Blackjack: Martingale vs Fixed Fractional Betting

Context:

All bankrolls started at £10,000

All bets are 5% of bankroll (£500)

Simulations are ran 1000 times (1,000,000 total games)

10 rounds = 1000 simulations

Mean Sharpe Ratio, Mean Ruin Probability and Mean Max Drawdowns are calculated after 10 rounds to improve accuracy and reduce random error.

Rounds	Metrics	Martingale	Fractional Betting
1	Win rate (%)	40.7	40.5
	Loss rate (%)	40.5	40.7
	EV per 100 hands (£)	-7500	-453
	Std dev of returns (£)	9100	4910
	Sharpe ratio	-0.824	-0.0923
	Ruin probability (%)	69.6	0.00
	Max drawdown (%)	100	94.9
2	Win rate (%)	40.6	40.6
	Loss rate (%)	40.7	40.5
	EV per 100 hands (£)	-2500	-500
	Std dev of returns (£)	9080	4930
	Sharpe ratio	-0.275	-0.101
	Ruin probability (%)	70.5	0.00
	Max drawdown (%)	100	94.6
3	Win rate (%)	40.9	40.5
	Loss rate (%)	40.3	40.8
	EV per 100 hands (£)	11500	-548
	Std dev of returns (£)	9390	4710
	Sharpe ratio	1.22	-0.116
	Ruin probability (%)	66.5	0.00
	Max drawdown (%)	100	94.7
4	Win rate (%)	40.7	40.5
	Loss rate (%)	40.5	40.8
	EV per 100 hands (£)	-7500	-3980
	Std dev of returns (£)	9340	4810
	Sharpe ratio	-0.803	-0.828
	Ruin probability (%)	65.2	0.00
	Max drawdown (%)	100	95.5
5	Win rate (%)	40.9	40.7
	Loss rate (%)	40.6	40.6
	EV per 100 hands (£)	-4000	5630
	Std dev of returns (£)	9150	4690
	Sharpe ratio	-0.437	1.20
	Ruin probability (%)	68.1	0.00
	Max drawdown (%)	100	95.9
6	Win rate (%)	40.9	40.6
	Loss rate (%)	40.4	40.6
	EV per 100 hands (£)	14500	-3940
	Std dev of returns (£)	9240	4970

	Sharpe ratio	1.57	-0.792
	Ruin probability (%)	68.6	0.00
	Max drawdown (%)	100	95.2
7	Win rate (%)	41.0	40.6
	Loss rate (%)	40.2	40.7
	EV per 100 hands (£)	-6000	-2180
	Std dev of returns (£)	9260	4580
	Sharpe ratio	-0.648	-0.477
	Ruin probability (%)	67.7	0.00
	Max drawdown (%)	100	95.2
8	Win rate (%)	40.7	40.7
	Loss rate (%)	40.6	40.4
	EV per 100 hands (£)	-3000	-1810
	Std dev of returns (£)	9060	4780
	Sharpe ratio	-0.331	-0.380
	Ruin probability (%)	69.4	0.00
	Max drawdown (%)	100	93.7
9	Win rate (%)	40.8	40.8
	Loss rate (%)	40.5	40.4
	EV per 100 hands (£)	-7000	-5270
	Std dev of returns (£)	9280	5170
	Sharpe ratio	-0.754	-1.02
	Ruin probability (%)	66.7	0.00
	Max drawdown (%)	100	96.0
10	Win rate (%)	40.4	40.7
	Loss rate (%)	40.8	40.5
	EV per 100 hands (£)	7000	15800
	Std dev of returns (£)	9030	4720
	Sharpe ratio	0.775	3.34 (outlier)
	Ruin probability (%)	69.1	0.00
	Max drawdown (%)	100	96.4

Mean Metrics after 10 Rounds	Martingale	Fractional Betting
EV per 10 hands (£)	-450	+275
Std dev of returns (£)	9190	4830
Sharpe ratio	-0.0507	+0.0734
Ruin probability (%)	68.1	0.00
Max drawdown (%)	100	95.2

Mean win rate = 40.8%

Mean loss rate = 40.5%

Martingale:

Mean Bet Size Over Time (Martingale) after 1000 session

Fixed Fractional Betting:

Balance Over Time (Fixed Fractional Betting) after 1000 sessions
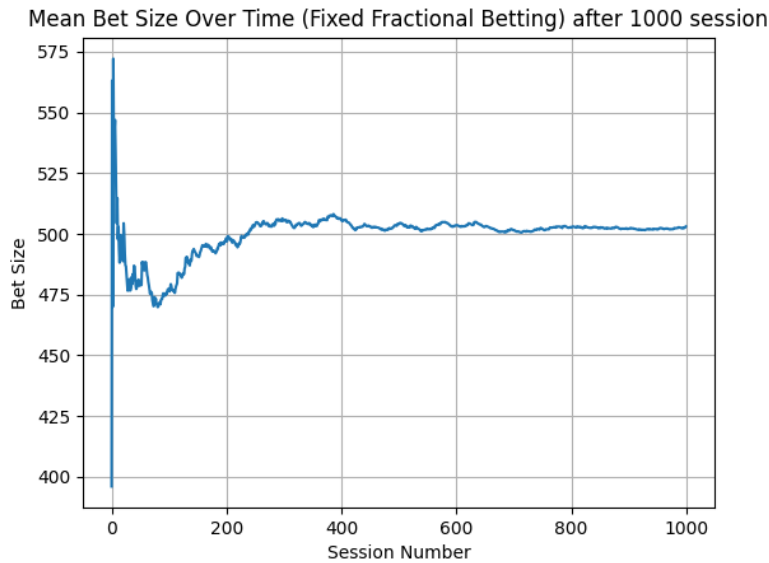
Mean Bet Size Over Time (Fixed Fractional Betting) after 1000 session
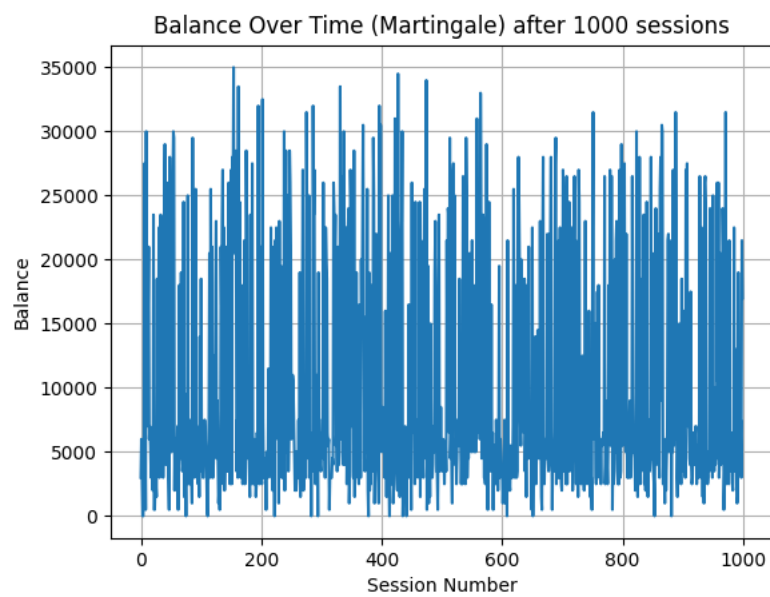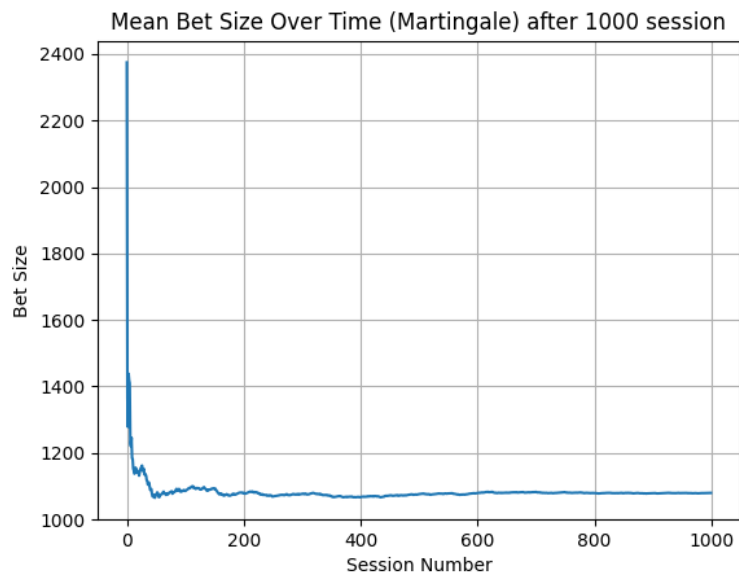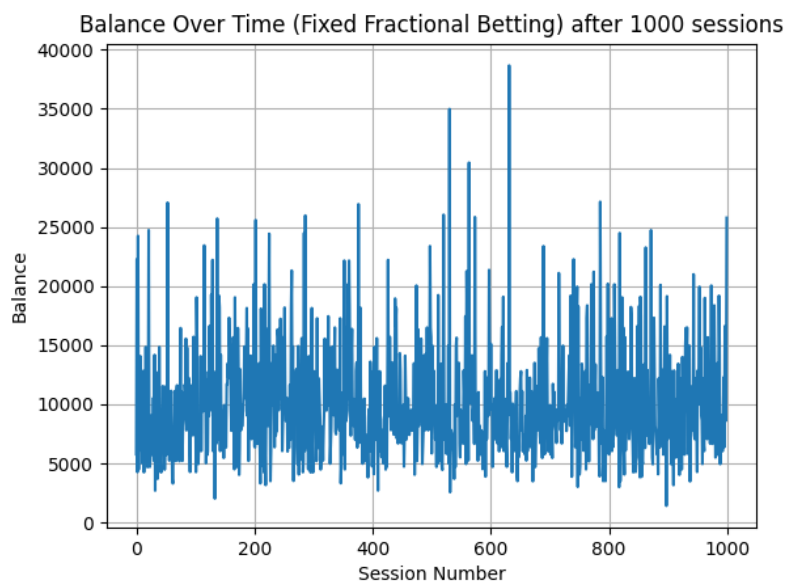
Conclusion

This simulation compared Martingale and Fixed Fractional betting strategies over 100,000 blackjack hands using Monte Carlo methods. While Martingale occasionally yielded gains, it displayed a high average ruin probability (68.1%) and consistent 100% drawdowns, highlighting its extreme fragility under realistic bankroll constraints. In contrast, Fixed Fractional betting avoided ruin entirely, delivered more stable performance, and achieved a slightly positive average return with lower volatility, demonstrating stronger risk-adjusted efficiency.

The generally low Sharpe ratios stem from the low average win rate of 40.8%, which reflects the simplified gameplay logic of hitting until reaching 17. A basic strategy table would likely raise the win rate by around 5%, but this study aimed to isolate the impact of betting strategy alone. Ultimately, the results demonstrate how aggressive recovery systems like Martingale fail under practical constraints, whereas conservative sizing strategies offer greater long-term viability.