MIT 15.S50 Lecture 1

January 11th, 2016

Welcome to MIT 15.S50!

- Instructor: Will Ma
- League Manager: Leigh Marie Braswell
- Credits: G 3 units

Schedule

Day	Location	Notes
Mon, Jan 11th	E62-276	Homework 1 out
Wed, Jan 13th	E62-276	
Fri, Jan 15th	E62-276	Homework 1 due
Wed, Jan 20th	E62-276	Homework 2 out
Fri, Jan 22nd	**E25-111**	
Mon, Jan 25th	E62-276	Homework 2 due
Wed, Jan 27th	E62-276	
Fri, Jan 29th	E62-276	guest speaker?

Grading

- Pass/Fail

- Need to do all of the following:
  - Attend at least 6 out of 8 lectures
  - Complete the 2 homeworks
  - Accumulate 10 points in the online Pokerstars league for MIT 15.S50

Pokerstars Tournament Lobby

Club Leaderboard

Pokerstars League

- Play money tournaments on Pokerstars
- Just try your best to win play money in the tournaments. This roughly translates to "points".
- The total points awarded for a qualified tournament are exactly equal to the number of players in the tournament. So a 20-player tournament awards 20 points and a 50-player tournament awards 50 points. The points awarded are spread across the top third of participants, with a higher proportion going to higher placements in the finish order. (Rounding may occur to ensure that total points equal total players and top third of players is a whole number.)

Prizes

- iPad Air Wi-Fi 16GB, courtesy of Jane Street Capital
- $200 Amazon gift certificate, courtesy of Akuna Capital
- (9) subscriptions to poker training website Cardrunners, with durations (in months) 6,4,3,2,2,1,1,1,1
- (2) one-hour private coaching sessions from Mike "Timex" McDonald, and myself
- (2) ifidelity Groove Bluetooth Speakers, courtesy of Jane Street Capital
- (2) BOOMPODS headpods, courtesy of Jane Street Capital
- (2) $50 Amazon gift certificates, courtesy of Akuna Capital
- (10) $20 Amazon gift certificates, courtesy of Akuna Capital (will be given during class and office hours)

Daily Tournament Schedule

- 6:00 PM – Daily 6-handed (2 hrs)
  7:00 PM – Daily Major (3 hrs)
  8:00 PM – Daily Turbo (2 hrs)
  9:00 PM – Daily Deepstack (3 hrs)
  10:00 PM – Daily Shortstack (2 hrs)
  11:00 PM – Daily Hyper-turbo (1 hr)
- Late registration for 1 hour
- Can multi-table
- Could change / have specials; talk to the League Manager

Tournament Policy

- Although this is a play money league for beginners, we want to see people trying to learn, playing their best poker.
- If we see regular behavior that suggests otherwise, we may kick you out of the league (and thus the class)
- Eg. Going all-in every hand, sitting out regularly, giving chips away to a friend

Stress of Playing

- Your tournament results will be visible to anyone in the league. Anyone in the league can watch you play hands.
- I hope no one is uncomfortable with this. We are all trying to learn.
- I hope it's a good social experience as well as a good learning experience.

Start playing right away!

- The 10 points requirements is actually very easy to meet, but the later you start, the harder it seems.
- It's difficult to relate to lecture material if you never play poker yourself.
- I do not want the 10 points requirement to be a source of stress for anyone. If you enjoy playing poker, play in lots of online tournaments, and cannot get to 10 points, I'll make considerations.

Other Fun Stuff

- MIT Poker Club in-person tournament
- MIT Pokerbots finals
- Everything happening weekend of Jan 30th–31st

Listeners

- Listeners are allowed, even if you are non-MIT
- Listeners are allowed to participate in online league (MIT poker club, Princeton poker club folks may join us)
- Only class participants are eligible for prizes

Attendance Tracking

- Approach Leigh Marie either before class, during the break, or after class
- Please don’t forget!

Syllabus

- Poker Concepts – preflop ranges, 3-betting, continuation betting, check-raising, floating, bet sizing, implied odds, polarization, ICM theory, data mining in poker
- Math Concepts – probability and expectation, variance and the Law of Large Numbers, Nash Equilibrium
- General Concepts – decisions vs. results, exploitative play vs. balanced play, risk management

The Decision Mentality

Expected Value ("+EV")

- Credit card roulette: poker players "split" the bill by selecting one person to pay at random
- Fair "on average"
- Saves time!
- Thrilling

Who is the Gentleman?

- Poker pro Matt goes to dinner with poker pro Steven and brings Emily, a close friend who he also has romantic interest in
- When the bill comes, Matt agrees to pay for Emily's meal by putting in two credit cards to Steven's one
- Matt, being a luck sack, pulls both his credit cards out before Steven's

Who should Emily thank for her meal?

Who should Emily thank for her meal?

- In this class, we want everyone to think in terms of EV and not results, so Emily should be thanking Matt.

- At the time, Emily thanked Steven for her meal. Matt was upset and told the entire poker community about it.

Law of Large Numbers

- Over your lifetime, the amount you end up paying from credit card roulette is the same as you would've paid from splitting the bill
- "All randomness eventually averages out to its expected value."
- What does "eventually" mean?

Risk

- The “riskier” the gamble, the longer it will take
- But no matter how risky, eventually it’ll get’cha!
- Death, taxes, and the Law of Large Numbers

Bad Decision, Good Result

- You get off the wrong bus stop because you were distracted
- Upset at yourself, you analyze how to not get distracted in the future
- You find $1000 on the ground at this wrong bus stop
- You immediately stop analyzing and marvel at your riches

In poker…

- Good decisions still yield a bad result 49% of the time
- Bad decisions still yield a good result 49% of the time
- You must have an insatiable desire to improve yourself, improve your decision-making, regardless of the result
- If you made $10000 in a situation where you could've made $12000, that's not good enough

Levels of Poker Reasoning

3 Levels of Reasoning

- Level 1: My hand vs. your hand

Jennifer Tilly hand

- “I thought you had pocket kings”
- http://www.poker.org/videos/jennifer-tilly-i-thought-you-had-pocket-kings-118900/

Example of Level 1 Reasoning

- “I thought you had pocket kings”
- No matter how strong a read you think you have on your opponent, to put your opponent specifically on KK out of all the possible combinations of cards is mathematically unfounded.

3 Levels of Reasoning

- Level 1: My hand vs. your hand
- Level 2: My hand vs. your range of hands ("Exploitative Play")

Example of Level 2 Reasoning

- We know opponent is tight and doesn't like bluffing
- We model opponent's range as AK-A8

Pot Odds

- The pot is currently 21000, 13000 from earlier betting rounds and the 8000 our opponent just put out.
- We are considering calling for 8000. If we lose, our net result from this decision is -8000. If we win, we get our 8000 back, as well as the 21000 in the pot, resulting a net of 21000.
- Therefore our win:lose ratio needs to be at least 8000:21000 for calling to be +EV.

Example of Level 2 Reasoning

- AK, AQ, AJ, A8 8 combos each. AT, A9 6 combos each. In total, 33 combos that beat us, 11 combos that we beat.
- Equity = 11/44 = 25%
- Pot odds = 21 to 8 ~ 2.56 to 1. Need equity 1/3.56 ~ 28% to call

Reading a Soul

- Hand reading is about using the opponent's past actions and your knowledge of their tendencies to tweak your probabilities on their hand
- Hand reading is not about pegging your opponent on a specific hand
- The sunglasses and ear-plugs are mostly a marketing scheme

“Exploitative Play”

- You can go very far with Level 2 reasoning, if you can build reasonable models for your opponent’s range and correctly compute the equities of hands.

- Level 2 reasoning is best targeted towards individual opponents with specific tendencies that you are trying to take advantage of.

Knowing the Enemy

The fatal flaw in every plan is the assumption that you know more than your enemy.

- Your opponent does not play according to a fixed static algorithm.
- They are an intelligent entity who is also building models for you, and adapting their strategy to beat you!

3 Levels of Reasoning

- Level 1: My hand vs. your hand
- Level 2: My hand vs. your range of hands ("Exploitative Play")
- Level 3: My range of hands vs. your range of hands ("Optimal Play")

Example of Level 3 Reasoning

- Given my previous actions in this hand, I will end up in this spot with the range AJ-A7,

“Optimal Play”

- I know my opponent’s propensity is to bet 1/1.6 of pot on the river, ie. in this situation they are risking 8000 to win 13000 with their bluffs.
- I must call with a frequency such that their EV from bluffing is 0.
- My call:fold ratio needs to be 1.6:1, ie. I must call 1.6/2.6~61.5% of the time. AJ is definitely in the top 61.5% of hands I can have, so I call.

Analogy with RPS

- Exploitative Play: “Since my opponent just played Rock 3 times in a row, I think their chances from playing Rock a 4^{th} time is diminished. Therefore, I will play Scissors.”

- Optimal Play: “I will memorize a sequence of random bits and always play each of Rock, Paper, Scissors with probability 1/3.”

How do you make money playing “optimally”?

- In RPS, you don’t.

- In poker, there are enough opportunities to be inconsistent (eg. call 65s but sometimes fold 76s in the same spot, eg. check-raise a strictly inferior range than optimal), that the theoretical “optimal” strategy will slowly extract money from even the best players.

“Nash Equilibrium”

Optimal Play	Exploitive Play
•Play R, P, S all with 33% probability (memorize a sequence of random bits?)	•Select between R, P, S by observing patterns in your opponent’s play
•You are indifferent to your opponent’s move	•You are susceptible to being out-read by your opponent
•Make money only when your opponent does something strictly suboptimal	•Make a lot of money when you are winning the mind games; lose a lot when you are losing them
•Good vs. opponents you respect	•Good vs. beginners
•Need to train your mentality	•Intuitive

Blinds, Position, and Equity

Who's Taller?

- Anyone can join the contest for $1
- The tallest person who joined gets the entire pot
- (also known as k-beauty game)

The Importance of Blinds

- Poker without blinds would be like the Who's Taller game.
- The motivation of every hand starts with stealing the money that was forced into the pot. Without the blinds, there is no game.
- You would always fold KK pre-flop if there were no blinds.

Stack Size

- Your stack size is always measured relative to the blinds. Having $400 in front of you in a game where the blinds are $1/$2 is, for our purposes, completely equivalent to having $4000 in front of you in a $10/$20 game.

- In both situations above, we say that you have “200 bets”, or “200 big blinds”, or “200BB”.

Effective Stack Size

- Why is stack size important? It essentially tells you "how much you're playing for", *relative* to the blinds.

- What we actually care about is *effective* stack size, which takes into account the stack sizes of the people remaining in the pot as well.

Calculating Effective Stack Size

- We are only wagering up to 12.5BB (the Big Blind's stack size).
- Sure, we could have wagered our entire 21BB vs. UTG+1 or UTG+2, but they have already folded.

Calculating Effective Stack Size 2

- Technically the effective stack size for Lojack is his entire stack (16BB), but only one person covers him, so in reality he is not risking 16BB vs. 5 people.

The Importance of Position

- How many players are remaining to compete vs. me for the blinds?
- The fewer players, the less strong my hand needs to be to attack the blinds.

Key to Naming Positions

- The key to naming positions is being clear how far away you are from the Button.
- UTG (Under-the-Gun) refers to the player to the left of the Big Blind, and is technically the same as Lojack in a 6-handed table … but it is much better to say Lojack since you know it is 3 from the Button. Alternatively, say “UTG at 6-handed table”.
- If everyone folds to you and you are Cutoff, you don’t even need to specify how many players were at the table, for the purposes of hand analysis.

Let's look carefully at position names on the same hands…

Let's look carefully at position names on the same hands…

Understanding Equity

- The equity of your cards is like your “secret height” for the Who’s Taller game.

- Your equity is the probability of your cards winning the pot (equivalently, the fraction of the pot you would win) once all the remaining cards are dealt.

Simple Example: Counting Outs

Simple Example: Counting Outs

- Hero has 8+9-3=14 outs.
- Equity = 14/44 = 7/22 ~ 1/pi ~ 32%

Example 2: Counting Hands

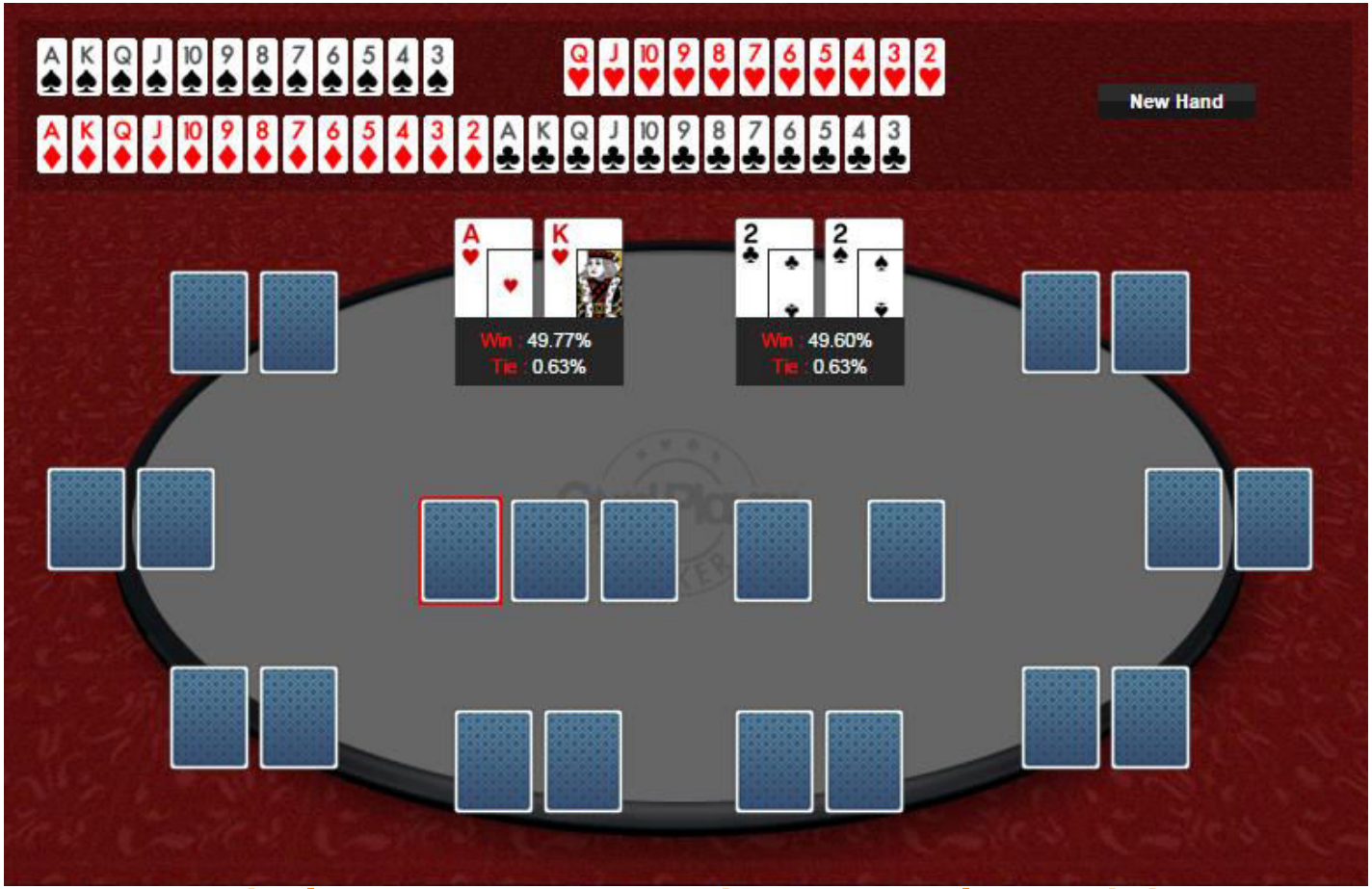
- We know opponent is tight and doesn't like bluffing
- We model opponent's range as AK-A8

Example 2: Counting Hands

- AK, AQ, AJ, A8 8 combos each. AT, A9 6 combos each. In total, 33 combos that beat us, 11 combos that we beat.
- Equity = 11/44 = 25%
- Pot odds = 21 to 8 ~ 2.56 to 1. Need equity 1/3.56 ~ 28% to call

Eg.3: All-in Preflop with Known Hands

Equity of AKs
= 50.085%



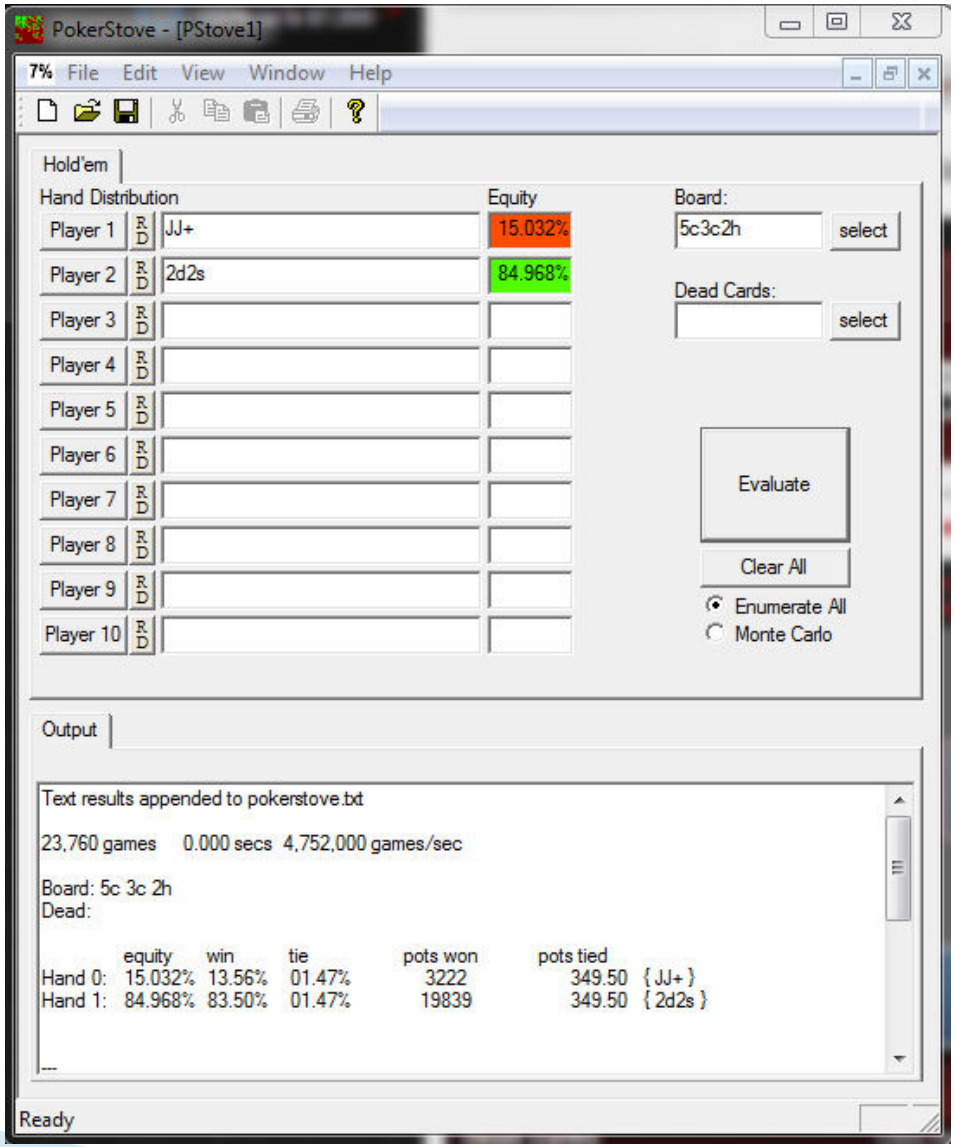
- http://www.cardplayer.com/poker-tools/odds-calculator/texas-holdem

Computing Equity in General

- 1st example was probability over river cards
- 2nd example was (Bayesian) probability over unknown
- Need calculator in general
- Download Pokerstove: http://www.thepokerbank.com/tools/software/pokerstove/

Eg. 4: All-in on Flop vs. Range

- Get it in with 2d2s on 5c3c2h vs. a range of JJ+
- Equity is ~85%



Summary of Equity

- You want to understand what equity means in every situation, and know how to calculate it (with Pokerstove).
- Examples:
  - Counting outs (can do in head)
  - Counting hands (can do in head)
  - All-in pre-flop (can memorize)
  - Anything more complicated (use Pokerstove a lot and try to memorize)

Raising to win Blinds and Antes

Antes

- An extra small bet that each player must put into the pot each hand; these sum to around a big blind
- Come in during the later stages of a tournament; inexistent in cash games
- This gives you so much more incentive to try to steal the blinds, since now essentially everyone posted a blind
- Don’t think of antes in the pot as just “the blinds are bigger”, since you don’t have to raise (and risk) any bigger to steal the blinds

What antes look like…

So you want the blinds…

- If no one has raised yet, do not call. Raise to give yourself a chance of winning the blinds without seeing a flop.

- This is definitely **beginner mistake #1**.

Raise Sizing

- The minimum raise is to raise to 2BB. However, this is a bit small. You give the blinds the odds to make a profitable call.
- On the other hand, if you raise to an amount too large (say all-in), you are risking more than necessary to make your steal.
- You want to hit that "sweet spot" between the minimum raise size of 2BB and all-in.
- Reasonable rule of thumb: raise to 2.25BB in tournaments.

Going All-in Preflop

- If you have 12BB or less (and there are antes), just go all-in, instead of raising to 2.25BB.
- Recall: rationale for raising big is to prevent blinds (and others) from calling for cheap; rationale for raising small is to lose less if we get re-raised and have to fold.
- But 12BB is little enough that you never really want to fold after committing 2.25BB, so all the benefits of raising small have disappeared
- Change rule to 10BB without antes

“To live, you must be willing to die”

- Being too scared to go all-in preflop is definitely **beginner mistake #2**.

What your goal should be

- Beginners tend to make all decisions based on their cards, ignoring what effective stack size they would be wagering, and position.

- Experienced players are willing to raise the blinds with much weaker hands from good positions, and risk going all-in a lot more frequently when their stack size is low. Their cards are almost the least important factor.

Concrete Opening Ranges

Tightish Range to Open from UTG at 9-handed table (7 players left)

Note how tight this is!

- Almost all beginners make the mistake of playing too many hands, especially from early position.

- Remember, only the best out of 9 hands wins the pot. When there's 9 hands, that hand will be very good! Second best gets nothing. So don't play a hand unless you think it can be the best of 9 hands.

Hands to add for UTG+1 (6 players left)

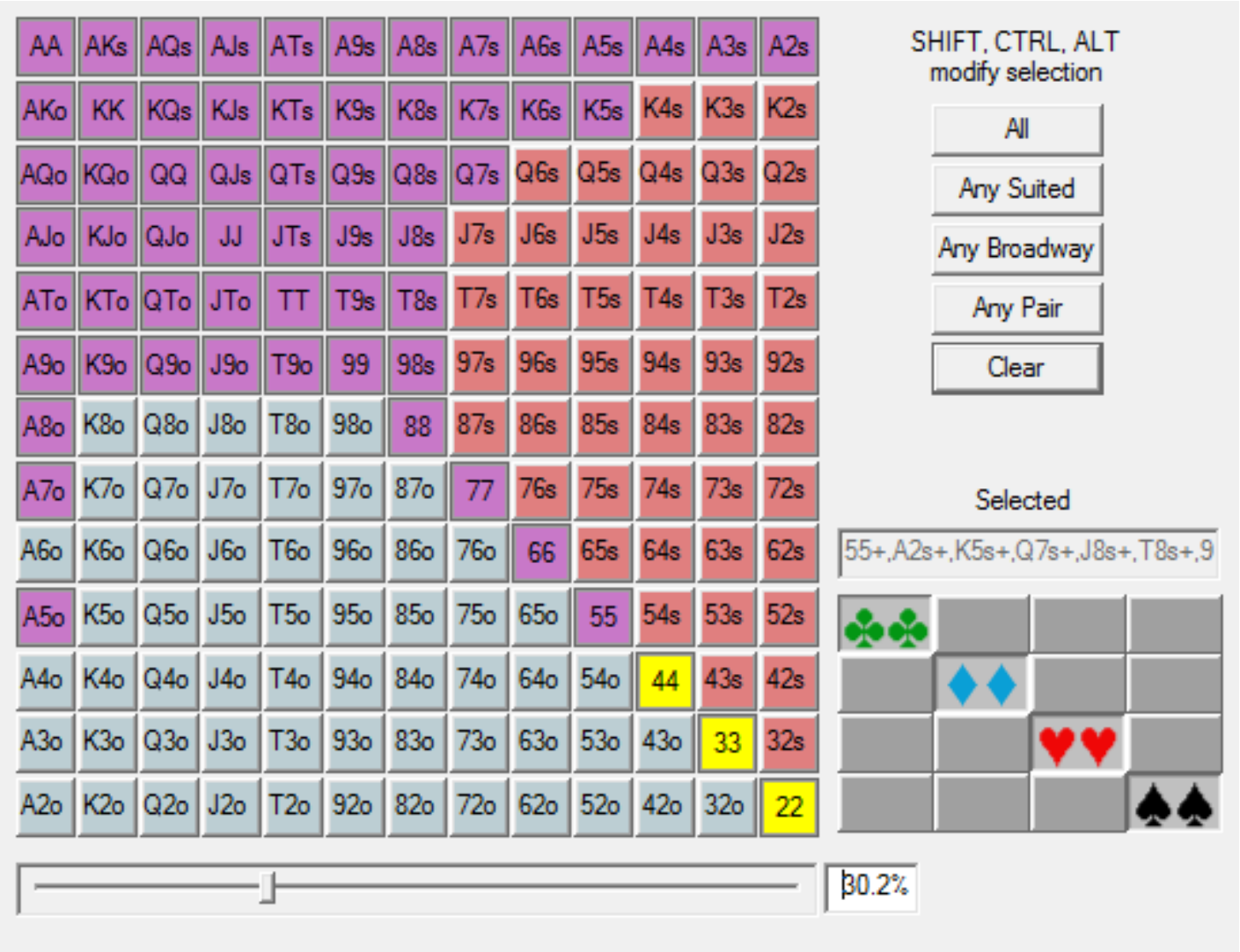
UTG+2 (5 players left)

4 to button

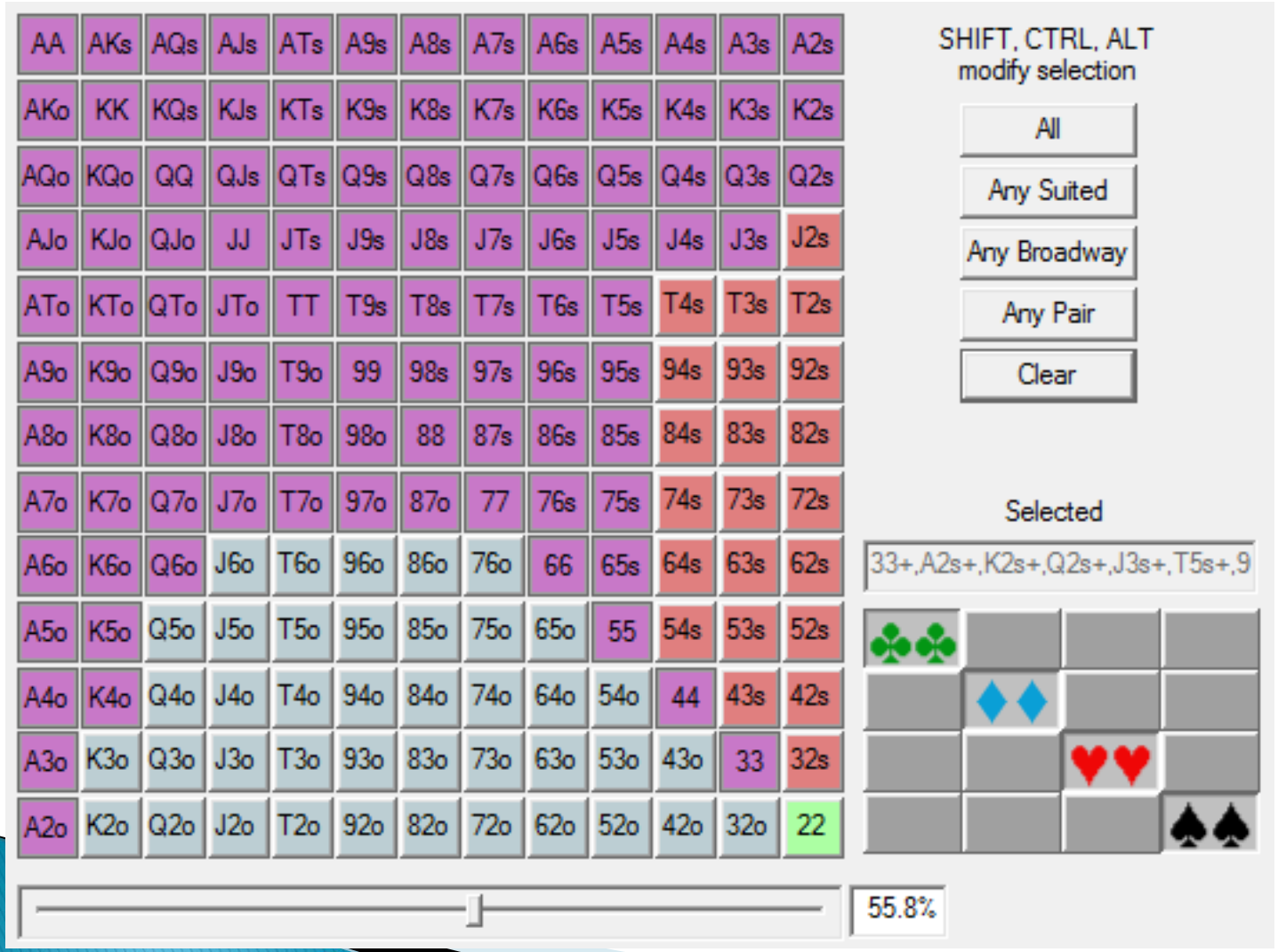

LEAVE TABLE
VIEW LOBBY
lehout
$3055
Aussie_star1
$3247
CutiePi314
$2960
BEGEMOTIK3
$2945
$40
$20
66+, AT+, A9s+, KQ, KJs
55, A8s, any two suited broadways, A9o, KJo
vunne
$1293
davidv1213
$2910
Sam7717
$3780
lotos64
$3000
andersbisse
$3135
Chat
Notes
Stats
Info
Last Action
BEGEMOTIK3 folds

Hijack (3 to button)

Cutoff (2 to button) : approx 30%



Button (1 to button): Approx 55%



Small blind

- Let's compare opening from the small blind to opening from the button.
- Opening from the small blind, you have to get through one fewer person
- You also have to wager less to raise, since half a bet has automatically been put in already.
- However, you are out of position.
- All in all, these factors balance out and you can open the same range from the small blind as you would from the button.
- The fact that you are out of position hurts less and less as stacks get shallower.

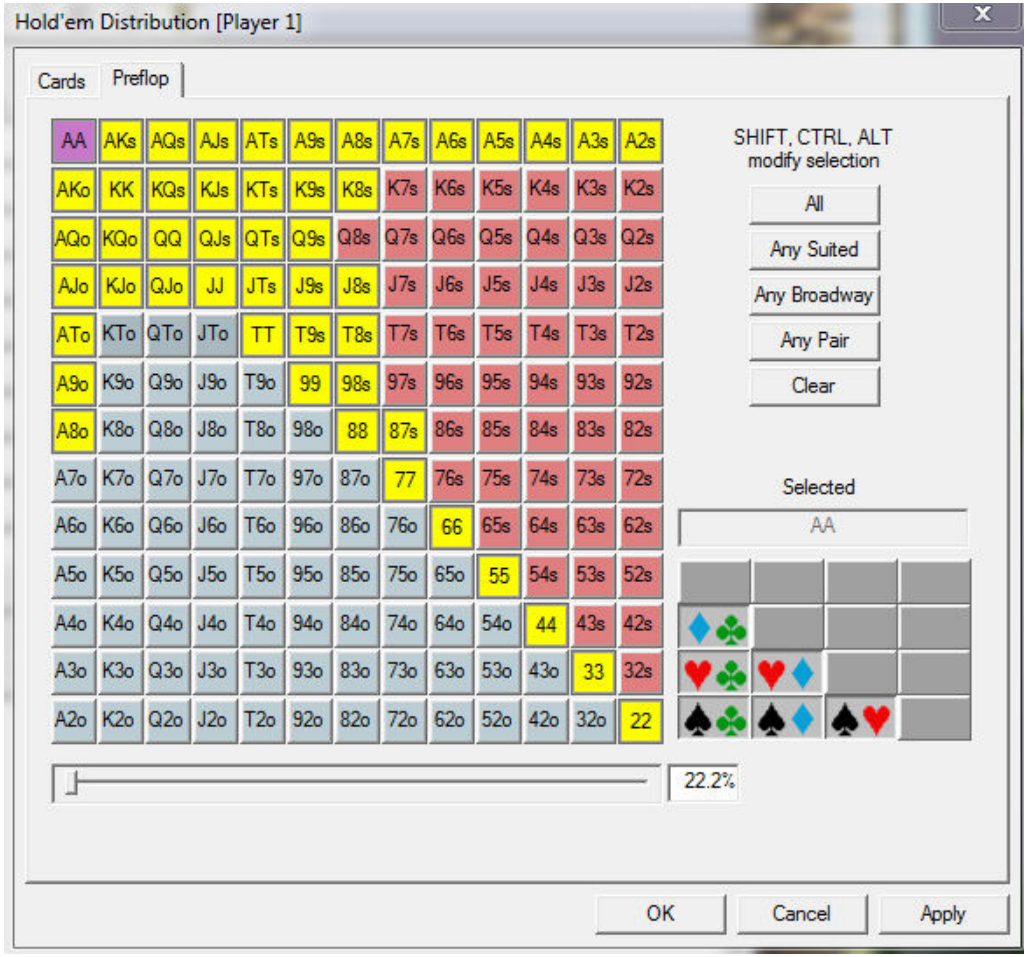
All-in Ranges vs. Opening

- When the effective stack size is closer to the minimum needed to be going all-in, your all-in range should be similar to the opening ranges I suggested

- When the effective stack size is much smaller (eg. 5BB), your all-in range can be a bit bigger, but not a lot bigger

What do you do here?

Some calculators say all-in with 22.2% is okay (approximately what you open)



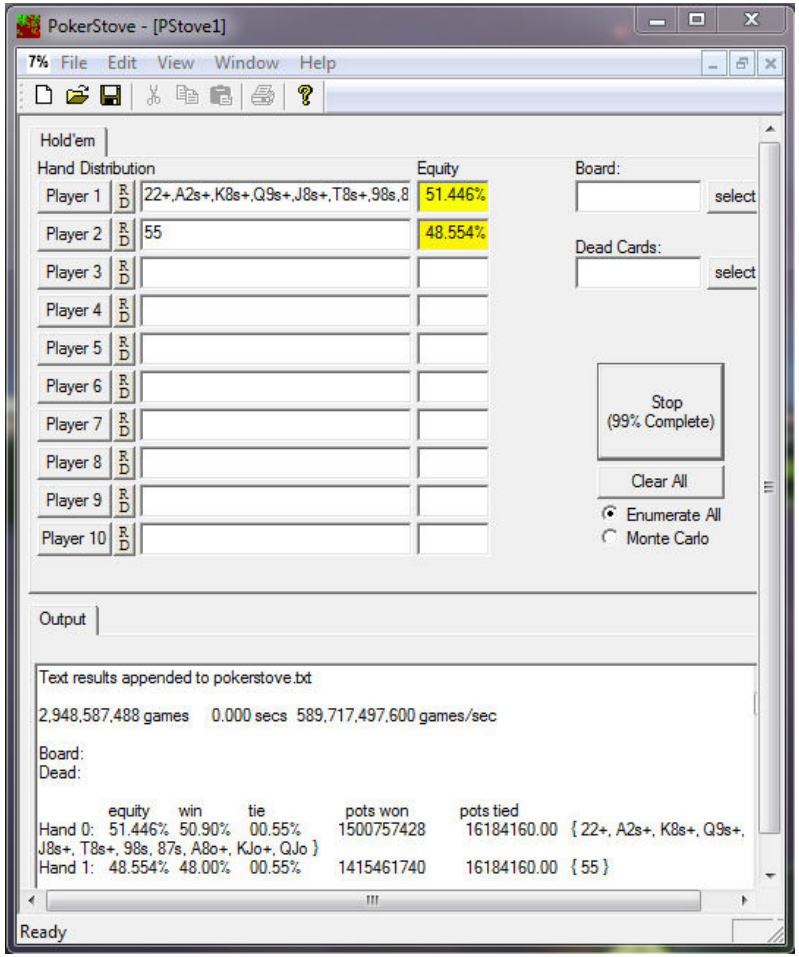
What range do you call with?

What equity should you need?

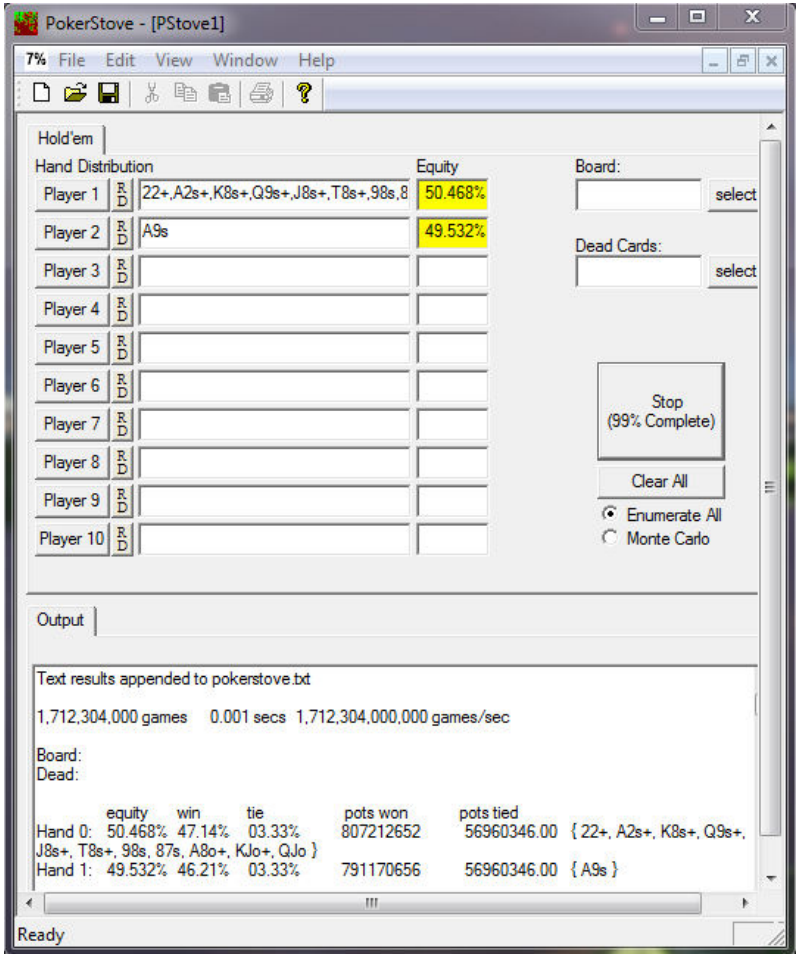
- A straight up pot odds calculation says
  - Getting 23 to 20 = 1.15 to 1 odds
  - Thus need 1/2.15 ~ 46.5%

- But 2 players behind who can wake up with monster hands, so in reality we need a bit more

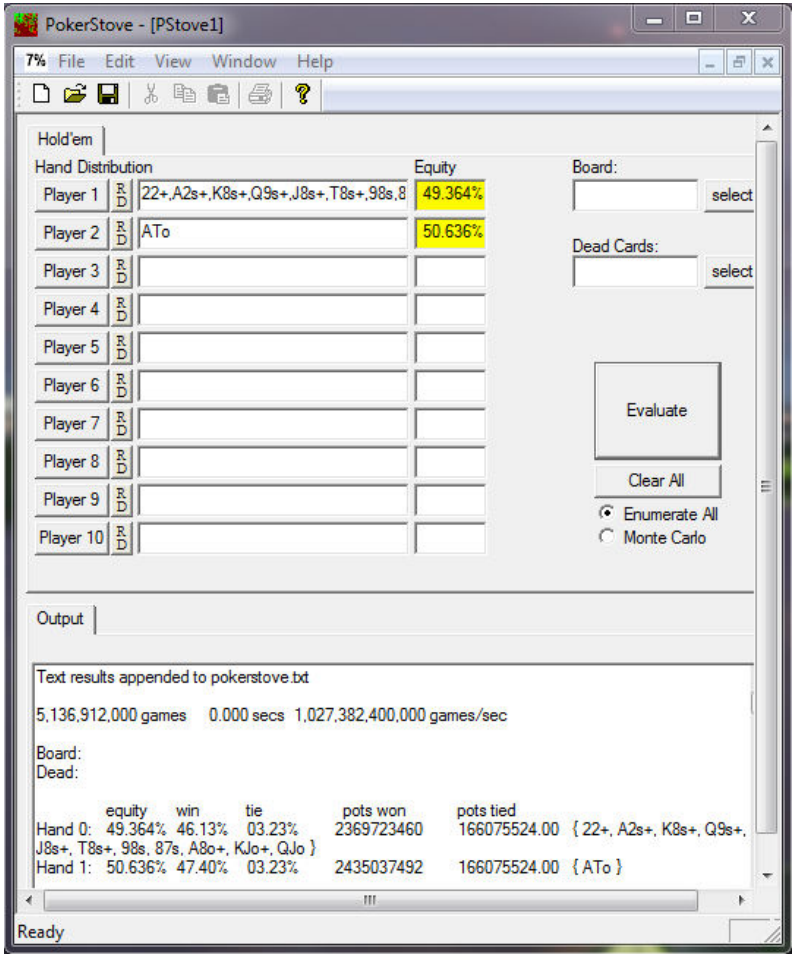
55+


PokerStove - [PStove1]
7% File Edit View Window Help
Hold'em
Hand Distribution
Equity
Board:
Player 1 R D 22+,A2s+,K8s+,Q9s+,J8s+,T8s+,98s,8 51.446%
Player 2 R D 55 48.554%
Player 3 R D
Player 4 R D
Player 5 R D
Player 6 R D
Player 7 R D
Player 8 R D
Player 9 R D
Player 10 R D
select
Dead Cards:
select
Stop
(99% Complete)
Clear All
Enumerate All
Monte Carlo
Output
Text results appended to pokerstove.txt
2,948,587,488 games 0.000 secs 589,717,497,600 games/sec
Board:
Dead:
equity win tie pots won pots tied
Hand 0: 51.446% 50.90% 00.55% 1500757428 16184160.00 { 22+, A2s+, K8s+, Q9s+, J8s+, T8s+, 98s, 87s, A8o+, KJo+, QJo }
Hand 1: 48.554% 48.00% 00.55% 1415461740 16184160.00 { 55 }
Ready

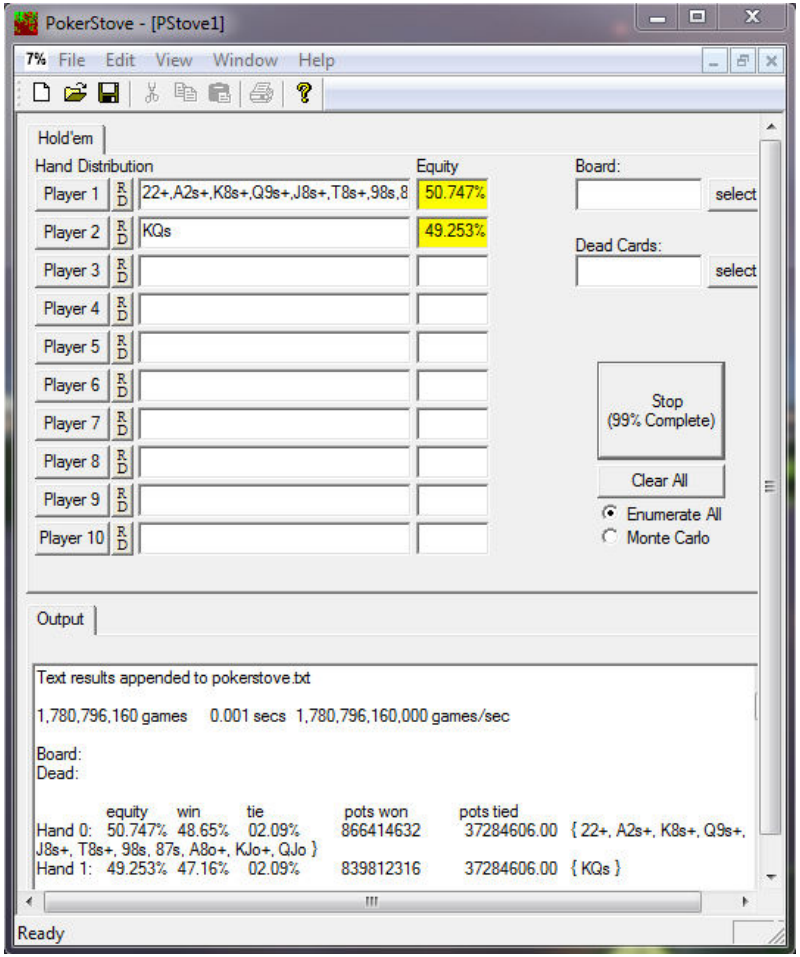
A9s+


PokerStove - [PStove1]
File Edit View Window Help
Hold'em
Hand Distribution
Equity
Board:
Player 1
22+,A2s+,K8s+,Q9s+,J8s+,T8s+,98s,8
50.468%
select
Player 2
A9s
49.532%
Dead Cards:
Player 3
Player 4
Player 5
Player 6
Player 7
Player 8
Player 9
Player 10
Stop
(99% Complete)
Clear All
Enumerate All
Monte Carlo
Output
Text results appended to pokerstove.txt
1,712,304,000 games 0.001 secs 1,712,304,000,000 games/sec
Board:
Dead:
equity win tie pots won pots tied
Hand 0: 50.468% 47.14% 03.33% 807212652 56960346.00 { 22+, A2s+, K8s+, Q9s+, J8s+, T8s+, 98s, 87s, A8o+, KJo+, QJo }
Hand 1: 49.532% 46.21% 03.33% 791170656 56960346.00 { A9s }
Ready

ATo+


PokerStove - [PStove1]
7% File Edit View Window Help
Hold'em
Hand Distribution
Equity
Board:
Player 1
22+,A2s+,K8s+,Q9s+,J8s+,T8s+,98s,8
49.364%
select
Player 2
ATo
50.636%
Dead Cards:
Player 3
Player 4
Player 5
Player 6
Player 7
Player 8
Player 9
Player 10
Evaluate
Clear All
Enumerate All
Monte Carlo
Output
Text results appended to pokerstove.txt
5,136,912,000 games 0.000 secs 1,027,382,400,000 games/sec
Board:
Dead:
equity win tie pots won pots tied
Hand 0: 49.364% 46.13% 03.23% 2369723460 166075524.00 { 22+, A2s+, K8s+, Q9s+, J8s+, T8s+, 98s, 87s, A8o+, KJo+, QJo }
Hand 1: 50.636% 47.40% 03.23% 2435037492 166075524.00 { ATo }
Ready

KQs


PokerStove - [PStove1]
File Edit View Window Help
Hold'em
Hand Distribution
Equity
Board:
Player 1
22+,A2s+,K8s+,Q9s+,J8s+,T8s+,98s,8
50.747%
select
Player 2
KQs
49.253%
Dead Cards:
Player 3
Player 4
Player 5
Player 6
Player 7
Player 8
Player 9
Player 10
Stop
(99% Complete)
Clear All
Enumerate All
Monte Carlo
Output
Text results appended to pokerstove.txt
1,780,796,160 games 0.001 secs 1,780,796,160,000 games/sec
Board:
Dead:
equity win tie pots won pots tied
Hand 0: 50.747% 48.65% 02.09% 866414632 37284606.00 { 22+, A2s+, K8s+, Q9s+, J8s+, T8s+, 98s, 87s, A8o+, KJo+, QJo }
Hand 1: 49.253% 47.16% 02.09% 839812316 37284606.00 { KQs }
Ready

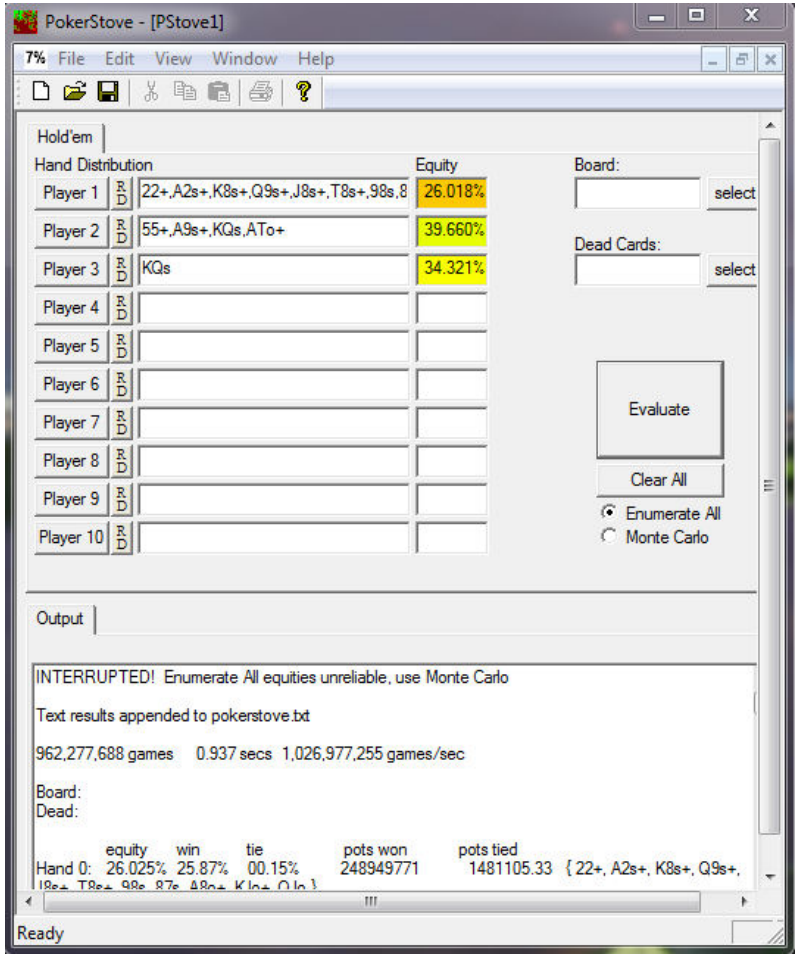
Do you call with, eg., KQs?

Improved Pot Odds

- Pot odds calculation:
  - Getting 43 to 18 = 2.39 to 1 odds
  - Thus need 1/3.39 ~ 29.5%

- There are no more players behind, so we need only this equity to call

Way more than enough!



Exact Hands


seat 9
$0.00
seat 1
$19.00
seat 2
$0.00
$20.00
$1.00
$20.00
seat 8
$20.00
PokerHandReplays.com
Pot: $61.00
seat 3
$20.00
$20.00
seat 7
$0.00
seat 6
$20.00
seat 5
$20.00
seat 4
$20.00

Preflop Equities

Who's ahead on the flop?

Turn


win:28.57%
tie:4.76%
seat 9
$0.00
seat 1
$19.00
win:0.00%
tie:4.76%
seat 2
$0.00
D
6
7
8
9
Pot: $61.00
seat 8
$20.00
seat 3
$20.00
win:66.67%
tie:4.76%
seat 7
$0.00
seat 6
$20.00
seat 5
$20.00
seat 4
$20.00

River


win:100.00%
tie:0.00%
seat 9
$61.00
Wins the pot
seat 1
$19.00
win:0.00%
tie:0.00%
seat 2
$0.00
D
seat 8
$20.00
seat 3
$20.00
Pot: $61.00
win:0.00%
tie:0.00%
seat 7
$0.00
seat 6
$20.00
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