examples to highlight this process in detail. If you still find yourself struggling through this process, I highly recommend that you practice it on your own. You can practice by reviewing hands you played previously before you attempt to use this method in a live game. This is especially crucial for online games, where you have only 15 to 45 seconds to make a decision at the poker table.

SECTION 3: PRE-FLOP CONCEPTS

Section Introduction

In this section, we'll be covering a plethora of fundamental pre-flop mathematics. These are concepts I consider to be essential to No-Limit Hold'em strategy. Specifically, we're going to discuss the following concepts:

- Pre-Flop All-in Situations
- Set-Mining Mathematics
- Blind Stealing Mathematics
- 3-Bet Bluff Mathematics

Chapter 12. Pre-Flop All-In Situations

Introduction

In this chapter, we're going to focus on pre-flop all-in scenarios. These situations are a common occurrence in No-Limit Hold'em. Fortunately for us, lots of bad recreational poker players don't truly understand how to properly handle them – so there's a lot of money to be made in these spots. Since we're playing for stacks, we want to make sure we make the best possible moves in pre-flop all-in scenarios. We'll be focusing on calling pre-flop all-ins rather than the mathematics behind going all-in, because I assume you'll be going all-in when you expect to be a huge equity favorite with hands such as QQ, KK, and AA. Let's get started!

Starting Hand Probabilities

While this concept isn't essential to know, nor should it affect your strategic pre-flop game, lots of people are interested in learning about starting hand pre-flop probabilities. I've listed some of the more prominent ones below as informational reference. The table below will tell you how often you should expect to be dealt certain starting hands.

Starting Hand Probabilities	Percentage
AA or KK	0.90%
AK Suited or Offsuit	1.21%
AA, KK, QQ, JJ or TT	2.3%
2 Suited Cards: 10+	3.2%
Any Suited Connector	3.9%
Any Pair	6.3%

Common Pre-Flop All-In Scenarios

We touched on this concept earlier in the book, but I want to revisit it in greater detail in this chapter. In No-Limit Hold'em, pre-flop all-in situations can occur in any single hand. Putting our opponent on a specific range of all-in hands and knowing how our specific holding does against any one of his particular hands will help us to better understand if we should call an all-in or not pre-flop.

In the table below, I've listed several common pre-flop all-in match-ups and highlighted the equity favorite and equity dog respectively in each match-up. You should become familiar with these match-ups and their respective equities because you'll see them on a daily basis at the tables.

Common All-In Scenarios	Example	Equity Favorite	Equity Dog
Over Pair vs. Under Pair	AA vs. KK	AA (82%)	KK (18%)
Over Cards vs. Pair	AK vs. QQ	QQ (56%)	AK (44%)
One Over Card vs. Pair	AJ vs. QQ	QQ (71%)	AJ (29%)
Over Cards vs. Under Cards	AK vs. JT	AK (63%)	JT (37%)
Dominated Hand	AK vs. AQ	AK (74%)	AQ (26%)

Pre-Flop All-In Pot Odds Considerations

While pre-flop all-in situations are a common occurrence in No-Limit Hold'em, a lot of inexperienced poker players don't consider everything necessary to consider in these situations. This leads lots of people to get their money all-in in bad spots. This is something we definitely want to prevent.

When faced with all-in situations, we need to be able to effectively assess the situation and determine if calling is +EV or –EV based upon a variety of criteria.

When faced with these decisions, we need to consider the following:

- Our Pot Odds
- Our Opponent(s) All-In Jamming Range
- Our Equity vs. Our Opponent(s) Ranges
- Multi-Way Side Pots & Implied Odds

Our Pot Odds

In most all-in situations, there are no implied odds. The only time implied odds are considered is when there are three or more opponents in the hand, and at least two of the people aren't all-in. This frequently happens when a short-stacker goes all-in, and two or more moderate to deep stacks call, but aren't all-in themselves. When this happens, a side pot occurs, potentially with additional implied odds considerations.

However, most all-in situations will occur in heads up battles where a person 3-bet, 4-bet, or 5-bet jams all-in, and the other player is forced to make a decision to call or fold. When this occurs, the player needs to base calling or folding upon the pot odds price they're being offered. For example, if we are faced with an all-in call or fold decision, we need to ensure our equity chance of winning is equal to or greater than the pot odds price we're being offered.

How do we determine our equity?

By estimating our opponent's all-in jamming range.

Our Opponent's All-In Jamming Range

This is a crucial concept to grasp and master. Understanding which hands our opponent is likely to go all-in with helps estimate our equity. We need to make an educated guess and assign our opponent a realistic all-in range. We need to ask ourselves questions such as, “Is our opponent only going all-in with the very top end of his range, with hands such as KK+, AK, or is he jamming all-in with weaker hands such as 99 and AJ?”

Narrowing down our opponent’s range is a skill that takes time to master, but we can help our cause by taking good notes and having a good understanding of our opponent’s playing style. Having notes – either written if we play online, or mental if we play live – will give us insight on what specific hands our opponent has gone all-in pre-flop in the past. Additionally, knowing if our opponent is a LAG, TAG, NIT, Loose Passive, etc. will help us to further narrow our opponent’s range. Once we have a good idea, we’ll then be tasked with estimating our equity against our opponent’s range.

Our Equity vs. Our Opponent’s Range

Estimating our equity versus our opponent’s range is, unfortunately, not an exact science. When we’re in the middle of a hand, we won’t have the luxury of equity calculators, such as Equilab, to perform equity calculations for us. Instead, we’ll need to have an idea of how our all-in calling ranges fare against our opponent’s all-in jamming range. This involves memorizing how various ranges match up against other ranges.

To make our job a bit easier, I’ve developed a simple table to help you understand how a good TAG’s all-in calling range would fare against ultra-tight to ultra-loose all-in jamming ranges, assuming we’re playing 100bb effective stacks.

We’ll assume a TAG will call an all-in with AA, KK, QQ and AKs, and assign our opponent’s the following jamming ranges below:

- **Ultra-Tight All-In Jamming Range** : AA, KK
- **Tight All-In Jamming Range** : AA, KK, AKs
- **Moderate All-In Jamming Range** : AA, KK, QQ, AK
- **Loose All-In Jamming Range** : AA, KK, QQ, JJ, AK, AQs

- **Ultra-Loose All-In Jamming Range** : AA, KK, QQ, JJ, TT, AK, AQ, AJ

Us	Our Equity	Villain	Villain's Equity
AA, KK, QQ, AKs	34%	AA, KK	66%
AA, KK, QQ, AKs	41%	AA, KK, AKs	59%
AA, KK, QQ, AKs	56%	AA, KK, QQ, AK	44%
AA, KK, QQ, AKs	61%	AA, KK, QQ, JJ, AK, AQ	39%
AA, KK, QQ, AKs	64%	AA, KK, QQ, JJ, TT, AK, AQ, AJs	36%

Of course, our opponents won't be going all-in with the exact all-in jamming ranges listed above. Some will go all-in with only AA and others will go all-in with much weaker hands. Understanding this, I recommend you use this table as a loose guideline to understand how a solid all-in calling range of AA, KK, QQ, and AKs fares against a wide range of potential all-in jamming ranges. Furthermore, understand that our equity drastically increases from 34% against an ultra-tight jamming range to 64% against an ultra-loose jamming range.

If you like, you can devise your own ranges in Equilab and further refine the table above. In fact, I highly recommend that you do so as a learning exercise, in order to better understand pre-flop all-in range match-ups.

Multi-Way Side Pots and Implied Odds

This is where pre-flop all-in situations get really tricky. When we're in a heads up situation, we only have to estimate our equity versus a single opponent's all-in jamming range, but when multiple people call a pre-flop all-in, we need to consider multiple opponents' ranges; as well as how our equity fairs against each opponent. Additionally, if we and at least one other opponent aren't all-in, we need to consider potential side pot implied odds implications.

The Declining Equity Concept

A vital concept to understand is that as more people call pre-flop, our equity declines, even with pocket Aces. To show how this works, we'll compare AA versus a single opponent with an ultra-tight all-in jamming range. We'll then compare it against two opponents, one with an ultra-tight all-in jamming range and another with a loose all-in jamming range.

Our Hand	Our Equity	Villain 1	Villain 1's Equity	Villain 2	Villain 2's Equity
AA	77%	AA, KK	23%		
AA	68%	AA, KK	19%	AA, KK, QQ, JJ, TT, AK, AQ, AJs	13%

The table above highlights that as more people enter the pot, the more our equity share of the pot declines. Against a single ultra-tight opponent, we're a 77% equity favorite to win a pre-flop all-in, heads up situation. However, once we add an additional opponent, even one with an ultra-wide range, our equity declines 9%. Villain #2 has a 13% equity chance of winning the hand by going all-in against both villain #1 and ourselves. If we added additional opponents to our all-in situation, we would see our equity decline further, since any player that enters the pot has a chance of winning the hand post-flop.

Side Pot Implied Odds Implications

When we're at the very top end of our range, with hands such as AA and KK, we can think of multi-way all-in pots where we and another opponent aren’t all-in as icing on the cake, even though we give up equity as opposed to when we’re in a heads up situation. Side pots where we can look to win additional money post flop can yield us implied odds money that we wouldn’t be able to gain from all-in, heads up situations. You’d be surprised at how often these situations occur at the lower stakes, usually with lots of bad recreational players at the table.

Let’s illustrate with an example. UTG open-raises to 3bb and a short-stacker in the CO position 3-bet jams all-in for 28bb. The action is now on us on the BTN with AA. We have two options; we can either smooth call the raise or re-raise all-in ourselves. Raising all-in serves one primary purpose: to maximize our equity by ensuring we isolate the short-stacker in an all-in, heads up situation. This works best when we have hands such as AK, QQ or JJ, as we prefer all-in, heads up situations for these.

Smooth calling serves another purpose. It capitalizes on an opportunity to extract additional money from UTG, who might call or re-raise all-in when we smooth call CO’s all-in jam. When we flat call a short-stacker’s pre-flop all-in, our range looks deceptively weak, with hands such as 88, 99, TT, JJ, AQ, and AKo. These are hands that lots of players don’t mind risking a 28bb stack on, but not a 100bb stack. Since we appear to have a weak, capped range, good TAGs and LAGs will sometimes re-raise jam all-in to put us to the test and try to make us fold our equity share of the pot. When they don’t, they’ll often be inclined to call in a multi-way pot getting close to 2:1 pot odds. When either of these situations occur, where UTG either re-raises all-in or just calls, we gain additional money that we wouldn’t have if we 4-bet re-raised all-in. Understanding in-game dynamics and these situations can help increase our winnings in the right spots.

Practice Hands

We’ll now work through several practice hands, in order to help you better understand pre-flop all-in situations. As we work through each hand, we’ll take each of the following into consideration:

- Our Pot Odds
- Our Opponents’ All-In Jamming Ranges
- Our Equity vs. Our Opponents’ Ranges
- Multi-Way Side Pots & Implied Odds

Practice Hand #1

Playing a $1-$2 No-Limit Hold’em game, we open-raise to $8 UTG with J♦ J♥, the action folds around to a short-stacker LAG in the SB, who 3-bet jams all-in for $44. The action is on us.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = $54
- **Pot Odds Ratio** = $54:$36 = **1.5:1 Pot Odds**

Pot Odds % Method = Call Size / Pot Size + Call Size

- **Pot Size + Call** = $54 Pot Size + $36 Call from You = $90
- **Pot Size %** = $36 / $90 = **40% Pot Odds**

What is our opponent’s estimated jamming range?

Knowing that our opponent is a loose aggressive short-stacker, we can expect him to be 3-bet jamming a wide range of hands, including a hand as weak as 66 and AJ.

- **Pocket Pairs** : 66+
- **Broadway Cards** : AJ+, KQ+

What is our estimated equity versus our opponent's jamming range?

Referring to the equity chart presented earlier in the chapter, we should expect to have good equity versus a very loose jamming range, and in fact, much more than the required 40% equity to call in this situation. How do we know this? Out of our opponent's entire estimated range, a majority of his jamming range is an equity dog to JJ, which tells us we're a favorite against most of it:

- **JJ Equity Favorite** : JJ-66,AJs+,KQs,AJo+,KQo
- **JJ Equity Dog** : AA, KK, QQ

We'll utilize Equilab to provide a definitive estimate:

- **Our Equity** : 58%
- **Opponent's Equity** : 42%

Should we call?

Yes. We estimate ourselves to be an equity favorite in the hand. Given that we only need 40% equity to call getting a 40% pot odds price, this is an easy call, where we know we are a 58% equity favorite in this situation.

Practice Hand #2

Playing a $1-$2 No-Limit Hold'em game, we open-raise to $6 UTG with 7♦ 7♥, the action folds around to a short-stacker NIT in the BB, which 3-bet jams all-in for $56. The action is on us.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = $63
- **Pot Odds Ratio** = $63:$50 = **1.26:1 Pot Odds**

Pot Odds % Method = Call Size / Pot Size + Call Size

- **Pot Size + Call** = $63 Pot Size + $50 Call from You = $113
- **Pot Size %** = $50 / $113 = **44% Pot Odds**

What is our opponent’s estimated jamming range?

This is a very similar situation to our previous example, except now our short-stacker opponent is a NIT. Knowing that NITs are the scrooges of poker, we can expect him to have a very strong range that easily dominates ours.

- **Pocket Pairs** : JJ+
- **Broadway Cards** : AK

What is our estimated equity versus our opponent’s jamming range?

Referring to the equity chart presented earlier in the chapter, we should expect to be a huge equity dog versus a NITs all-in jamming range with 77. We could reasonably estimate to have about 30% equity knowing we have a dominated range and aren’t the favorite to win the hand if we call.

Again, we’ll utilize Equilab to provide a definitive estimate:

- **Our Equity** : 33%
- **Opponent’s Equity** : 67%

Should we call?

No. Getting 44% pot odds and only having 33% equity makes calling a –EV play. Since there are no implied odds in this situation, folding is our only option.

Practice Hand #3

Playing a $1-$2 No-Limit Hold’em game, a relatively conservative TAG open-raises to $6 in the CO position. We look down at A♠ Q♠ on the BTN and 3-bet to $18. Both of the blinds fold, and the TAG 4-bet jams all-in for $125 total. With $200 behind, the action is on us.

What are the pot odds?

Pot Odds = [pot size]:[amount to call]

- **Pot Size** = $146
- **Pot Odds Ratio** = $146:$107 = **1.36:1 Pot Odds**

Pot Odds % Method = Call Size / Pot Size + Call Size

- **Pot Size + Call** = $146 Pot Size + $107 Call from You = $253
- **Pot Size %** = $107 / $253 = **42% Pot Odds**

What is our opponent’s estimated jamming range?

This is an interesting spot. We know that villain is a somewhat conservative TAG; however, a decent TAG will also know that we’ll potentially be 3-betting light on the BTN versus a wider CO opening range. Given this, we shouldn’t necessarily expect villain’s 4-bet jamming range to be ultra-tight. Instead, we should expect a much looser range, similar to the ultra-loose range discussed earlier in this chapter: AA, KK, QQ, JJ, TT, AK, AQ, and AJs.

What is our estimated equity versus our opponent’s jamming range?

While we estimate villain’s 4-bet jamming range to be fairly loose, our light 3-bet puts us in a precarious spot. Even against such a loose range, AQ is only ahead of AJs. Knowing this, our equity is very minimal in this situation. A conservative estimate would be around 30% equity.

Again, we’ll utilize Equilab to provide a definitive estimate:

- **Our Equity** : 40%
- **Opponent’s Equity** : 60%

Should we call?

No. Getting 46% pot odds and only having 40% equity makes calling a –EV play. Since there are no implied odds in this situation, folding is our only option.

Practice Hand #4

Playing a $1-$2 No-Limit Hold'em game, a solid LAG with a $440 stack open-raises to $6 on the BTN, a bad aggressive short-stacker with a $60 stack 3-bet jams all-in, and the action is on us in the BB. With a $320 stack, we look down at A♦ A♣. What is the optimal move in this situation, flat calling or cold 4-betting?

What are our opponents' estimated ranges?

Given we are in a multi-way hand with multiple opponents, we must estimate both of our opponents' ranges. First, we'll tackle the LAG on the BTN. A solid loose aggressive opponent will be open-raising a very wide range on the BTN, attempting to steal our blinds. It wouldn't be unreasonable to assign him a range as loose as a 50% opening range:

BTN's Estimated Open-Raising Range:

22+, A2s+, K2s+, Q4s+, J7s+, T8s+, 97s+, 86s+, 75s+, 64s+, 54s, A2o+, K7o+, Q8o+, J8o+, T8o+, 97o+, 87o, 76o, 65o, 54o

Knowing the short-stacker in the SB is a bad aggressive maniac with a 30bb stack, we should also expect him to have a fairly wide jamming range, including all pocket pairs, all Broadway cards and some decent suited connectors:

SB's 3-Bet All-In Jamming Range:

22+, ATs+, KTs+, QTs+, JTs, T9s, 98s, 87s, ATo+, KTo+, QTo+, JTo

Call or Raise?

We know we're an equity favorite in this hand; however, we must determine whether to simply flat call the raise or cold 4-bet re-raise. Let's examine the merit of both.

Merits of 4-Bet Re-Raising

By 4-bet re-raising, we put immense pressure on BTN by showing a lot of strength. With 160bb effective stacks, we would expect him to fold a large portion of his hands and only continue with AA, KK, QQ, and AKs a majority of the time. Given that BTN is opening-raising a very wide range, we would expect him to fold greater than 95% of the time. By folding out BTN, we also ensure we maintain a higher equity edge versus SB, not having to give up some post-flop equity to BTN. This essentially ensures an all-in, heads up situation versus SB, where we're a huge equity favorite to win the $68 already in the pot.

Merits of Flat Calling

By flat calling, we under-represent our hand, making it look deceptively weak to BTN. We represent hands such as 77, 88, 99, TT, AQs and AKo, where we're willing to risk 30bb, but not go all-in. This encourages two potential actions from a loose aggressive BTN. First, assuming we don't want to call an all-in with our 3-bet flatting range, BTN may be encouraged to 4-bet jam to scare us out of the pot with a semi-decent range of hands that do well against SB's jamming range. Second, if BTN isn't willing to 4-bet jam, flatting gives him a better price to call behind with a range of hands we dominate post-flop. With either of these two scenarios, we now have the ability to potentially win up to an additional $260 in implied odds money, given $320 effective stack sizes between us and BTN. Knowing this, calling is much more profitable than 4-bet re-raising in this spot.

- **4-Betting Potential Winnings** : $68 in Current Pot
- **Flat Calling Potential Winnings** : $68 in Current Pot + $260 in Implied Odds Money

Conclusion

In this chapter, we discussed pre-flop all-in situations in No-Limit Hold’em. We highlighted common all-in scenarios and the many factors we need to consider when determining if calling a pre-flop all-in is profitable or not. This includes pot odds, equity versus our opponent's jamming range and potential side pot implied odds consideration. By now, you should have a good idea of how to evaluate such situations. One vitally important take away from this chapter is the concept of evaluating “hand versus range” – specifically, our hand versus our opponent's all-in jamming range. The better we become at doing so, the more profitable our pre-flop all-in calls will be over the long-run. In the next chapter, we'll continue looking at pre-flop mathematics, touching specifically on set-mining, 3-betting and steal mathematics.

Chapter 13. Set-Mining, Steal & 3-Bet Bluff Math

Introduction

In this chapter, we'll be finishing up our discussion on pre-flop mathematics. We'll be talking about three important concepts: set-mining, blind stealing and 3-bet bluff mathematics. Poker players love to call pre-flop with small pocket pairs in hopes of flopping a set, but most do it unprofitably. This is something you'll learn to prevent by understanding the simple math behind profitable set-mining. Another concept many people fail to apply are 3-bet bluffs and steal attempts. You'll learn the math behind 3-bet bluffs and steal attempts to understand the mathematics of how often they need to work to be profitable.

Set-Mining Basics

Let’s kick off our discussion with set-mining mathematics. Set-mining is when you call a pre-flop raise with the sole intention of flopping a set with a small pocket pair such as 22-55. Poker players love the thrill of flopping a set and stacking their opponents, but this doesn’t occur that often. As a consequence, lots of poker players set-mine incorrectly, therefore losing potential profit.

As you will remember from Chapter 4, we calculated the odds of flopping a set or better as being 11.76% or 7.5:1, or simply, 1 in every 8.5 times.

- **Odds of Flopping a Set or Better** : 11.76% or 7.5:1 Odds

Because we’ll only flop a set every 1 in 8.5 times we try, we have to make sure that during the one time we do, we make enough money to make up for the other 7.5 times we don’t flop. Since we’ll rarely get a good pot odds price to call pre-flop, set-mining is an implied odds play that relies on us making a decent profit post flop. This is where lots of poker players misunderstand set-mining.

Let’s explain it with a simple example, where you call a 3bb pre-flop raise with the hopes of flopping a set. For simplicity’s sake, and to ensure we make winning set-mining decisions, we’ll round up our set-mining odds to 8:1, or 1 in every 9 times.

Hand #	Call and Lose (Don't Flop a Set)	Call and Win (Flop a Set)
1	3bb	
2	3bb	
3	3bb	
4	3bb	
5	3bb	
6	3bb	
7	3bb	
8	3bb	
9		24bb
Total Lose / Win	24bb	24bb

What the table above shows us is that since we lose 3bb every time we don't flop a set, the one time we do, we need to win 24bb – not including rake – just to break-even. Since we're not interested in break-even decisions, but rather, profitable ones, let's move on to discuss profitable set-mining.

Profitable Set-Mining: 15-to-1 Rule

To ensure our set-mining decisions are profitable, we should follow the 15-to-1 rule. This rule states that for every 1bb we invest, we should expect a return of 15 times our initial 1bb investment. Expanding on the table above, we would then need a (3bb x 15 =) 45bb return on our investment every time we flop a set.

Since set-mining relies on implied odds, we need to take several factors into consideration. First, we must consider the effective stack sizes in the hand to determine if we can get a 15 times return on our investment. Second, we need to consider the strength of our opponent's hand. If it's strong, we might have good implied odds. Conversely, if it's weak, we won't get good implied odds. Lastly, we need to consider our opponent's playing style and if we expect him to pay us off or not when we hit our set.

Set-Mining Practice Hands

We'll now work through several set-mining practice hands together to ensure you understand profitable set-mining.

Practice Hand #1

A bad aggressive opponent with a 168bb stack open-raises to 4bb and the action folds around to us in the BB. We look down at 2♥ 2♣ with a 100bb stack.

Should we call?

Let's examine our profitable set-mining criteria to determine if we can call or not.

Effective Stack Sizes

Basing our call upon the 15-to-1 rule, we need to win 60bb from villain if we hit our set, so with 100bb effective stack sizes, we meet this criterion.

Opponent's Hand Strength

What about our opponent's hand strength?

Given that he is a bad aggressive opponent, we don't expect him to have a great starting hand that often. Unfortunately, we don't meet the second criterion.

Implied Odds

Do we expect to get paid when we hit our set? Given that our opponent is a bad aggressive maniac, he'll often bluff post-flop and bet heavily with top pair. So, yes, we expect to get paid off nicely when we hit our set a decent amount of the time.

Should We Call?

While we don't expect our opponent to have that great of a hand, we do stand the chance to win up to 100bb from our opponent, which is well above our 60bb requirement. We also expect him to spew off a lot of chips post flop whenever he flops a good pair or is entirely bluffing. So yes, we can call in this situation, given that our opponent is a bad aggressive maniac.

Practice Hand #2

A conservative TAG with a 147bb stack open-raises to 3bb pre-flop from UTG, a loose passive opponent with a 47bb stack calls and the action is on us with 4♦ 4♣ with a 105bb stack. Should we call?

Let's examine our profitable set-mining criteria to determine if we can call or not.

Effective Stack Sizes

Basing our call upon the 15-to-1 rule, we need to win 45bb if we hit our set. With a 105bb effective stack size between us and the UTG TAG, we meet this criterion. Also, with a 47bb effective stack size between us and the loose passive opponent, we also meet this criterion.

Opponent's Hand Strength

What about our opponents' hand strengths? We expect the initial UTG raiser to have a relatively strong opening range. However, the loose passive caller will typically have a fairly weak calling range.

Implied Odds

Do we expect to get paid when we hit our set? It really depends. We shouldn't expect either opponent to commit 45bb to the pot without an extremely strong hand. Typically, a conservative TAG won't overplay and stack off with top pair alone. Our loose passive opponent will also most likely play in a fit-or-fold fashion since he's not a calling station. Knowing this, we don't have great implied odds in this situation.

Should We Call?

We probably shouldn't call in this situation due to our implied odds not being that great. We want to set-mine in situations where we have a high probability of getting paid off and this just isn't one of those situations.

Practice Hand #3

We open-raise to 3bb with 3♥ 3♣, a NIT 3-bets to 10bb, and the action is back on us. Effective stack sizes are 89bb. Should we call?

Let's examine our profitable set-mining criteria to determine if we can call or not.

Effective Stack Sizes

Since this is a 3-bet pot, we need to call an additional 7bb to continue in the hand. Basing our call upon the 15-to-1 rule, we then need to win 7bb x 15 = 105bb to make this a profitable call. Since effective stack sizes are only 89bb, we don't meet this criterion. However, with our break-even point being 8:1, we know that 7bb x 9 = 63bb is our breakeven point. So, while we can't win 15 times our investment, we can win well over 9 times it – just under 13 times our investment, to be exact.

Opponent's Hand Strength

What about our opponent's hand strength? Given that our opponent is a NIT and has 3-bet us, we should put him on an extremely strong range that he is willing to stack off with post-flop on most board textures. A good estimate would be AA, KK, QQ and AKs.

Implied Odds

Do we expect to get paid when we hit our set? Most definitely. NIT's only 3-bet is with the very top portion of their range, which they're willing to stack off with in most situations. So by flat calling, we can expect to get stacks all-in in many situations post-flop when we hit our set. Furthermore, it's always easier to get stacks all-in in 3-bet pots, given the larger pot sizes going to the flop.

Should We Call?

Yes, we can definitely call in this situation based upon several factors. While we aren't getting 15-to-1 on our money, we are getting close to 13-to-1 if we stack our opponent, which is still profitable for set-mining purposes. Additionally, we expect our opponent to have an extremely strong range that will stack off post-flop in most situations.

Blind Steal Mathematics

In this section, we're going to talk about pre-flop steal mathematics. Playing from the BTN is the most profitable position in No-Limit Hold'em because it allows us to steal our opponents' blinds with a wide range of cards. Theoretically, we should be opening a very wide range of hands from late position in an attempt to steal the blinds. But, before we do so, we also need to know how often our steal attempts need to work to be profitable.

This is an important concept, because when the action folds around to us and we have the opportunity to steal our opponents' blinds, we theoretically should be opening a very wide range, including good to mediocre starting hands. While we're not worried about our opponents playing back against us with our good starting hands, we prefer to take down the blinds in a relatively painless fashion when we hold mediocre hands such as K7s and T7o. Therefore, as we go through this section, we'll be primarily concerned with blind stealing mathematics when we are considering stealing the blinds with mediocre starting hands.

Risk versus Reward

When we're attempting to steal our opponents' blinds, we're risking a certain amount to win a certain amount. Typical blind steal sizing is 2bb, 2.5bb or 3bb. In most games, the small blind will be 0.5bb and the big blind with be 1bb. So we're typically risking 2bb – 3bb to win 1.5bb.

Steal Break-Even Point

We'll now determine how often our steal attempts need to work to be a breakeven proposition, meaning we neither make, nor lose, money.

The easiest way to do so is to use the following simple equation:

Blind Steal Break Even Percentage : Risk / (Risk + Reward)

- **3bb Steal Sizing** : 3bb / (3bb + 1.5bb) = 66.7% Breakeven Point
- **2.5bb Steal Sizing** : 2.5bb / (2.5bb + 1.5bb) = 62.5% Breakeven Point
- **2bb Steal Sizing** : 2bb / (2bb + 1.5bb) = 57.1% Breakeven Point

What this shows us is that, on the average, our blind steal attempts need to work approximately two-thirds of the time. Furthermore, a 2bb sizing needs to work approximately 10% less often than a 3bb sizing. In general, you want to risk the least amount possible when stealing your opponents' blinds.

Blind Stealing Considerations

When we're considering stealing our opponents' blinds, we're not interested in breaking even; we're interested in winning money. Mathematically, we want to steal our opponent's blinds with our mediocre starting hands when we expect them to fold more often than our breakeven point. However, it's not as simple as that.

When our opponents don't fold, we need to take potential pre-flop and post-flop actions and scenarios into consideration.

- **Our Opponents' Overall Playing Style** : We need to take our opponents' overall playing style into consideration, as well as whether our opponents are good or not. Different types of players will defend their blinds at different frequencies and also play differently post-flop. Good players will make fewer mistakes while bad ones will make many mistakes both pre- and post-flop.
- **Our Opponents' Blind Defense Propensity** : Certain opponents will fold a very high frequency of hands in the blinds, whereas others will not. We can attack opponents folding a very high frequency with a wide stealing range, but we need to steal more cautiously versus those who defend their blinds more liberally by calling or 3-betting as a bluff.
- **Our Opponents' Post-Flop Tendencies** : Stealing the blinds from fit-or-fold opponents is much easier than stealing from good opponents

that will defend well from the blinds, but we need to be on the lookout for both types of opponents. Moreover, we should target bad fit-or-fold opponents and be wary of stealing against better opponents.

Understanding these considerations is vitally important because our steal attempts aren't played in a vacuum. Whenever we're considering a steal attempt, we need to take all pre- and post-flop scenarios and our opponents' playing styles into consideration.

Quantifying our opponents' fold equity

The dilemma with blind stealing (if we don't play online and utilize a HUD) is that we'll never fully know how often our opponents are folding to our blind steal attempts. Online players utilizing a HUD will have this information; however, those that don't or play live poker will have to make an educated guess. This is often based upon the blind stealing considerations discussed in the chapter, as well as the reads, tells and notes they have on their opponents.

Blind Stealing Practices Hands

Now that we've discussed blind stealing, we'll work through several steal practice hands together.

Practice Hand #4

The action folds around to us on the BTN with A♣ 3♥ with two NITs in the blinds.

Should we attempt to steal their blinds?

A3o is by no means a premium starting hand, so it's not a hand we want to be stealing with too lightly against the wrong opponents. Luckily for us, both of our opponents in the blinds are NITs, who characteristically have a tendency to fold too much pre-flop due to their risk-adverse nature. Given this information, we should definitely attempt to steal their blinds with a 2-2.5bb steal sizing.

Practice Hand #5

The action folds around to us on the BTN with K♣ T♥ with a NIT in the SB and a loose passive calling station in the BB.

Should we attempt to steal their blinds?

KTo, while it appears to be a good starting hand, is a mediocre Broadway hand. On the other hand, this is a good situation to steal for two main reasons; first, we expect the NIT in the SB to fold a high percentage of the time. Second, and most importantly, we also expect the loose passive calling station in the BB to defend his blinds very liberally, with a wide range of hands. Our goal with this steal attempt is not to make BB fold, but instead call so we can make money off of his post-flop mistakes.

Luckily, KTo has good equity against a loose passive calling station's calling range, providing us with the opportunity to win additional money post-flop whenever we flop top pair or better – simply because calling stations hate to fold. When we miss, King-high will often be good at showdown. Knowing all of this, we should be attempting to steal our opponents' blinds with a 3bb steal sizing.

Practice Hand #6

The action folds around to us on the BTN with J♣ 7♣ with a TAG in the SB and a LAG in the BB.

Should we attempt to steal their blinds?

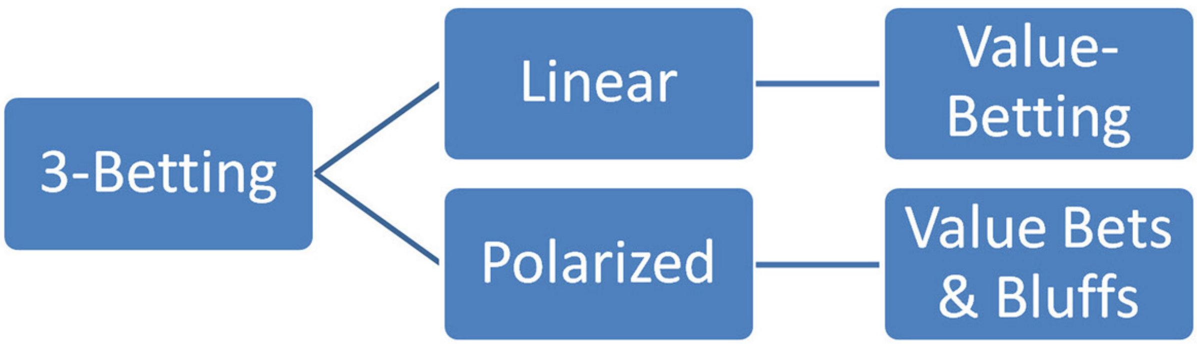
This is a very unfavorable steal situation due to both of our opponents in the blinds. First, both are good, aggressive opponents that won't make many mistakes both pre- and post-flop. Second, since they'll both be aware that we'll be attempting to steal their blinds lightly, we can expect them to defend their blinds by 3-bet bluffing at a decent frequency to discourage us from doing so. Knowing this, we should be tightening up our stealing range against these types of opponents and simply throw our J7s into the muck.

3-Bet Bluff Mathematics

Our last topic for this chapter is 3-bet bluff mathematics – something a lot of poker players don't truly understand. When we're 3-betting, we're either 3-betting for value, or as a bluff. Before we talk about 3-bet bluff mathematics, though, let's do a quick refresher on linear and polarized 3-betting ranges.

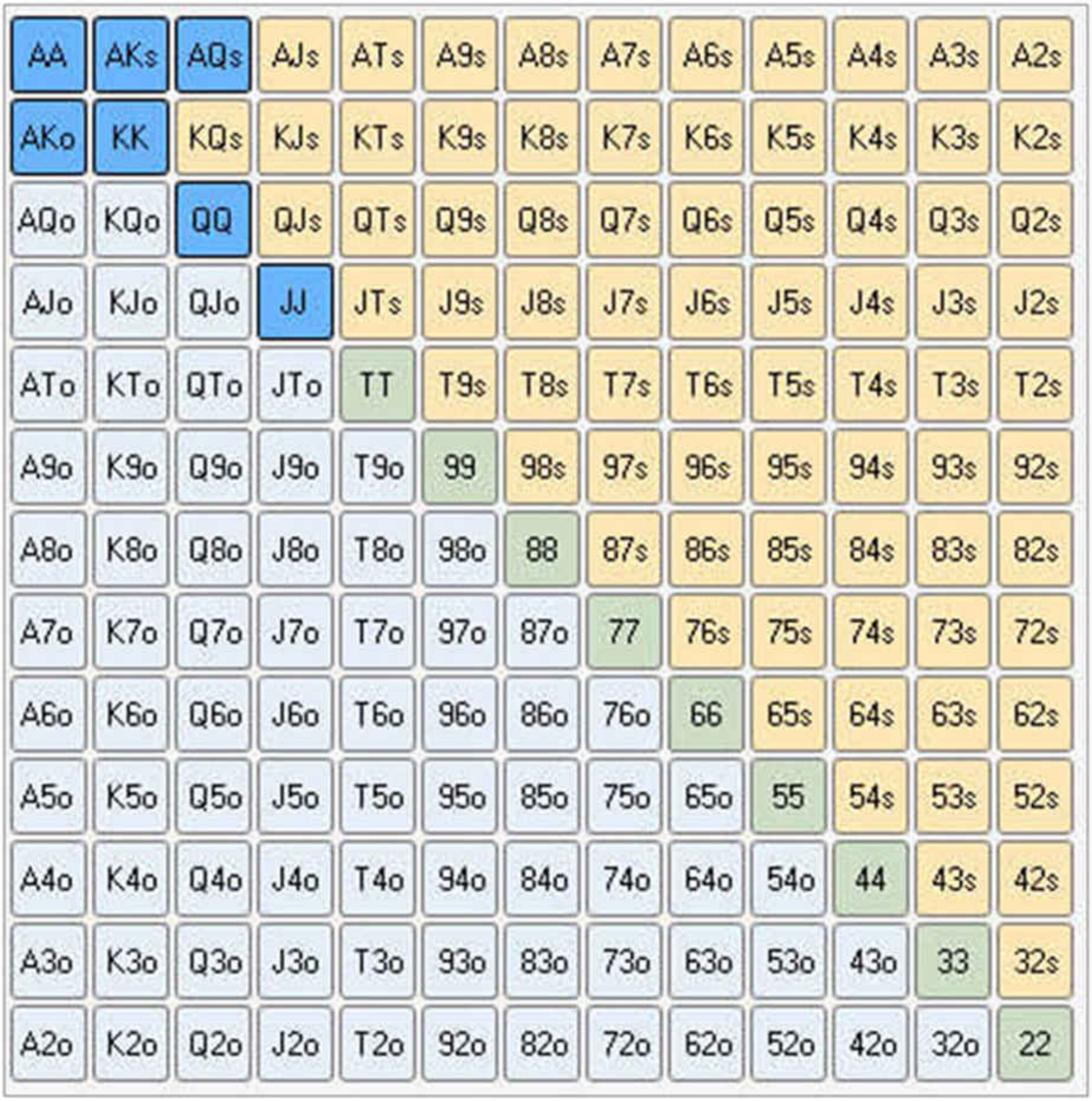
Linear and Polarized 3-Bets

In poker, there are two main categories of 3-bets: linear and polarized 3-bets.



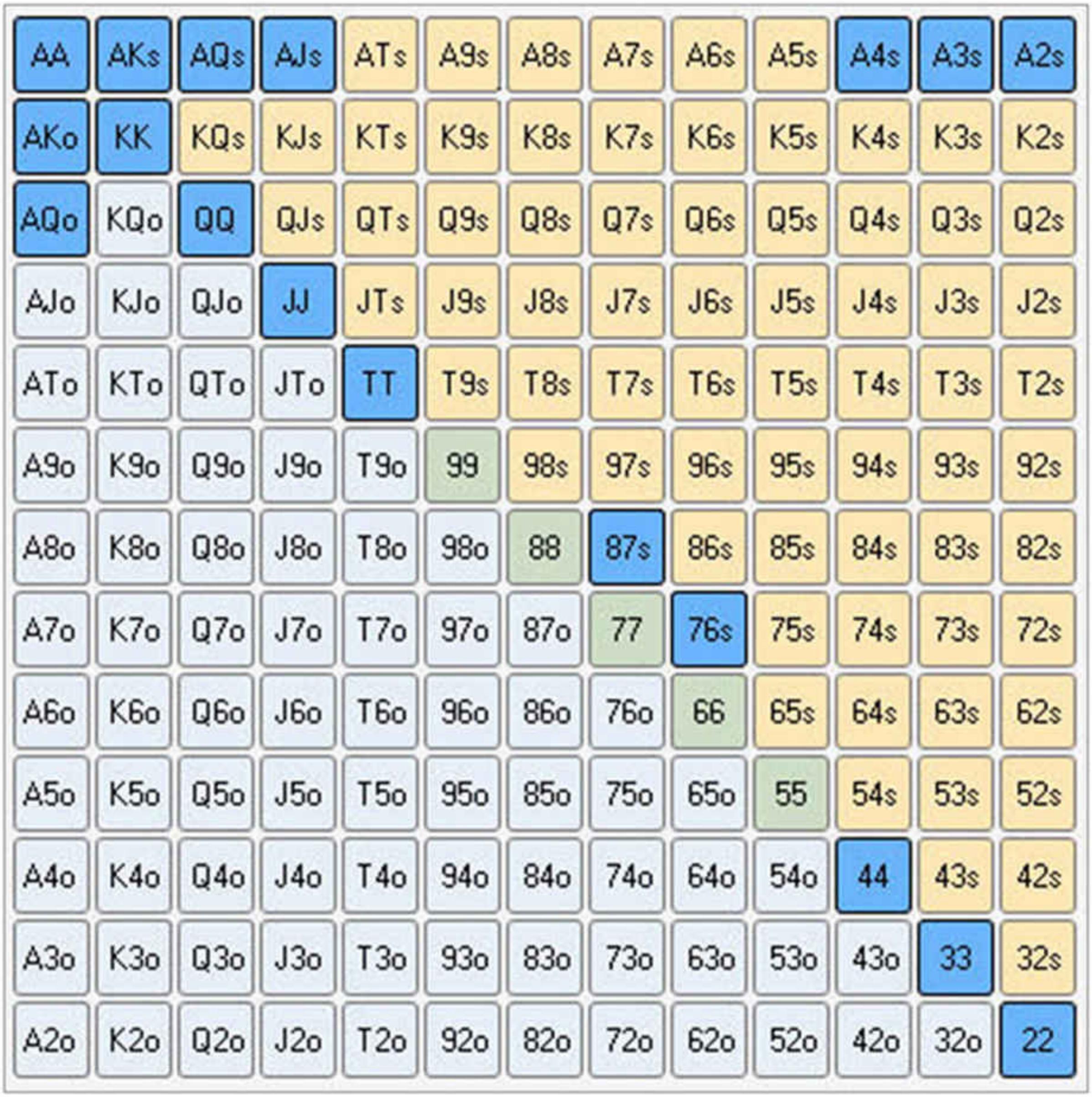
Linear 3-Betting Range

A linear 3-betting range is one composed solely of value-bets. When we 3-bet a linear range, we are 3-betting for value where we expect to be ahead of our opponent's open-raising range. For example, the image below shows a linear value 3-betting range of JJ+, AQs+, and AKo.



Polarized 3-Betting Range

Conversely, a polarized 3-betting range is one composed of a combination of value bets and bluffs. So, unlike the linear 3-betting range, when we 3-bet a polarized range, we are sometimes betting for value, and other times bluffing. The image below shows a polarized 3-betting range composed of value hands and bluff hands. In this example, we are 3-betting TT+, AJs+, and AQ+ for value and 44-22, A4s-A2s, 87s, and 76s as a bluff.



Why Do We 3-Bet?

We 3-bet for two specific reasons:

- When we have a hand that's **too good to call**, such as KK or AA for value.
- When we have a hand that's **too bad to call**, such as A2s or 33.

If we have a hand that fits within one of these two different categories, then we have a hand we can "potentially" 3-bet.

3-Bet Sizing

Typically, 3-bet sizing is 3 times our opponent's initial open-raise sizing, with some slight deviations depending upon if we're in or out of position:

- **Out of Position Sizing** : When we're out of position to the raiser, we should make our sizing a bit larger, closer to 3.5x due to our positional disadvantage in the hand.
- **In Position Sizing** : When we're in position to the raiser, we should make our sizing a bit less, closer to 2.8x due to our positional advantage in the hand.

3-Bet Bluff Break-Even Point

Now that you know the basics of 3-betting, as well as common 3-bet sizings, let's calculate 3-bet bluff breakeven points. For these calculations, we'll assume our opponent has open-raised to 3bb and there is 1.5bb in the pot from the SB and BB.

3-Bet Bluff Break Even Percentage : Risk / (Risk + Reward)

- **2.8x Sizing** : 8.4bb / (8.4bb + 4.5bb) = 65.1% Breakeven Point
- **3x Sizing** : 9bb / (9bb + 4.5bb) = 66.7% Breakeven Point
- **3.5x Sizing** : 10.5bb / (10.5bb + 4.5bb) = 70% Breakeven Point

What you'll notice is that, on the average, our 3-bet bluff attempts need to work around two-thirds of the time, with larger bluffs having to work a bit more often. All-in-all, 3-bet bluffs are a risky endeavor because we are re-raising the initial raiser, risking approximately 9bb pre-flop, so we need to win approximately 67% of the time just to break even. On top of that, if our opponent calls, we stand to lose additional money post-flop.

Can We 3-Bet Bluff?

Because 3-bet bluffing is a risky endeavor, we should have a very good reason for attempting this play. There are two primary reasons why we would want to attempt this play:

- **Balancing Our Ranges** : When we're balancing our ranges, we're 3-bet bluffing to ensure we get paid off when we value 3-bet. This is an advanced concept beyond the scope of this book, so we won't focus on it.
- **High Fold Equity** : The second instance that we would attempt a 3-bet bluff in is when we assume we have high fold equity, meaning we expect our opponent to fold a high percentage of the time to our 3-bets. This typically would occur when our opponents are opening a wider, weaker range.

Therefore, we should only apply the polarized 3-betting model with 3-bet bluffs if our opponent(s) are folding to a lot of 3-bets. If they aren't, then 3-bet bluffing will only cause us to unnecessarily spew off a lot of chips pre-flop. Conversely, if our opponent(s) are folding to a high frequency of 3-bets, approximately 67% at minimum, then we can 3-bet bluff profitably.

Therefore, 3-bet bluffing and the polarized 3-betting model works best when we have a lot of **fold equity**. When our **fold equity** is low, we shouldn't apply this model. Instead, we should stick with the linear 3-betting model.

3-Bet Bluffing Practices Hands

We'll now work through several 3-bet bluff practice hands together.

Practice Hand #7

A NIT open-raises to 3bb in UTG and the action is on us. We look down at 8♣ 7♣. Would this be a good time to consider a 3-bet bluff?

Hopefully, you've already come to the correct conclusion with this hand. When a NIT open-raises from UTG, he has a very strong starting range; therefore, we should expect to have very little fold equity. Knowing this, we shouldn't attempt a 3-bet bluff in this situation.

Practice Hand #8

A TAG open-raises to 3bb from the BTN as a steal attempt, SB calls, and the action is on us with 2♦ 2♥. The TAG on the BTN has been attempting to steal our blinds every single orbit, so we know he is opening a wide range. Would this be a good time to consider a 3-bet bluff?

This is a great spot to consider a 3-bet bluff, as well as consider a re-steal in this specific situation. Since the TAG on the BTN has been attempting to steal our blinds every single orbit, we know he is opening a very wide range with a lot of mediocre hands that cannot profitably call a 3-bet. We also have a re-steal situation, meaning we can re-steal SB's call, which is typically composed of a weak, capped range that doesn't include hands strong enough to call a 3-bet.

Practice Hand #9

A LAG open-raises to 3bb from MP, a loose passive calling station in the CO calls and the action is on us on the BTN with A♠ 4♠. Would this be a good time to consider a 3-bet bluff?

While we know that a LAG will be opening a fairly wide range, we also know that he'll be likely to fight back in a smart and aggressive way against our 3-bet attempts. Additionally, the loose passive calling station will be apt to call our 3-bet as well. Even though both of our opponents most likely have weaker starting ranges, we shouldn't expect both of them to fold that often. Knowing this, we shouldn't attempt a 3-bet bluff in this situation.

Conclusion

In this chapter, we covered three important pre-flop concepts: set-mining, blind stealing and 3-bet bluff mathematics. While these core concepts are easy to understand, lots of players don’t apply them properly. Hopefully this chapter has provided further insight into these pre-flop concepts. This chapter will conclude our pre-flop discussion. In our next chapter, we’ll begin discussing important post-flop concepts.

SECTION 4: POST-FLOP CONCEPTS

Section Introduction

In this section, we'll be continuing to discuss post-flop mathematics. While we already discussed numerous topics, including pot odds, implied odds, the Rule of 2 and 4 and calling with drawing hands, there are still several topics we need to explore. In this section, we'll continue our discussion of post-flop concepts and mathematics. More specifically, we'll discuss the following topics:

- Betting with the Best Hand
- Semi-Bluffing All-In
- Bluffs and Hero Calls

Chapter 14. Betting with the Best Hand

Introduction

Leading up to this point, we've spent a great deal of time focusing on correctly playing drawing hands post-flop. Since we'll often have the best hand, this chapter focuses on betting with the best hand post-flop. We'll focus on two specific points: extracting maximum value and giving our opponents a bad mathematical pot odds price to call our bets. We do this by betting an amount we think our opponents will call that's –EV for them based upon the pot odds we offer with our value bet.

Board Texture

Before we begin talking about bet-sizing with our made value hands, we need to discuss the concept of board texture. Board texture plays an incredibly important role in determining the likelihood that our opponents have a drawing hand or not, as well as how much we should bet in certain situations. There are two specific types of board textures: wet and dry. We need to learn how to identify and interpret both to determine how our opponents’ pre-flop ranges connect with them to create drawing hands. Let's start off by discussing wet board textures.

Wet Board Textures

Wet board textures are draw-heavy, coordinated board textures with the likelihood of numerous possible draws; the most important among them being flush and straight draws.

Below are two sample wet boards:

- **Example #1** : A♣ J♣ T♣
- **Example #2** : 5♦ 6♦ J♥

As you can see with both examples, there are numerous possible draws. Example #1 is an example of an extremely wet board texture, while Example #2 is an example of a semi-wet board texture.

We consider Example #1 extremely wet because our opponent(s) can have made flushes and straights, in addition to numerous flush and straight draw possibilities with a single card, such as a King, Queen or any club card.

Example #2 is considered semi-wet, since our opponent(s) cannot have a made flush or straight, but a draw to both with any two diamond cards or numerous gut shot and open-ended straight draws.

Flops like these are very precarious situations when we have a made value hand, such as top pair, two pair, a set, or even better. We need to consider the likelihood that our opponent(s) either have a better made hand, or a draw to a strong flush or straight draw on the turn or river. Just like when we have a drawing hand, we do so by evaluating their potential outs and equity of hitting their draws. Because wet boards increase the likelihood of our opponents having strong drawing hands, we often need to bet for both value and protection.

Dry Boards

The opposite of wet board textures are dry board textures. Dry board textures are non-coordinated boards with little to no possible draws. On a dry board texture, our opponents either have a made hand or not, with very little chance of making a drawing hand by the river. Typically with dry boards, our opponents will potentially have only a backdoor draw, meaning they need two specific cards to make their draw on the river. If both cards don't come, they won't make their draw.

Below are two sample dry boards:

- **Example #1** : 2♦ 6♥ J♣
- **Example #2** : K♦ 8♠ 2♥

As you can see, there are very few possible draws in either hand shown above. In fact, there are only backdoor draws. The only way our opponent(s) can make a flush or straight is with runner-runner turn and river cards on the river. Therefore, we're less worried about protecting our value hands on dry boards, since there aren't many drawing hands that can suck out on us.

Revisiting Drawing Hand Equities

Remember from our previous discussions that different drawing hands have different equities. This is an important concept for this chapter, because our bet sizing will be based upon our opponents' perceived equity. The table below provides a quick recap, specifically flop not all-in and turn equity:

Drawing Hands	Outs	Flop Not All-In & Turn Equity
Gut-Shot Straight Draw	4	8%
Over Cards 2-Pair Draw	6	13%
Open-Ended Straight Draw	8	17%
Flush Draw	9	19%
Flush + Gut-Shot Straight Draw	12	25%
Flush + OESD	15	33%

Knowing how to quickly determine what draws our opponents most likely have based upon the board texture combined with each draw's equity is very important. We use our opponents' estimated equity to determine our proper value bet sizing. The goal is to always give our opponents a bad pot odds price to call. We should also be seeking to extract maximum value as well.

Our Bets = Opponents' Pot Odds

Whenever we bet, we're offering our opponents a gambling wager. Mathematically, our bet offers our opponents a specific pot odds price to call. Getting back to what I just said in the previous paragraph, our main goal with betting is to provide our opponents a –EV pot odds price, forcing them to call more than they should, based on mathematics. This is the foundation of our strategy. Therefore, whenever we bet, we should always consider the pot odds price we're offering our opponent(s) based upon their estimated equity to hit their draws. To help simplify this process, I've included a bet size-to-pot odds table below. This table shows common bet sizes and their associated pot odds. For example, a 1/2 pot-sized bet equates to offering our opponent(s) 25% pot odds.

Bet Size	Pot Odds Ratio	Pot Odds Percentage
1/4 Pot Sized Bet	5:1 Pot Odds	16.7% Pot Odds
1/3 Pot Sized Bet	4:1 Pot Odds	19.9% Pot Odds
1/2 Pot Sized Bet	3:1 Pot Odds	25% Pot Odds
2/3 Pot Sized Bet	2.5:1 Pot Odds	28.5% Pot Odds
3/4 Pot Sized Bet	2.3:1 Pot Odds	30% Pot Odds
Pot Sized Bet	2:1 Pot Odds	33.3% Pot Odds

How much should we bet?

Since our goal is to always offer our opponents a –EV pot odds price, we should always bet a pot odds amount greater than their estimated drawing hand equity. By doing so, we're ensuring they're making a bad pot odds call. Below is a table that highlights recommended bet sizing, taking this information into consideration. It highlights minimum recommended bet sizes based upon our opponents' possible draws.

Drawing Hand	Flop Not All-In & Turn Equity	Our Bet Size?	Pot Odds We Offer
Flush + OESD	33%	Slightly Over Bet Pot	Greater than 33%
Flush + Gut-Shot Straight Draw	25%	2/3 Pot-Sized or More	28.5% or more
Flush Draw	19%	1/2 Pot-Sized or More	25% or more
Open-Ended Straight Draw	17%	1/3 Pot-Sized or More	25% or more
Over Cards + 2-Pair Draw	13%	1/4 Pot-Sized or More	25% or more
Gut-Shot Straight Draw	8%	1/4 Pot-Sized or More	25% or more

While the table highlights recommended minimum bet sizing, we should always consider the maximum bet sizing we think our opponent(s) will call based upon their playing style and tendencies. For example, if our opponent is a calling station, we should definitely bet more; however, if our opponent is a NIT, we should bet the recommended minimum amount instead. All-in-all, if we think our opponent will call a bigger bet size, by all means we should bet more.

Additionally, in my experience at the lower stakes and micro stakes levels, most opponents will call a large bet with a flush or straight draw. Most are simply unaware of the basic math behind their draws and will often make –EV calls, so regardless of their draw, we can get away with betting more against bad, recreational players.

Over-betting the Pot

There are certain situations in which over-betting the pot is correct. This is when we think our opponents could have a flush + open-ended straight draw with 15 outs and 33% equity. Whenever this is the case, we need to slightly over-bet the pot to ensure we offer them a –EV pot odds call. The reason for this is that a pot-sized bet equates to 33% pot odds. If we estimate our opponent to have 33% equity, we need to offer them more than 33% pot odds – hence the over-bet. My recommendation is to slightly over-bet the pot to around a 1.2 to 1.3 pot-sized bet. However, you'll often find that when someone has such a strong draw, he'll often re-raise all-in on the flop, because with 15 outs, such a strong draw is greater than a 50% equity favorite to win all-in by the river.

Implied Odds Caveat

One caveat to this strategy is to always take implied odds into consideration. Since our opponent(s) will usually be inclined to call given a bad direct pot odds price if they think they have excellent implied odds, we should also take implied odds into consideration. One major factor for implied odds is stack sizes. When effective stack sizes increase and both opponents are deep-stacked, we can expect our opponents to call larger bets with draws in hopes of earning a big pay day when they hit their draw. So, always consider stack sizes and implied odds when sizing your bets.

In addition, we must be vigilant and not pay off our opponents when they hit their drawing hands. When we pay them off, they can profitably call with implied odds value; but when we’re attentive, identify when draws hit and are able to make big folds. We can essentially negate implied odds all together – making our opponent’s initial pot odds-based call -EV.

Let's Practice

We'll go through some practice hands, starting off with some simple ones and then getting a bit more complex as we go.

Practice Hand #1

We have A♣ K♣ and the flop is K♥ 9♥ 4♠.

What's the board texture?

This is a semi-wet board texture, with both a flush and gut-shot straight draw.

What is our opponent's drawing hand estimated equity?

A flush draw and gut-shot straight draw have a combined 25% equity if we suspect our opponent can have both draws.

How much should we bet?

We should bet at minimum a 2/3 pot-sized bet, which will offer 28.5% or more pot odds. If we think our opponents will call a 3/4 or pot-sized bet, we should bet more to extract additional value. But at minimum, we should bet a 2/3 pot-sized bet.

Practice Hand #2

We have 7♦ 7♣ and the flop is 5♥ 6♥ 7♠.

What's the board texture?

This is a very wet board texture with both a flush and open-ended straight draw. Most likely, we have the best hand with the top set however; it is possible one of our opponents could have flopped the straight.

What is our opponent’s estimated drawing hand equity?

Such strong draws combined can have up to 33% equity in the hand, so we need to bet big to give our opponents a bad price to call.

How much should we bet?

We should over-bet the pot to around a 1.2 to 1.3 pot-sized bet, and if we are re-raised all-in, we should definitely consider calling with top set. Even if we are behind, we have redraws to quads or the full house.

Practice Hand #3

We have K♣ Q♦ and the flop is K♥ 7♣ 2♦.

What’s the board texture?

This is an extremely dry flop. We almost certainly have the best hand, unless our opponent flopped two pair or a set, which are both unlikely.

What is our opponent’s estimated drawing hand equity?

Our opponent either has a made hand, or doesn’t, without any draws on the turn. We’re either way ahead or way behind in this spot to two pair or sets.

How much should we bet?

On such a dry board texture, we should bet no more than a 1/2 pot-sized bet. If we think our opponents are unlikely to have a King, then we should also consider betting less or checking the flop to allow our opponents to catch up on the turn or induce a bluff.

The benefit of checking here is two-fold. Firstly, it induces our opponents to potentially bluff into us by sensing weakness with our check. Secondly, it allows our opponents to catch up by making a pair on the turn, or to think a pair of 7’s, or small pocket pairs such as 88 or 55, are potentially good on the flop. If we’re in position, we also allow our opponents to bet the turn with smaller pairs, or call our delayed turn continuation bet with weaker hands, thinking their smaller pairs are potentially the best hand.

Practice Hand #4

We open raise to 3bb UTG with A♦ Q♦, a loose passive calling station in the CO calls, and everyone else folds. Effective stack sizes are 115bb going to the flop. The flop is A♣ Q♣ T♣.

What's the board texture?

This is an extremely wet flop with numerous flush and straight draws, as well as possible made flushes and nut straight. Our opponent can make a flush with a single club card and the nut straight with either a King or Jack.

What is our opponent's estimated drawing hand equity?

We know that our opponent is a calling station. Therefore, we should estimate that his pre-flop calling range is too wide, and includes lots of mediocre hands. This is usually a good thing; however, in this situation, having such a wide pre-flop calling range allows our opponent to easily have a random club card flush draw and numerous weaker Kx and Jx hands for straight draws. Without a doubt, we should assume our opponent could have a combination of a flush + gut shot straight draw giving him 25% equity.

How much should we bet?

At minimum, we should bet a 2/3 pot-sized bet to give our opponent 28.5% pot odds. But, understanding that he is a calling station, we can easily get away with betting more. Against an opponent that isn't folding his draws, we should be looking to extract maximum value. Accordingly, this would be an opportune spot to over bet the pot to around a 1.3 pot-sized bet.

Practice Hand #5

We open raise to 3bb in MP with A♠ A♦, an aggressive LAG calls from the CO and everyone else folds. Effective stack sizes are 178bb going to the flop. The flop is 2♥ 7♣ Q♠ and the action is on us.

What's the board texture?

This is a very dry board texture with only backdoor runner-runner draws. We can safely assume we have the best hand the majority of the time, unless our opponent has flopped a set.

What is our opponent's estimated drawing hand equity?

We know that our opponent is an aggressive LAG. Therefore, we should estimate that his pre-flop calling range is somewhat wide, but shouldn't include too many junk hands. We would expect him to call with Broadway cards not good enough to 3-bet, suited connectors, suited one-gappers, and medium to small pocket pairs. It's possible our opponent also has a pair with Qx hands, 7x hands, and pocket pairs.

He will also flop a set of 2's or 7's a very small percentage of the time. We wouldn't expect him to have QQ, since we would expect him to 3-bet such a strong hand pre-flop. Knowing this, we almost always have the best hand in this situation. Furthermore, our opponent has very little equity to make the best hand by the river with a runner-runner flush, straight, three of a kind, or two-pair draw.

How much should we bet?

We almost always have the best hand, and we're facing a good, aggressive opponent out of position. Since we aren't concerned with betting for protection, our sole mission with this hand is to extract as much value as possible from our opponent. Value-betting the flop around a 1/2 to 2/3 pot-sized bet is a good option here, because we don't expect our opponent to fold a pair of Q's, 7's or 88-JJ.

Checking to induce a bluff is another great option. If we expect our opponent to value bet worse hands or bluff when we check the flop first to act, we can extract value by showing weakness on the flop. All-in-all, the most optimal move depends on our previous reads on our opponent – but both are good options.

Conclusion

Understanding the basic mathematics behind betting with the best hand is equally as important as when we have a drawing hand, except the roles are reversed. When we have the best hand, our goal is to make our opponent(s) make a –EV call, as well as to extract as much value as possible with the best hand. All of this relates to equity and pot odds, a recurring theme in this book.

Remember, whenever you have the best hand, always base your bet sizing on your opponent’s equity, and do your best to always offer them a bad pot odds price.

Chapter 15. Semi-Bluffing All-In

Introduction

In this chapter, we're going to be discussing the mathematics behind the semi-bluff, with a specific focus on all-in semi-bluff plays. There are certain situations when it's okay to go all-in on the flop with certain draws that have a lot of equity, and that's the focus of this chapter.

Defining the Semi-Bluff

First, we need to define exactly what a semi-bluff is and how it differs from a pure bluff. A semi-bluff occurs when you bet with a drawing hand, such as a flush draw, straight draw, or over cards. While it’s a bluff at the time of your bet, you stand a chance of making your draw on the next street of action to make a better hand than your opponent, hence it becomes a semi-bluff. A pure bluff, on the other hand, has very few to no draws at all. If you’re wondering if we’ll be covering non all-in (semi) bluff scenarios, we’ll cover that in the next chapter.

Quick Review of All-In Equities

When we semi-bluff with the intent of going all-in, we’re concerned with our all-in equity. Reviewing the handy Rule of 2 and 4, we multiply our outs by either 4 or 2, depending on whether we are going all-in on the flop or the turn to determine our all-in equity:

- Use the Rule of 2 and 4 to find your **all-in equity:**
- **On the Flop**: multiply your outs x **4**
- **On the Turn**: multiply your odds x **2**

Spots to Go All-in as a Semi-Bluff

Semi-bluffing all-in is a common play you'll see in No-Limit Hold'em, with very strong draws that provide us a strong equity chance of making our draw by the river. In a heads up hand, if we have approximately 50% equity, we are happy to semi-bluff all-in on the flop. Despite this, in a 3-way hand, we can optimally go all-in with around 33% equity, if we expect both opponents to call. Good drawing hands to semi-bluff all-in are the following:

- **Open-Ended Straight Draw** : 8 Outs
- **The Nut Flush Draw** : 9 Outs
- **Flush + Gut Shot Straight Draw** : 12 Outs
- **Flush + Open-Ended Straight Draw** : 15 Outs

Below is a table highlighting each draw's respective all-in equity. We'll use this table as a guideline to determine when we can go all-in with these various draws.

Draw	# of Outs	Flop All-In Equity	Turn All-In Equity
Open-Ended Straight Draw	8	31.5%	17%
The Nut Flush Draw	9	35%	19.1%
Flush + Gut Shot Straight Draw	12	45%	25.5%
Flush + Open-Ended Straight Draw	15	54.1%	32.3%

Our Semi-Bluff Goal

When we semi-bluff, whether it's an all-in situation or not, we have two primary goals. Our first goal is to maximize fold equity by forcing our opponent into a tough decision, hoping he folds. When we're (semi) bluffing, we're always happy when our opponent folds and we can take down the pot right then and there without going to showdown, simply because we're betting with the worst hand. Our secondary goal with semi-bluffing is to maximize our value when we hit our hand. When we bet or raise all-in with a semi-bluff, we ensure that we maximize our value when we're called and make our hand. This is why you'll often see people aggressively semi-bluffing the nut flush all-in; if they simply took a check/call line, when the flush hits most opponents, it will shut down and not pay them off since it's an obvious draw. All-in-all, we're happy if our opponents either fold or call our all-in semi-bluffs.

Practice Hands

We’ll now go through a couple of example practice hands to highlight the semi-bluff in action. This is a fairly straightforward concept, so we won’t do too many examples.

Practice Hand #1

We have A♣ K♣ and the flop is Q♣ J♣ 4♠. Villain bets $75 into a $100 pot, making it $175, and the action is on us.

Is this a good semi-bluff spot?

- **Pot Odds:** Given the bet size, we are being offered 2.3:1 pot odds, which converts to 30% pot odds.
- **Outs** : We have 9 outs to make the nut flush draw, plus an additional 3 outs to make the nut straight, giving us a total of 12 outs.
- **Not All-In Equity** : 12 outs x 2 = ~24% Equity
- **All-In Equity** : 12 outs x 4 = ~48% Equity

Calling would be slightly –EV, since we are being offered 30% pot odds with a 24% equity chance of making our draw on the turn. If either the flush or straight completes on the turn, our opponent might shut down and not pay us off, rendering our implied odds minimal.

With that being said, this is a great spot to semi-bluff. If we think our opponent will fold hands, such as top pair to a flop check/raise all-in, this is an ideal spot to maximize our fold equity. Furthermore, with approximately 48% flop all-in equity, we’re okay with being called, as this is essentially a coin-flip scenario.

Practice Hand #2

We have 8♦ 9♦ and the flop is 6♣ 7♥ K♠. Villain bets $50 into a $100 pot, making it $150, and the action is on us.

Is this a good semi-bluff spot?

- **Pot Odds** : Given the bet sizing, we're getting 3:1 pot odds, which converts to 25% pot odds.
- **Outs** : We have 8 outs to make the straight with our open-ended straight draw.
- **Not All-In Equity** : 8 outs x 2 = ~16% Equity
- **All-In Equity** : 8 outs x 4 = ~32% Equity

This is a very interesting spot with great implied odds. In a heads up pot, it's not an ideal semi-bluff spot, based upon our equity. If it were a multi-way pot with several aggressive opponents, then given our approximately 32% flop all-in equity, semi-bluffing all-in is potentially correct, given the math.

However, given that this is a heads up situation, calling is much more preferable than semi-bluffing, which I'll explain below.

When our opponent continuation bets into us, it's very likely that he has a pair of Kings. Knowing this, even though we are getting poor direct pot odds, we have great implied odds with a hidden draw. Neither card that completes our straight will deter our opponent from continuing with a pair of Kings; if the turn or river card is a T or 5, we wouldn't expect our opponent to shut down. This ensures that we get implied odds value from our hand.

Practice Hand #3

A NIT open-raises to 4bb UTG, we call with K♥ Q♥ from MP, CO folds, BTN calls, and both blinds fold. The flop is J♥ T♥ 2♣, UTG continuation bets a 10bb into a 13.5bb pot and the action is on us with 110bb effective stack sizes.

Is this a good semi-bluff spot?

- **Pot Odds** : Given the bet sizing, we're getting 2.35:1 pot odds, which converts to 30% pot odds.

- **Outs** : We have 9 outs to make the flush and an additional 6 to make the straight, giving us a total of 15 outs.
- **Not All-In Equity** : 15 outs x 2 = ~30% Equity
- **All-In Equity** : 15 outs x 4 = ~60% Equity (54.1% Actual Equity)

This is a dream situation when it comes to semi-bluffing our hand. We have a royal flush draw combined with an open-ended straight draw, giving us more than enough equity to semi-bluff raise with the intention of going all-in on the flop. Yes, we're getting the correct pot odds to flat call. However, with such a strong hand (a 54% favorite) to make the best hand by the river, raising makes much more sense in this specific situation.

When a NIT open-raises to 4bb UTG and continuation bets very large amounts into two opponents on this flop, we would expect him to have a very strong made hand, possibly as strong as a set of J's or T's. This increases the likelihood that he'll call our semi-bluff raise or re-raise us all-in. However, if a heart or a card that completes the straight comes on the turn or river, he may stop being a cautious NIT. For this reason, semi-bluffing with the intention of going all-in on the flop is preferable to simply calling with this hand.

Conclusion

There are many great spots to semi-bluff the flop with a strong draw with the intention of going all-in. Don’t be afraid to play strong draws aggressively with 12 or more outs on the flop, because with so many outs, you are essentially a coin flip away to win by the river. Doing so ensures we get value from our strong draws, where if we simply called, we might not get paid off when they hit.

Also, remember that we have two primary goals with our semi-bluffs. Our first, and main, goal is to try and take down the pot on the flop by making our opponent(s) fold better hands. Our second goal is to extract the maximum value when they do call and we make our drawing hand. While aggressively playing such draws can lead to higher variance swings in our game – and can be a bit scary for beginning poker players – just understand that they are +EV in the long run, and should be implemented into our poker game.

Chapter 16. Bluffs and Hero Calls

Introduction

In the previous chapter, we discussed semi-bluffing with draws. In this chapter, we're going to discuss the mathematics and reasoning behind bluffing and making hero calls. While lots of poker players understand what a bluff and hero call are, what they don't really understand why we would use them, or how to use them profitably. The goal with this chapter is to help you understand how often your bluffs and hero calls need to work in the long-run to be profitable.

What is a hero call?

Everybody knows what a bluff is, so there is no need to explain one here.

However, not everybody knows what a hero call is, so we'll quickly define it. A hero call is simply when you call a potential bluff on the river with a marginal hand, hoping to catch your opponent bluffing. It's called a hero call because you're the hero in the hand when you catch your opponent bluffing, and the table is in awe of your opponent reading abilities!

For example, you have 8♣ 8♥ and call an aggressive opponent's pre-flop raise. The flop comes 2♦ 4♦ 9♣. Your opponent fires out a continuation bet and you call. The turn comes T♠. Your opponent bets again and you call. The river comes 7♣. You opponent goes all-in. You think about it for a few minutes, and decide to call. Your opponent turns up A♦ K♦ and you take down a massive pot. This would be considered a hero call because you called your opponent's bluff with a mediocre hand, which in this case was the third best pair.

They Don’t Have to Work All The Time

The first thing you need to know about bluffs and hero calls is that they don’t need to work 100% of the time to be profitable; nor should you expect them to work all the time. Lots of beginning poker players struggle with this simple fact and become too emotionally involved with their bluffs and hero calls. They make the mistake of getting upset when a bluff doesn’t work, or their hero call is wrong. Rather than understanding the basic mathematics behind bluffs and hero calls, they go on tilt and become irate at the table.

Instead of becoming upset, we need to understand that bluffs and hero calls generally need to work only a small fraction of the time to be profitable, which we’ll discuss in the section below. When they work, we should definitely be happy, but when they don’t, we should shrug it off and move onto the next hand.

How often do bluffs need to work?

When we're bluffing, we're risking our bet-size to win the amount of money that's already in the pot. Therefore, we have a simple risk-to-reward ratio where we risk a certain amount to win a certain amount:

- **Risk** : Our Bet Size
- **Reward** : The Pot

Simple Example

The pot is $100 and we bluff $50.

How often does our bluff need to work?

- **Reward:Risk Ratio** = $100:$50 = 2:1 = 1/3 = 33.3%

In this situation, we're risking $50 to win the $100 already in the pot. You can see from the simple ratio above that our break-even point is 33.3%. Therefore, our bluff needs to work 33.3% of the time to be break-even. So, if it works more than 33.3% of the time, it's profitable!

Bluff Break-Even Table

Below is a simple table that highlights how often a bluff needs to work to break-even, based upon the size of our bet. Looking at the table, if we commonly bluffed a 1/3 pot-sized bet, it only needs to work 25% of the time to be break-even.

If it works more than 1/4 of the time, then it is profitable.

Bluff Size	Reward:Risk Ratio using $100 Pot Size	Break-Even Percentage
1/4 Pot Sized Bet	$100:$25 = 4:1	20%
1/3 Pot Sized Bet	$100:$33 = 3:1	25%
1/2 Pot Sized Bet	$100:$50 = 2:1	33%
3/4 Pot Sized Bet	$100:$75 = 1.3:1	43%
Pot Sized Bet	$100:$100 = 1:1	50%

Bluffing Caveat

The math is as simple as that; but there are many more factors that go into successfully bluffing such as the board texture, our perceived ranges, effective stack depth, our opponents' playing styles, the stakes we're playing, and so forth, including those which are beyond the scope of this book.

When you're bluffing, you need to take a wide array of information into consideration when determining if a bluff will be successful or not. You need to understand that the simple math discussed in this chapter can't tell us if a bluff will work or not in a specific scenario, but only *how often* it needs to work based upon the size of your bluff. Learning when and how to successfully bluff is an entirely different skill set you'll need to master in your poker game.

How often do hero calls need to work?

Now that we've talked about bluffs, let's discuss hero calls. Hero calls, and how often they need to work, are based purely upon the pot odds we're being offered. If we're being offered 25% pot odds, then our hero calls need to be right more than 25% of the time to be profitable.

One thing to note is that, just like bluffs, hero calls don't need to work that often to be profitable, which can be seen in the hero call break-even table below.

Hero Call Break-Even Table

Villain Bet Size	Hero Call Pot Odds	Hero Call Break Even %
1/4 Pot Sized Bet	5:1 Pot Odds	16.7%
1/3 Pot Sized Bet	4:1 Pot Odds	19.9%
1/2 Pot Sized Bet	3:1 Pot Odds	25%
2/3 Pot Sized Bet	2.5:1 Pot Odds	28.5%
3/4 Pot Sized Bet	2.3:1 Pot Odds	30%
Pot Sized Bet	2:1 Pot Odds	33.3%

Hero Calls Caveat

Just like bluffs, there is a lot that goes into making profitable hero calls. We really need to understand how our opponent is playing in order to determine if he is bluffing or not on the river.

Learning to read our opponent’s ranges and how they connect with the board texture, as well as our opponent’s propensity to bluff rivers, in addition to the many other factors I touched upon earlier, will help improve the overall success of your hero calls. Remember, the math discussed in this chapter won’t tell us if a hero call will work, just how often it needs to work.

Conclusion

The mathematics behind how often bluffs and hero calls need to work to be profitable is really simple. Unfortunately, lots of people neglect to use them in their game, especially when it comes to bluffs. The great thing about bluffs and hero calls is that they really don't need to work that often to be profitable.

Bear in mind that knowing that they don't need to work that often isn't an open-license to bluff liberally and make hero calls all of the time. You need to take a wide array of other factors into consideration as well whenever you're considering bluffing or making a hero call.

SECTION 5: EV CALCULATIONS AND COMBINATORICS

Section Introduction

This section will conclude our book, focusing on EV calculations and Combinatorics, better known as hand combinations. In this section, you'll learn how to quantify the expected value of hands you've played in the past, as well as learn about utilizing hand combinations and Combinatorics in your poker game.

Chapter 17. EV Calculations

Introduction

In this chapter, we’re going to build on our earlier discussion about Expected Value (EV). Specifically, we’re going to introduce basic EV calculations, which you can use for off-the-table analysis to determine whether a particular play you made in a previous hand was +EV or –EV.

EV Refresher

Remember, EV is simply how much you expect to win or lose on the average over the long run. Furthermore, it is based upon a certain play that you make in a poker game:

- **+EV** = A profitable long-term play
- **-EV** = A losing long-term play

Why is it important?

We want to make as many **+EV** plays, aka profitable plays, as possible in the long run.

How do we use it?

We use correct poker mathematics and poker decisions at the table to enhance our likelihood of making **+EV** plays. Also, we use EV calculations off the table to analyze our previous plays to determine whether they were profitable or not.

The Basic EV Calculation

The basic EV calculation is very simple and is composed of two parts:

EV = [Part A] - [Part B]

- **Part A** : How often you <u>win</u> ***x*** How much you <u>win</u>
- **Part B** : How often you <u>lose</u> ***x*** How much you <u>lose</u>

EV = [Expected Long-Term Winnings] – [Expected Long-Term Loses]

As you can see above, the calculation compares your long-term winnings and long-term losses to determine if a play is profitable or not.

Computing EV In 3 Simple Steps

In this section, we'll perform a basic EV calculation using the 3-step methodology shown below. I've gone ahead and pre-populated some numbers and percentages to highlight how this process works:

Step 1 : Determine how often you will win and how much you will win:

- 80% of the time you will win $500 = (.80 x 500) = **$400**

Step 2 : Determine how often you will lose and how much you will lose:

- 20% of the time you will lose $250 = (.2 x 250) = **$50**

Step 3 : Subtract how much you expect to lose from how much you expect to win:

- $400 - $50 = **$350 +EV**

This play is +EV and you expect to win $350, on the average, in the long run.

Basic EV Calculation Example Hands

Practice Hand #1

Pre-flop, we have J♣ J♠ and villain open-jams all-in with $80 effective stack sizes in a $500 buy-in deep-stack game.

We estimate that we're a 59% favorite to win and will lose 41% of the time, based upon our opponent's 3-betting frequency. If we call and win, we'll win a total of $161.50, which includes the blinds. However, if we call and lose, we'll lose the $80 we risked pre-flop by calling villain's all-in jam.

What is the EV calculation for this play?

EV = [Part A] - [Part B]

- **Part A** : How often you <u>win</u> ***x*** How much you <u>win</u>
- **Part B** : How often you <u>lose</u> ***x*** How much you <u>lose</u>

Part A : How much we will win x percentage to win = ($161.50 x .59) = **$95.29**

Part B : How much we will lose x percentage to lose = ($80 x .41) = **$32.80**

EV = $95.29 - $32.80 = **$62.49**

Is it a +EV or -EV play?

This is a **+EV** play. Each time you make this play, you can expect to win $62.49 on average, over the long run.

Practice Hand #2

We raise UTG to $6 with A♣ A♦ and get called by one opponent. The flop comes K♠ 8♥ 3♠. We bet $12 into a $15 pot, our opponent raises to $40 and we go all-in for our remaining $180 stack. Having us covered, our opponent calls and turns up K♣ 9♦. The turn card is 9♥ and the river card is Q♣, causing us to become unlucky and lose a massive pot.

While we lost this particular hand, as well as our entire stack, we made a very profitable long-term winning play. We'll do a simple EV calculation to show exactly how profitable our play was.

Determining Win & Loss Information

We first need to determine how often we expect to win. To do so, we'll use our handy Equilab software. Using Equilab, we determine that we expect to win and lose:

- **Win** : 82.40%
- **Lose** : 17.60%

Next, we need to determine how much we expect to win and lose with this play.

If we win, we win a total amount of $399:

- $15 Flop Starting Pot Size
- $12 Bet from Us
- $40 Raise from Villain
- $180 All-In Jam from Us
- $152 All-In Call from Villain
- **Total Pot Size** : $399

If we lose, we lose our final $180 all-in bet, since the money already wagered by us in the pot no longer belongs to us. This is a very important concept to grasp, because we just lose our flop all-in re-raise amount of $180, not the entire $198 we committed to the pot.

- **Win Amount** : $399
- **Loss Amount** : $180

What is the EV calculation for this play?

EV = [Part A] - [Part B]

- **Part A** : How often you win ***x*** How much you win
- **Part B** : How often you lose ***x*** How much you lose

Part A : How much we will win x percentage to win = ($399 x .824) = **$322.78**

Part B : How much we will lose x percentage to lose = (-$180 x .176) = **$31.68**

- **EV** = (.824 x $399) - (.176 x -$180) = **$291.10**
- **EV** = $322.78 - $31.68 = **$291.10**

Hand Conclusion

Even though we lost a lot of money with this particular hand in a vacuum, in the long-run we expect to win $322.78 on average, making this an extremely **+EV** play. Nobody likes losing a lot of money at the poker table, but our EV calculation confirms we made the right play and that we shouldn't dwell on the fact that we lost this particular hand. We should, in fact, be happy that our opponent called our all-in with such a weak hand and hope he continues to do so in the future, since we'll win a lot of money from him in the long run.

The key take away from this EV calculation is that poker is a game of long-term EV, not short-term wins and losses. Anybody can get lucky and win a massive pot, as well as get unlucky and lose a massive pot, in any single hand. Long-term results are what determine how profitable a poker player's plays are.

(Semi) Bluffing EV Calculation

Now that you're familiar with the basic EV calculation, let's expand it to a somewhat more complex scenario: the (semi) bluff all-in move. When we either semi-bluff or purely bluff, we give ourselves two ways of winning a hand. The first is by making our opponent fold immediately, while the second is making the best hand at showdown when we do get called. This EV calculation takes both of those scenarios into account, making it a bit more complex than the basic EV calculation:

- **Scenario 1** : Hero (semi) bluffs, villain folds, and **hero wins**
- **Scenario 2** : Hero (semi) bluffs, villain calls and **hero wins**
- **Scenario 3** : Hero (semi) bluffs, villain calls and **hero loses**

Our EV calculation then becomes the following:

Semi-Bluff EV = (Scenario 1) + (Scenario 2) – (Scenario 3)

- **Scenario 1** = (Villain Fold % x Size of Pot)
- **Scenario 2** = [(Villain Call % x Probability of Winning) x (Size of Pot + Villain Call)]
- **Scenario 3** = [(Villain Call % x Probability of Losing) x (Semi-Bluff Amount)]

Semi-Bluffing EV Calculation Example Hands

I'll explain this calculation with a couple of example hands.

Practice Hand #3

Hand Details: We flop an open-ended straight draw with an estimated 8 outs and 32% all-in equity. We put our opponent on a very strong range and assume we have to make our draw to win the hand. There is $50 in the pot and our opponent bets $25. With $100 left in our stack, we go all-in as a semi-bluff.

What is the EV calculation for this play?

Semi-Bluff EV = (Scenario 1) + (Scenario 2) – (Scenario 3)

- **Scenario 1** = (Villain Fold % x Size of Pot)
- **Scenario 2** = [(Villain Call % x Probability of Winning) x (Size of Pot + Villain Call)]
- **Scenario 3** = [(Villain Call % x Probability of Losing) x (Semi-Bluff Amount)]

Estimating how often villain folds will always be an educated guess. You'll never know exactly how often he'll fold, so you should do your best to estimate based upon your opponent's hand strength and playing style.

In this example, we assume our opponent has a very strong holding and will only fold 20% of the time and call the remaining 80%. We also assume that if our opponent does call, we will only win 32% of the time.

Semi-Bluff EV = (Scenario 1) + (Scenario 2) – (Scenario 3)

- **Scenario 1** = (20% x $175) = $35
- **Scenario 2** = [(80% x 32%) x ($175 + $75)] = $64
- **Scenario 3** = [(80% x 68%) x ($100)] = $54.40

Semi-Bluff EV = $35 + $64 - $54.40 = **$44.60**

Is it a +EV or -EV play?

This is a **+EV** play, if our assumptions are correct. When we semi-bluff, we must estimate how often our opponent will fold, i.e., how much fold equity we have in the hand. Sometimes we'll be correct, while other times we'll be incorrect.

However, what this EV calculation shows is that, by semi-bluffing, we provide ourselves two ways to win the hand. If we correctly assume our opponent will fold 20% of the time, we'll win $35 outright when he folds and $64 when he calls and we suck out to make the best hand.

One thing to note with this calculation is that when we lose, we don't take into account the total amount of money we invested into the hand, because the money in the pot no longer belongs to us. When we lose, we're assuming we only lose our semi-bluff amount.

Practice Hand #4

Hand Details: A LAG on the BTN open-raises to 3bb and it folds to us in the BB. With A♣ 5♣, knowing our opponent is attempting to steal our blinds with a wide range of hands, we 3-bet bluff to 10bb. Villain thinks for a minute, 4-bets to 24bb and we 5-bet shove with our remaining 90bb stack.

What is the EV calculation for this play?

Semi-Bluff EV = (Scenario 1) + (Scenario 2) – (Scenario 3)

- **Scenario 1** = (Villain Fold % x Size of Pot)
- **Scenario 2** = [(Villain Call % x Probability of Winning) x (Size of Pot + Villain Call)]
- **Scenario 3** = [(Villain Call % x Probability of Losing) x (Semi-Bluff Amount)]

This is an interesting spot that you'll see often at the mid-to-higher stakes, where Meta game and balanced plays assume a major role in profitable poker. When we 3-bet our opponent, he knows we'll sometimes defend our blinds with a 3-bet bluff, so it's not unlikely that he will also sometimes 4-bet bluff us. For the sake of this example, we'll assume he'll fold to our 5-bet shove 40% of the time, however, when he calls, we only expect to win 20% of the time against his 5-bet all-in calling range.

Semi-Bluff EV = (Scenario 1) + (Scenario 2) – (Scenario 3)

- **Scenario 1** = (40% x 124.50bb) = 49.80bb
- **Scenario 2** = [(60% x 20%) x (124.50bb + 76bb)] = 24.06bb
- **Scenario 3** = [(60% x 80%) x (90bb)] = 43.20bb

5-Bet All-In Bluff EV = 49.80bb + 24.06bb - 43.20bb = **30.66bb**

Is it a +EV or -EV play?

According to our sample analysis of our opponent's likelihood of folding and our equity against his calling range, this is a +EV play.

Conclusion

EV calculations are an excellent way to perform off-the-table analysis, especially when we're in a big hand and aren't certain whether our play was optimal or not. They form a good tool to have in your poker arsenal, in order to help validate whether a play was a long-term +EV or –EV play – regardless of the outcome at the table in any particular session.

Remember, poker is a game of long-term EV. As poker players, we shouldn't be focused on any particular outcome other than whether a play was long-term +EV or –EV, employing the help of EV calculations to determine this.

Chapter 18. Combinatorics

Introduction

In this chapter, we're going to discuss the concept of hand combinations, commonly referred to as combinatorics. This is a fairly complex concept, and we'll merely be brushing the surface, covering basic concepts that are important for you to know.

What are hand combinations?

In this chapter, we're going to discuss the concept of hand combinations, commonly referred to as combinatorics. This is a fairly complex concept, and we'll merely be brushing the surface, covering basic concepts that are important for you to know.

Below shows starting hand combinations:

- **Any Pocket Pair** : 6 Combinations
- **Any 2 Non-Pair Cards** : 16 Combinations
- **Any 2 Suited Non-Pair Cards**: 4 Combinations
- **Any 2 Non-Suited Non-Pair Cards**: 12 Combinations

Any pocket pair can be combined 6 different possible ways, and any non-pair starting hand can be combined 16 possible ways, with 4 combinations being suited, and the remaining 12 being off-suit combinations.

The table below highlights this with some example hands.

Hand Type	Example Hand	# of Combos	Exact Combos
Pocket Pair	AA	6	A♣A♠,A♦A♥,A♣A♦, A♣A♥,A♠A♦, A♠A♥
Non-Paired Suited Hand	KQs	4	K♣Q♣,K♠Q♠,K♦Q♦, K♥Q♥
Non-Pair Off-Suited Hand	KQo	12	K♣Q♦,K♣Q♥,K♣Q♠, K♦Q♣,K♦Q♥,K♦Q♠, K♥Q♣,K♥Q♦,K♥Q♠, K♠Q♣, K♠Q♦,K♠Q♥

How do we use combinatorics?

We use combinatorics for two primary reasons in poker. The first is to estimate the likelihood of any particular made hand, both pre-flop and post-flop. Combinatorics can be used, in conjunction with hand reading, to quantitatively estimate our opponent's made hands into various hand combinations. It can also be used in more advanced poker concepts, such as developing polarized, balanced ranges.

Pocket Pair Combinations

A pocket pair can be dealt 6 different ways, meaning there are a total of 6 possible combinations of any pocket pair. Below, we highlight this with pocket Aces:

- A♣ A♠
- A♦ A♥
- A♣ A♦
- A♣ A♥
- A♠ A♦
- A♠ A♥

3 + 2 +1 Rule

Whenever we want to estimate the likelihood that our opponent holds any particular pocket pair, we can use the simple 3 + 2 + 1 rule. We'll continue to use pocket Aces as our example to explain this rule.

- **3 + 2+ 1** = 6 combinations of pocket Aces

When We Have an Ace

A NIT open-raises to 4bb UTG and we have A♣ Q♣. How many combinations of pocket Aces does our opponent have in his UTG opening range?

Using the simple 3 + 2 + 1 rule, we would eliminate "3" from our simple formula:

~~3 +~~ 2 + 1 = 3 Combinations Left:

- **Eliminated Combos** : A♣ A♠, A♣ A♠, and A♣ A♦
- **Remaining Combos** : A♦ A♥, A♠ A♦, and A♠ A♥

Every time we have an Ace or see an Ace on the flop, we eliminate one number, starting with the "3" going left to right. Accordingly, the 3 + 2 +1 rule tells us that our opponent can only have 50% of the total 6 combinations of pocket Aces when we hold an Ace in our starting hand.

When We Have an Ace and There Is an Ace on the Flop

Let's take this example a bit further. Still assuming we have A♣ Q♣, and the flop is A♦ 7♠ 2♥, how many combinations of pocket Aces can our opponent have in his UTG opening range?

Since we hold an Ace and there is a visible Ace on the flop, we would eliminate the "3" and "2" from the 3 + 2 + 1 rule formula:

~~3 + 2~~ + **1** = 1 Combinations Left:

- **Eliminated Combos** : A♣ A♠, A♣ A♠, A♣ A♦, A♦ A♥, and A♠ A♦
- **Remaining** Combo: A♠ A♥

When there are two visible Aces, such as when we have one in our hand and one on the flop, there is only one remaining combination of pocket Aces available for our opponent to have in his UTG opening range. This reduces the likelihood that he has pocket Aces by 83.3%.

Blockers and Card Removal

This concept is called **blockers** and **card removal**. In our previous examples, by having an Ace in our hand or an Ace on the board, we block our opponent from having certain combinations of pocket Aces. With specific cards removed from the deck, such as the A♣, our opponent cannot have any combinations of AA that include the A♣.

Whenever potential cards that make up our opponent's made or starting hands are no longer available to our opponent by either: (1) being in our starting hand, or (2) being on the board, we can use combinatorics to quantitatively remove combinations of hands from our opponent's possible made hands in a process called card removal.

Pocket Pair Combinatorics Practice hands

Below, we will go through three simple examples where we don't have an Ace in our starting hand, and determine how many combinations of AA it is possible for our opponent(s) to have:

Practice Hand #1

If the flop is K♣ J♣ T♥, there are **6** possible combinations of pocket Aces. If we don't have an Ace in our starting hand and there are no Aces on the board, all 6 combinations of pocket Aces remain:

- 3 + 2 + 1 = 6 Combos of AA remaining

Practice Hand #2

If the flop is A♣ J♣ T♥, there are **3** possible combinations of pocket Aces:

- ~~3 +~~ **2 + 1** = 3 Combos of AA remaining

Practice Hand #3

If the flop is A♣ J♣ A♥, there is **1** possible combination of pocket Aces:

- ~~3 + 2 +~~ **1** = 1 Combo of AA remaining

Non-Paired Hand Combinations

For any non-paired hand, such as AK, JT, or 56, there are a total of 16 combinations with 4 combinations being suited and the remaining 12 being unsuited. There is a simple calculation to show this. We will use AK as an example.

There are 4 suits for any card (A♣, A♦, A♥, and A♠). So for AK, we know there are 4 Aces and 4 Kings in the deck. To find out the total possible combinations of AK, we would simply multiply:

- 4 Aces x 4 Kings = 16 Total Combinations

We can further break down our 16 combinations to suited hands and off-suited hands:

- 4 Suited Combinations (A♣ K♣, A♦ K♦, A♥ K♥, and A♠ K♠)
- The remaining 12 combinations of AK are off-suited AK hands.

Non-Paired Combinations Adjustments

Estimating the number of combinations of any non-suited hand is really easy. We start with our simple 4 x 4 calculation, and whenever a card is taken via card removal, we reduce the number of cards left in the calculation. For example, if we continue with AK and an Ace hits the flop, there are 12 combinations of AK possible:

- 3 Remaining Aces x 4 Kings = 12 Combinations

Non-Pair Combinatorics Practice hands

Let’s look at some more examples to illustrate this.

Practice Hand #4

If the flop is K♣ J♣ T♥, how many combinations are there of KJ left in the deck?

Well, we must eliminate the K♣ and J♣ from our calculation. So there are only 3 Kings and 3 Jacks left in the deck, giving us:

- 3 Kings x 3 Jacks = 9 Combinations

Practice Hand #5

If the flop is 9♣ T♣ T♥, how many combos are there of AT left in the deck?

Well, we must eliminate two Tens from our calculation. So, there are two Tens left in the deck and 4 Aces:

- 4 Aces x 2 Tens = 8 Combinations

Using Combinatorics Pre-Flop

We can use Combinatorics to help us with our difficult pre-flop decisions, such as calling a 3-bet or 4-bet all-in. When determining if we can call a pre-flop all-in jam, we take a deep dive look at our opponent’s estimated all-in range to determine how many combinations of starting hands we beat compared to how many we lose against. We then evaluate this compared to our pot odds to determine if calling is +EV or –EV.

One word of caution – you won’t be able to perform this detailed analysis while you’re in a hand, so it’s best suited for off-the-table hand analysis to determine if you made an +EV or –EV call based upon your opponent’s estimated all-in range.

Pre-Flop Combinatorics Example Hand

Let’s practice with an example hand.

Practice Hand #6

We raise to 3bb in MP with Q♣ Q♦, CO 3-bets to 10bb, we 4-bet to 24bb and CO 5-bet jams all-in for his remaining 94bb stack. CO is a bad aggressive opponent that has been playing somewhat wildly all session.

What is CO’s Estimated Jamming Range?

Given that CO is a bad aggressive opponent, we know he will be 5-bet jamming a fairly wide range. We estimate that range to include all pocket pairs, KQ+, AJ+, some suited connectors, and some suited Ace bluffs, giving him the following estimated 5-bet jamming range: 22+, AJs+, A5s-A2s, KQs, QJs, JTs, T9s, 98s, 87s, AJo+, and KQo.

What is Our Equity versus Villain’s Range?

According to Equilab, we are a 69.55% equity favorite versus villain’s range.

Evaluating Villain’s Hand Combinations

Without doing any pot odds and equity analysis, we already know that calling villain’s pre-flop all-in is a profitable play. We can use Combinatorics to break villain’s range down into combinations to see how much of his actual range we’re ahead of pre-flop.

Combinations We Beat		Combinations We Don't Beat	
Hand	**# of Combos**	**Hand**	**# of Combos**
A5s – A2s	16	AA	6
QJs – 87s	20	KK	6
22 - JJ	60		
KQo, KQs	16		
AJs+, AJo+	48		
Total	**160 (93%)**	**Total**	**12 (7%)**

As you can see from the analysis above, we're currently ahead of 93% of villain's pre-flop jamming range. Specifically, we're ahead of 160 combinations and behind 12 combinations of AA and KK. We're also a 50/50 equity split with pocket Queens, which I didn't include in the table.

If we're currently ahead of 93% of villain's all-in jamming range, then why does Equilab estimate that we have 69.55% equity versus this range? Because our opponent's hands have post-flop equity against us. Remember that equity changes from pre-flop to post-flop, so while we're winning now, that doesn't mean we'll have the best hand at show down. Equilab estimates we'll have the best hand at show down 69.55% of the time.

Making Use of Hand Combinations in Tough Pre-Flop Decisions

While this example was fairly clear-cut and straightforward, you'll often be put to the test with very difficult all-in situations, where your opponent is jamming with a narrower range. When this occurs, you should evaluate your equity compared with your pot odds and potentially use Combinatorics to visualize your opponent’s range in actual hand combinations.

Using Combinatorics Post-Flop

Hand combinations come in quite handy post-flop, especially when you're doing an in-depth hand review and analysis to determine if you played a hand correctly or not. To illustrate, we'll examine a hand that a fellow poker coach that I know posted to a poker study group I'm a member of.

Practice Hand #7

In a 30nl game, a good aggressive regular raises to $0.90 pre-flop and hero calls from the SB with A♥ K♠. The flop comes J♠ A♠ K♥, giving hero top two pair on a really wet board texture. Hero checks, villain bets $0.90 into a $2.10 pot and hero calls. The turn card is the 7♦. Hero checks again, villain bets $2.40 into a $3.90 pot and hero calls. The river is the T♠ making the final board J♠ A♠ K♥ 7♦ T♠. Hero checks again, villain bets $7.80 into an $8.70 pot and the action is on hero. Should hero call?

What are Hero's Pot Odds?

Hero has to call $7.80 to win the $16.50 pot, giving him 32% pot odds, meaning hero must have 32% equity or better to call here.

Hand Analysis

Flush Analysis

With the K♠ in his hand, hero blocks K♠ Q♠ Furthermore, villain cannot have a good Q♠ hand, because all other spade Broadway cards are on the board. Accordingly, this rules out all high Broadway combos of flush draws via blockers and card removal. Knowing this, the only likely flush draws villain can have made are suited connectors, such as 9♠ 8♠, 8♠ 7♠, and possibly 6♠ 7♠. This tells us that it's highly unlikely that villain made a flush on the river.

Straights and Worse Made Hands

Since villain can only realistically have 3 combinations of made flush draws on the river, it's much more likely that he has either the nut straight or a set. Given his river bet sizing on such a scary board texture, we should weigh his hand towards Qx (AQ, KQ, and QJ) hands for the nut straight.

With a flush and 4-straight on the board, we would expect him to check back sets and two pairs, due to their showdown value and the unlikelihood of getting paid off on such a bad river card for those hands.

Assuming that villain would only value bet the nut straight on the river, we can assign him the following combinations of made straights with AQ, KQ and QJ:

- AQ = 2 Aces x 4 Queens = 8 Combos
- KQ = 2 Kings x 4 Queens = 8 Combos
- QJ = 4 Queens x 3 Jacks = 12 Combos

Combos Analysis

We estimate that villain has 28 combinations of made nut straights and only 3 combinations of made flushes.

Call, Raise or Fold?

Calling is out of the question. Hero only beats a pure bluff, which doesn't occur that often at the micro stakes. However, since we weigh villain's range strongly to made straights with very little combinations of made flushes, this is a potential opportune spot to check/raise jam all-in as a bluff if we think villain will lay down the straight to a flush. Most of the time, we should just be folding here, but against certain opponents, this is a potential bluff spot, especially if stack sizes are deep enough.

Developing Balanced Ranges with Combinatorics

The last topic we're going to discuss in this chapter is the concept of using Combinatorics to develop balanced ranges. As you move up in stakes, or as you watch high stakes games on television, you'll often hear of the term "balance" – which means to balance our value and bluff hands. When we balance our ranges, we compose them with equal amounts of value and bluff hands. We can use Combinatorics to balance our value and bluff hands into polarized ranges, such as polarized 3-bet and 4-bet ranges, which I'll show you how to do right now.

Developing a 1:1 Value-to-Bluff Polarized 3-Betting Range

To show you how this works, we're going to develop a simple 1-to-1 value-to-bluff polarized 3-betting range. To do this, we first need to determine what our 3-bet value range will be composed of, which for this example will be QQ+ and AKs:

- AA – 6 Combinations
- KK – 6 Combinations
- QQ – 6 Combinations
- AKs – 4 Combinations

This gives us a total of 22 combinations of value hands. Next, we add close to 22 combinations of 3-bet bluffing hands. I personally like to use small pocket pairs, suited connectors and small suited Aces, so we'll add some until we get close to 22 combinations of hands:

- 22 – 6 Combinations
- A2s – 4 Combinations
- A3s – 4 Combinations
- 87s – 4 Combinations
- 98s – 4 Combinations

We now have a total of 22 combinations of 3-bet bluffing hands, giving us a balanced polarized 3-betting range that looks like the following:

3 Bet Value Hands		**3 Bet Bluff Hands**	
Hand	**# of Combos**	**Hand**	**# of Combos**
AA	6	22	6
KK	6	A2s	4
QQ	6	A3s	4
AKs	4	87s	4
		98s	4
Total	**22 (50%)**	**Total**	**22 (50%)**

As you expand your value range, you can expand your bluffing range accordingly to maintain a 1:1 value-to-bluff polarized 3-betting range.

Conclusion

While this was only a brief introduction to Combinatorics, we covered a lot of concepts related to hand combinations and how you can utilize them to analyze your poker game both while you play, and during in-depth, off-the-table analysis.

Remember, we can use hand combinations to determine the likelihood of our opponents having any particular starting or made hand, as well as use it to develop balanced ranges.

It's especially useful, in both on the table and off-the-table analysis, to see exactly how many combinations of hands are in your opponents' ranges, in order to determine how many beat you versus how many you potentially beat. As you can probably imagine, understanding hand combinations allows you to further advance your hand reading abilities, as well as to start utilizing more advanced concepts, such as blockers, in your poker game.

There are many resources on the Internet discussing hand combinations in detail – if you are interested in finding out more on this topic, I highly recommend that you simply Google "Poker Hand Combinations", as well as practice determining hand combinations on your own from previous hands you have played.

SECTION 6: CONCLUSION & REFERENCE MATERIALS

Chapter 19. Conclusion and Congratulations

Congratulations

I would like to congratulate you on finishing this book on essential No-Limit Hold'em Poker mathematics. If you previously read the original edition of this book, I hope you learned much more in this extended edition. We covered a wide array of essential (and hopefully easy-to-learn) poker mathematics topics in this book that you'll now be able to implement into your poker game to give you the best chance of making more +EV decisions than your opponents. Hopefully this book has shown you how powerful, yet simple, basic No-Limit Hold'em mathematics really are.

Moving forward, I implore you to continue to study any topics and subjects in this book that you feel need additional review. Your goal should be to be able to implement everything you have learned in this book at the poker table with speed and accuracy.

Your Free Poker Course

As a special thank you to my readers, everyone who has purchased this book will receive free enrollment into my *Essential Poker Math* course at MicroGrinder Poker School. To claim your free course, follow the steps below:

1. Take a screenshot of your proof of purchase on Amazon
2. E-mail me your proof of purchase to **support@microgrinder.com**
3. I'll e-mail you your free enrollment code!

One Last Thing…

If you enjoyed this book and found it useful, I'd be very grateful if you'd post a short review on Amazon. Your support really does make a difference and I read all of the reviews personally so I can get your feedback and make this book even better.

Thanks again for your support!

Glossary of Terms

3-Bet : The act of re-raising the initial raiser during pre-flop action.

All-In : The act of putting all of your remaining chips in the pot during a round of betting.

Backdoor Draw : A draw that requires two cards to complete the draw.

Big Blind : The larger of the two blinds in the game.

Blank Card : A card that does not improve your or your opponents' hand.

Blind : A forced or partial bet put in by one or more players before any cards are dealt. There's typically a small blind and big blind in No-Limit Hold'em.

Blocker : A card that reduces the number of combinations of hands in a player's range.

Bluff : To bet or raise with little to no equity in the hand, with the intention of making your opponent(s) fold better hands.

Board Texture : Refers to the suitedness and connectedness of the cards on the board and how it connects hole cards.

Button : A small, white, acrylic disk that indicates the dealer position in the hand. The dealer button moves clockwise each hand.

Continuation Bet : A continuation bet is when the pre-flop raiser continues with a bet on the flop.

Check/Call : Checking with the intention of calling a bet.

Check/Fold : Checking with the intention of folding to a bet.

Check/Raise : Checking with the intention of raising a bet.

Combination Draw : A combination draw is a combination of two or more draws, such as a straight and a flush draw.

Dominated Hand : A hand that's dominated by a better hand due to its kicker card. For instance, KT is dominated by KQ.

End of Action Spot : The last possible action in a hand, such as a player betting all-in.

Equity : Your rightful share of the pot based upon how often you expect to win.

Expected Value (EV) : The amount you expect to win or lose on average when you make a certain poker play.

Flop : The first three community cards placed face up by the dealer.

Flush Draw : To have four cards to a flush with one or more cards to come.

Fold Equity : The likelihood that you expect your opponent to fold when facing a bet.

Gut shot : Drawing to a straight with one of the middle cards missing, commonly called an inside straight draw.

Heads Up : When there are only two players in a hand.

Implied Odds : The amount of money you expect to win on later streets if you hit your draw. Typically used in situations where you're getting bad pot odds.

Jam : To move all-in in No-Limit Hold'em.

Muck : To fold your hand.

Nuts : The best possible hand that can be made after the flop, turn, or river.

One-Gapper : A starting hand with two cards two apart in rank. For instance J9 or T8.

On the Button : To be in the dealer’s position and accordingly last to act throughout each post-flop betting round.

Open-Raise : To raise first into the pot pre-flop before any other player has called or raised.

Open-Limp : To call the 1bb pre-flop as the first person to voluntarily enter the pot.

Outs : Cards left in the deck that will improve a drawing hand on future streets of action.

Pot Odds : The odds the pot is offering you. Specifically, the amount of money already in the pot compared to the bet size amount you must call to continue in the hand.

Rake : The amount of money a poker room or poker site charges per a pot.

Range : The possible range of hands a person has in a poker game.

Semi-Bluff : To bet or raise with a drawing hand that has reasonable equity, with the intention of making our opponents fold.

Set : When you hold a pocket pair and one of your cards is on the board, giving you three of a kind.

Set Mine : To call a pre-flop raise with the intention of flopping a set.

Small Blind : The smaller of the two blinds in the game.

Smooth Call : To call a bet or raise, instead of raising yourself.

Straight Draw : To have four cards to a straight with one or more cards to come.

Value Bet : To bet when you expect to have the best hand with the intention of getting called by the worst hands.

Reference Charts

I have compiled all of the important charts from this book in this chapter for easy future reference.

SPR Guideline Table

SPR	SPR Size	Hands to Commit
Low	0 to 2	Over Pair, Top Pair, Bottom 2 Pair
Medium	3 to 6	Top 2 Pair, Sets, Non-Nutted Flushes & Straights
High	7+	Sets, Nutted Hands

Common Pre-Flop Equity Scenarios

Scenario	Example	Equity Favorite
Over Pair vs. Under Pair	AA vs. QQ	AA (81.55%)
Over Cards vs. Pair	AK vs. TT	TT (56.17%)
Dominated Hand	KQ vs. KJ	KQ (73.16%)
Over Cards vs. Under Cards	JT vs. 68	JT (69.69%)

Odds-to-Percentage Table

Odds Ratios	Odds Percentages
1:1	50%
2:1	33%
3:1	25%
4:1	20%
5:1	16.7%
6:1	14.3%
7:1	12.5%

Common Drawing Hand Equity Scenarios

Draw	Outs	Flop Not All-In	Flop All-In	Turn
Flush Draw	9	9 x 2 = 18%	9 x 4 = 36%	9 x 2 = 18%
Open-Ended Straight Draw	8	8 x 2 = 16%	8 x 4 = 32%	8 x 2 = 16%
Over Cards 2-Pair Draw	6	6 x 2 = 12%	6 x 4 = 24%	6 x 2 = 12%
Gut Shot Straight Draw	4	4 x 2 = 8%	4 x 4 = 16%	4 x 2 = 8%

Common Drawing Hand Equities

Drawing Hands	Outs	Flop Not All-In & Turn Equity
Gut-Shot Straight Draw	4	8%
Over Cards 2-Pair Draw	6	13%
Open-Ended Straight Draw	8	17%
Flush Draw	9	19%
Flush + Gut-Shot Straight Draw	12	25%
Flush + OESD	15	33%

Starting Hand Probabilities

Starting Hand Probabilities	Percentage
AA or KK	0.90%
AK Suited or Offsuit	1.21%
AA, KK, QQ, JJ or TT	2.3%
2 Suited Cards: 10+	3.2%
Any Suited Connector	3.9%
Any Pair	6.3%

Outs to Equity Chart

# of Outs	% Flop Not All-In	% Flop All-In	Flop All-In Odds	% Turn	Turn Odds
1	2.1%	4.3%	22.5:1	2.1%	45:1
2	4.3%	8.4%	10.9:1	4.3%	22:1
3	6.4%	12.5%	7:1	6.4%	14.3:1
4	8.5%	16.5%	5.1:1	8.5%	10.5:1
5	10.6%	20.3%	3.9:1	10.6%	8.2:1
6	12.8%	24%	3.1:1	12.8%	6.7:1
7	14.9%	27.8%	2.6:1	14.9%	5.6:1
8	17%	31.5%	2.2:1	17%	4.8:1
9	19.1%	35%	1.9:1	19.1%	4.1:1
10	21.3%	38.4%	1.6:1	21.3%	3.6:1
11	23.4%	41.7%	1.4:1	23.4%	3.2:1
12	25.5%	45%	1.2:1	25.5%	2.9:1
13	27.7%	48.1%	1.1:1	27.7%	2.6:1
14	29.8%	51.2%	.95:1	29.8%	2.3:1
15	31.2%	54.1%	.8:1	32.3%	2.1:1

Common Pre-Flop All-In Scenarios

Common All-In Scenarios	Example	Equity Favorite	Equity Dog
Over Pair vs. Under Pair	AA vs. KK	AA (82%)	KK (18%)
Over Cards vs. Pair	AK vs. QQ	QQ (56%)	AK (44%)
One Over Card vs. Pair	AJ vs. QQ	QQ (71%)	AJ (29%)
Over Cards vs. Under Cards	AK vs. JT	AK (63%)	JT (37%)
Dominated Hand	AK vs. AQ	AK (74%)	AQ (26%)

Pot Odds Offered by Bet Sizing

Bet Size	Pot Odds Ratio	Pot Odds Percentage
1/4 Pot Sized Bet	5:1 Pot Odds	16.7% Pot Odds
1/3 Pot Sized Bet	4:1 Pot Odds	19.9% Pot Odds
1/2 Pot Sized Bet	3:1 Pot Odds	25% Pot Odds
2/3 Pot Sized Bet	2.5:1 Pot Odds	28.5% Pot Odds
3/4 Pot Sized Bet	2.3:1 Pot Odds	30% Pot Odds
Pot Sized Bet	2:1 Pot Odds	33.3% Pot Odds

Recommended Bet Sizing with Made Hands

Drawing Hand	Flop Not All-In & Turn Equity	Our Bet Size?	Pot Odds We Offer
Flush + OESD	33%	Slightly Over Bet Pot	Greater than 33%
Flush + Gut-Shot Straight Draw	25%	2/3 Pot-Sized or More	28.5% or more
Flush Draw	19%	1/2 Pot-Sized or More	25% or more
Open-Ended Straight Draw	17%	1/3 Pot-Sized or More	25% or more
Over Cards + 2-Pair Draw	13%	1/4 Pot-Sized or More	25% or more
Gut-Shot Straight Draw	8%	1/4 Pot-Sized or More	25% or more

Bluff Break-Even Table

Bluff Size	Reward:Risk Ratio using $100 Pot Size	Break-Even Percentage
1/4 Pot Sized Bet	$100:$25 = 4:1	20%
1/3 Pot Sized Bet	$100:$33 = 3:1	25%
1/2 Pot Sized Bet	$100:$50 = 2:1	33%
3/4 Pot Sized Bet	$100:$75 = 1.3:1	43%
Pot Sized Bet	$100:$100 = 1:1	50%

Hero Call Break-Even Table

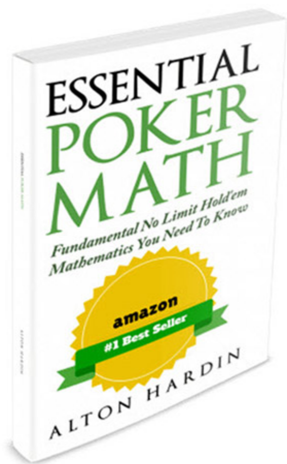
Villain Bet Size	Hero Call Pot Odds	Hero Call Break Even %
1/4 Pot Sized Bet	5:1 Pot Odds	16.7%
1/3 Pot Sized Bet	4:1 Pot Odds	19.9%
1/2 Pot Sized Bet	3:1 Pot Odds	25%
2/3 Pot Sized Bet	2.5:1 Pot Odds	28.5%
3/4 Pot Sized Bet	2.3:1 Pot Odds	30%
Pot Sized Bet	2:1 Pot Odds	33.3%

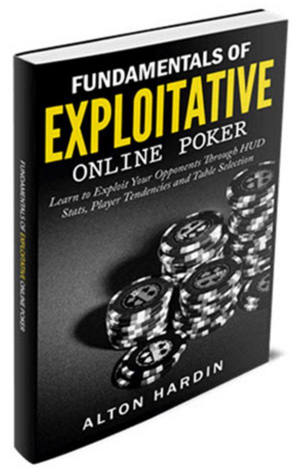
Hand Combinations Table

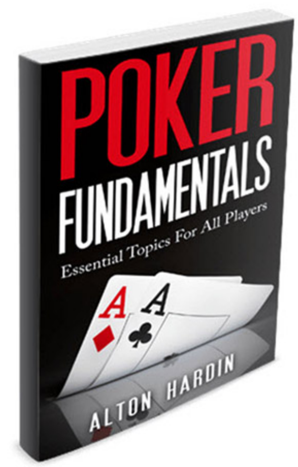
Hand Type	Example Hand	# of Combos	Exact Combos
Pocket Pair	AA	6	A♣A♠,A♦A♥,A♣A♦, A♣A♥,A♠A♦, A♠A♥
Non-Paired Suited Hand	KQs	4	K♣Q♣,K♠Q♠,K♦Q♦, K♥Q♥
Non-Pair Off-Suited Hand	KQo	12	K♣Q♦,K♣Q♥,K♣Q♠, K♦Q♣,K♦Q♥,K♦Q♠, K♥Q♣,K♥Q♦,K♥Q♠, K♠Q♣, K♠Q♦,K♠Q♥

More From Alton Hardin

Other Books By Alton Hardin







Connect with Alton

Find out more at www.MicroGrinder.com

YouTube
Page https://www.youtube.com/channel/UC6Sbyk7qnsiKJRLt2XyNytQ

Facebook Page

https://www.facebook.com/microgrinderpoker/

Twitter Feed

https://twitter.com/Micro_Grinder