G.O.A.T Algo Coaching

25 Position Sizing Models for Futures Algo Trading

There are hundreds of different position size models and an almost infinity amount of hybrid models. For this training and to keep things simple, we will start with 25 models shown in this document.

- **Fixed Models**

1. Fixed Lot Size
2. Fixed $ Risk per Trade
3. Fixed % of Equity (Fixed Fractional)
4. Fixed % of Starting Equity
5. Fixed $ Position Size (not risk, but notional)

- **Volatility-Based Models**

6. ATR-Based Sizing
7. Volatility Targeting (% Portfolio Volatility)
8. Risk Parity (Equal Vol Contribution)
9. Value-at-Risk (VaR)-Based Sizing
10. Max Drawdown-Constrained Sizing

- **Equity-Curve Based Models**

11. Fixed Ratio (Ryan Jones)
12. Drawdown-Based Throttling
13. Pyramiding on Growth Milestones
14. Dynamic Pyramiding (In-Trade)
15. Equity Curve Leveraging

- **Probabilistic / Formula-Based Models**

16. Kelly Criterion (Full)

17. Fractional Kelly
18. Optimal f
19. Secure f
20. Monte Carlo-Based Sizing

🔹 **Hybrid / Tactical Models**

21. CPPI (Capital Floor Model)
22. Time-Based Scaling
23. Reserve Capital Model
24. Anti-Martingale (Increase After Wins)
25. Capital Risk Reserve with Profit Unlocking

Position Sizing Models

Position sizing is a critical component of risk management for futures day trading. It answers the question **"How much of my capital should I put on this trade?"**. Below we present a comprehensive overview of major position sizing models, organized by category, followed by detailed explanations, examples, formulas, and pros/cons for each model. The focus is on futures day trading (e.g. E-mini S&P 500 (ES), Nasdaq (NQ), Gold (GC) futures) with a starting account equity of $100,000.

Summary of Position Sizing Models by Category

The table below groups the major position sizing techniques into five categories (Fixed, Volatility-Based, Equity-Curve Based, Probabilistic, and Hybrid/Tactical) and briefly describes each model:

Category	Model	Key Idea
Fixed Models	**Fixed Lot Size**	Always trade a constant number of contracts (e.g. always 1 ES contract per trade), regardless of account size. Simplest approach; does not adjust for equity changes or trade risk.

Category	Model	Key Idea
	Fixed $ Risk per Trade	Risk a fixed dollar amount on each trade. Position size is set so that the worst-case loss (based on stop-loss) is the same fixed amount (e.g. $1,000) every trade. As equity grows, this becomes a smaller % of equity.
	Fixed % of Equity	Risk a fixed percentage of current account equity on each trade (also called *fixed fractional*). Position size scales **proportionally** with account balance so that each trade risks, say, 1%–2% of *current* equity. This causes trade size to compound as the account grows.
Volatility-Based	**ATR-Based Position Sizing**	Uses **Average True Range (ATR)** or similar volatility measure to set position size. Larger positions in low-volatility conditions and smaller positions in high-volatility conditions, aiming to risk a consistent amount in terms of recent price fluctuation. For example, risk one ATR (or a fraction of ATR) per trade so that a 1 ATR move equals your chosen risk in dollars.
	Volatility Targeting (% Vol)	Adjusts position size to target a desired **portfolio volatility** level. For instance, increase leverage when recent portfolio volatility is below target and reduce exposure when volatility is above target, aiming to maintain a stable volatility (e.g. 10% annualized) for the account.
	Risk Parity (Equal Vol)	Allocate capital such that each asset or trade contributes equally to overall portfolio risk (volatility). In a multi-futures portfolio, more capital is given to less volatile contracts and less to more volatile ones so that each has equal volatility contribution. This balances risk across positions.
Equity-Curve Based	**Drawdown-Based Throttling**	Dynamically **reduce position sizes during drawdowns** to curb risk. For example, if account equity falls by a certain percentage from its peak, position size is cut (e.g. 50% size after 15% drawdown) to slow further drawdown. Size may be restored after recovery.

Category	Model	Key Idea
	Pyramiding on Growth	**Stepwise increase** in trade size as account hits new equity highs or profit milestones. Rather than continuously compounding each trade, the trader "pyramids" by adding additional lots only when equity grows by a set amount (e.g. add 1 contract every $10,000 profit). This is a discrete way to scale up on strength. (Ryan Jones's Fixed Ratio method is a specific formula-driven version of this.)
Probabilistic Models	Kelly Criterion	A formula-based **optimal bet size** given win probability and payoff. The classic Kelly formula $f^* = p - q/b$ gives the optimal fraction of capital to risk per trade. Full Kelly maximizes theoretical growth but leads to high volatility. Fractional Kelly (e.g. half-Kelly) is often used to moderate risk.
	Optimal f / Secure f	**Ralph Vince's Optimal f:** the fraction that maximizes geometric growth based on historical worst-case loss. Tends to be similar to Kelly for a given trade set but specifically uses the largest loss. **Secure f:** a variant of Optimal f that incorporates a maximum drawdown constraint– essentially finding the largest fraction that does not exceed a defined drawdown (more conservative than pure optimal f).
	Monte Carlo-Based Sizing	Determine position size through **Monte Carlo simulation** of trade outcomes. By simulating many random trade sequences (using your strategy's win/loss stats), you can find the largest risk per trade that keeps the probability of ruin or extreme drawdown below an acceptable level. In practice, this often means testing different fixed risk percentages via simulation to pick one that meets your risk tolerance with 95%+ confidence.
Hybrid & Tactical	CPPI (Capital Protection)	**Constant Proportion Portfolio Insurance** dynamically allocates between a risky asset (trading account) and a safe asset (cash) to protect a floor value. At all times, a *floor* (minimum protected equity) is set, and a **cushion = Equity**

Category	Model	Key Idea
		– **Floor** is calculated. A fixed multiple *M* of the cushion is allocated to trading (risky asset), and the rest to safe asset. If losses erode the cushion, exposure is cut; if equity rises, exposure increases, while ensuring the floor isn't violated.
	Time-Based Scaling	Increase (or decrease) position size according to a **time schedule** or performance periods, rather than immediately with each trade or equity change. For example, a trader might start with 1 contract and only scale up to 2 contracts after 3 months of profitable trading (consistent profitability over a defined period). This method rewards sustained success and can impose a minimum timeframe to prove strategy performance before risking more.
	Reserve Capital Model	A conservative approach where you **trade with only a portion of your capital** and keep the rest in reserve (unexposed). For instance, you might actively trade with 70% of your account and hold 30% in reserve cash. This reserve can cushion against losses or be deployed if needed, but generally it is kept back to limit the amount of capital at risk. By not fully leveraging all capital, you protect a portion from drawdowns (at the cost of lower maximum returns).

Pros and Cons of Key Position Sizing Approaches

Different position sizing models have varied strengths and weaknesses. The table below compares the pros and cons of each major approach or model group:

Position Sizing Model	Pros	Cons
Fixed Lot Size (constant contracts)	- *Simplicity:* Very easy to implement, no calculations needed each trade. - *Stable Trade Routine:* Position size doesn't fluctuate, so each trade feels the same.	- *Ignores Account Changes:* Does not compound gains – as equity grows, you risk a smaller % each trade, limiting upside. - *Risk Not Adjusted:* If equity falls a lot, you could end up

Position Sizing Model	Pros	Cons
		risking a larger % of remaining capital (potentially too much in a drawdown).
Fixed $ Risk per Trade	- *Fixed Loss Ceiling:* You cap the dollar loss on any given trade, aiding risk control and consistency in worst-case loss. - *Gradual De-Risking:* As account grows, that fixed $ becomes a smaller fraction, naturally becoming more conservative over time.	- *No Growth Leverage:* Does not scale up position with equity, so profits don't compound – leads to linear growth of equity at best. - *Not Adaptive:* Doesn't account for changes in market volatility or strategy performance; the $ risk is arbitrary without context of strategy edge.
Fixed % of Equity (Fixed Fractional)	- *Risk Scales with Equity:* Always risking, say, 1–2% keeps losses proportional to account size, preventing any single trade from wiping you out. - *Compounding:* Profits are reinvested automatically – position size grows as your account grows, accelerating equity growth over time. - *Mathematically Optimal (to a point):* For a given edge, there is a fraction that maximizes growth (Kelly/Optimal f); fixed % can be chosen near that for strong growth.	- *Volatility:* Compounding means account swings also grow – dollar drawdowns increase as equity increases. This can be emotionally challenging. - *Slow Recovery from Drawdown:* After a loss, dollar risk per trade drops (since equity is smaller), which can make recovering to new highs slower. - *Overbetting Risk:* If the chosen % is too high (near or above Kelly), risk of ruin rises dramatically due to sequence risk. Choosing the wrong percentage can lead to excessive drawdown.
ATR-Based Sizing	- *Volatility-Adjusted:* Automatically accounts for market volatility – you take smaller positions in volatile conditions, reducing chance of large losses. In calm markets, larger positions help not to underutilize capital. - *Consistent Risk in Price Terms:* By tying position size to	- *Requires Volatility Estimates:* Needs calculation of ATR or volatility for each instrument and periodic updates. Complexity is higher than fixed sizing. - *Whipsaw in Changing Volatility:* If ATR changes quickly (e.g. sudden volatility spike), your position size must drop quickly; if ATR falls, size

Position Sizing Model	**Pros**	**Cons**
	ATR (or similar), you risk roughly the same **price movement** (e.g. 1 ATR) on each trade. Traders can set stops at a fixed ATR multiple and size so that *ATR * size * value per point = desired $ risk*. - *Adaptable to Different Instruments:* Allows equalization of risk between instruments of different volatility or price (similar to risk parity concept on a per-trade level).	increases. This can cause variability in trade outcomes (a big position right when volatility was low could be risky if volatility returns). - *May Overshoot Risk if Gapping:* ATR assumes typical range; extreme gaps or moves can still exceed your planned risk.
Volatility Targeting (% Vol)	- *Stable Portfolio Volatility:* Keeps overall account swings more steady over time by adjusting exposure. This can make returns more predictable and drawdowns more controlled. - *Objective Risk Limit:* Clearly defines how much volatility you are willing to bear (e.g. target 10% annual vol) and manages position sizes to stay near that. - *Adaptive to Market Regime:* Naturally de-leverages in high-vol regimes (protecting capital) and re-leverages in low-vol regimes (boosting returns when things are calm).	- *Lag and Estimation Error:* Realized volatility must be estimated (often from recent historical data). Sudden shocks can exceed targets until the model adjusts. - *Underperformance in Low Vol:* If markets stay calm, you'll constantly leverage up to hit target volatility, which can backfire if a volatility spike occurs unexpectedly (leading to larger losses). - *Complexity:* Requires continuous monitoring of portfolio variance and rebalancing positions. It's more of a portfolio-level overlay, not as straightforward for single strategy trading as fixed fractional.
Risk Parity (Equal Risk)	- *Balanced Risk Distribution:* Prevents any one asset or market from dominating risk. Useful in multi-futures portfolios where, for example, equity indices might be less volatile than commodities – this method scales up the index	- *Mismatches Return vs Risk:* It ignores expected return; an asset with low volatility but poor returns would still get a big allocation. Equal risk contribution is not equal return contribution. - *Dynamic Changes:* As individual volatilities

Position Sizing Model	**Pros**	**Cons**
	positions and scales down commodity positions so each contributes equally to total risk. - *Diversification Benefits:* Tends to produce portfolios with lower volatility and more consistent performance across different market conditions by not over-concentrating risk.	change and correlations shift, need to constantly recalc weights. Can lead to turnover and trading costs. - *Not Single-Asset:* Primarily useful for portfolios of multiple assets; not directly applicable if you trade only one market at a time (in that case ATR-based or fixed % is more relevant).
Drawdown-Based Throttling	- *Capital Preservation:* By cutting down risk during downturns, it helps **avoid deeper drawdowns** or blowing up. This can be psychologically comforting and keeps you in the game to recover later. - *Discipline During Losses:* Provides a systematic rule to reduce leverage when you're trading poorly (or market is unfavorable), potentially preventing rash trades or "doubling down" in a slump.	- *Prolongs Drawdowns:* While it limits drawdown depth, throttling also means when you finally hit a turnaround, you're trading smaller size, so recovering the drawdown takes longer. You might gain back equity slowly. - *Rules Can Be Arbitrary:* Deciding how much to cut at X% drawdown is subjective (e.g. reduce 25% at 10% DD, 50% at 20% DD, etc.). Too aggressive cuts might underutilize opportunities; too light might not avert risk. - *Whipsaw Risk:* If a drawdown is brief and you reduced size, a sharp recovery rally could be undercapitalized because you had scaled down at the worst time.
Pyramiding on Growth	- *Accelerates Growth on Strength:* As profits accrue and milestones are hit, increasing position size in steps allows you to leverage your gains. It's a controlled way to compound – e.g. every $X profit, add 1 contract. This can boost returns faster than waiting for	- *Step Jumps in Risk:* The jumps in position size can cause a sudden increase in risk. Right after adding a contract, your next trade might be significantly larger, potentially causing a big equity swing if that trade is a loss. - *Arbitrary Milestone Setting:* Choosing the increment $ or

Position Sizing Model	Pros	Cons
	percent-based compounding because you add size in chunks once you can afford it. - *Buffer Before Adding Risk:* The use of milestones creates a buffer of realized profits before scaling up. You're effectively using "house money" (profits) to increase size, which can be safer psychologically.	percentage is tricky – too small and you might scale up too fast; too large and you underutilize capital for too long. - *May Ignore Current Risk/Volatility:* It focuses on past profits to add size, not whether current market conditions warrant it. If conditions worsen just as you pyramid up, you could be oversized for the new regime.
Kelly Criterion (Full Kelly)	- *Maximal Growth Theoretically:* Kelly sizing maximizes the long-run growth rate of capital if probabilities and payouts are exactly as estimated. No other fixed fraction will grow wealth faster **in the long run** than full Kelly. - *Objective, Mathematical:* Provides a formula-based answer to "how much to bet" given your edge (win probability and payoff). It's grounded in information theory and has a strong theoretical foundation.	- *Extremely Aggressive:* In practice, full Kelly is far too aggressive – it yields very large drawdowns and high chance of dropping a huge percentage of your bankroll along the way. Small estimation errors in win rate or payoff can lead to overbetting and ruin. - *High Volatility:* Equity swings are massive. A 10-20 consecutive loss streak (which will happen over thousands of trades) can cut equity dramatically when using Kelly-sized bets. Many traders cannot psychologically withstand the volatility of Kelly sizing. - *Requires Accurate Inputs:* You must know your **true** win probability and payoff ratio. Misestimating these – or them changing over time – invalidates the Kelly calculation and can result in disaster by overbetting.

Position Sizing Model	Pros	Cons
Fractional Kelly (e.g. ½ Kelly)	- *Much Improved Risk-Adjusted Returns:* Using a fraction (like ½ or ¼ Kelly) dramatically reduces volatility and drawdown risk while still achieving good growth—often close to optimal in practice. It provides a safer cushion against misestimation. - *Balances Growth and Risk:* Fractional Kelly offers a compromise between maximizing growth and minimizing the probability of large losses. Many find around half-Kelly gives a good trade-off (higher Sharpe ratio).	- *Still Needs Edge Estimate:* It inherits the need for accurate probability and payout inputs. If your strategy changes or the edge degrades, even a fractional Kelly could become too high. - *Not as Intuitive:* The concept of "Kelly fraction" might be hard for some to grasp compared to just saying "2% risk per trade". It feels more abstract (though it can be converted to a % of equity). - *May Underperform in Short Term:* Even fractional Kelly can lead to sequences of losses that, while not ruinous, set you back significantly. In the short-run, it might underperform simpler methods if luck doesn't favor the assumed probabilities.
Optimal f / Secure f	- *Customized to Worst-Case Loss:* Optimal f explicitly factors in the worst loss in your data, which can make it more *strategy-specific*. It finds the point of maximum growth given that worst loss as a limiting factor. Secure f further ensures drawdown constraints, which adds a layer of capital preservation. - *Maximizes Terminal Wealth (Historically):* If your past trade distribution is representative, Optimal f gives the fraction that would have most grown the account historically (with perfect hindsight of worst loss). Secure f then reduces this to satisfy a max	- *Highly Sensitive to Largest Loss:* Optimal f often ends up large (similar to Kelly) if the worst loss was reasonably small or an outlier. It can recommend dangerously high fractions that would cause intolerable drawdowns if a new "worst loss" occurs. Indeed, Optimal f shares Kelly's drawback of huge drawdowns. - *Retrospective and Static:* It's based on historical worst loss – which might not predict future worst loss. If you haven't seen the worst-case scenario yet, Optimal f will overestimate safe size. Secure f tries to cap drawdown, but you must choose a "max drawdown" parameter somewhat

Position Sizing Model	Pros	Cons
	drawdown criterion, which is useful to very risk-averse traders.	arbitrarily. - *Complex Calculation:* Determining Optimal f requires iterative or computational methods, and Secure f even more so (solving constrained optimization). It's not as straightforward as simpler position sizing rules.
Monte Carlo-Based	- *Data-Driven and Probabilistic:* Provides a robust way to account for the randomness of trade sequences. It answers questions like *"If I risk X% per trade, what's the probability of a 30% drawdown over 10,000 trades?"*. This helps tailor position size to a defined risk tolerance (e.g. 5% chance of ruin). - *Customizable to Strategy:* By sampling your actual trade distribution (or a model of it), Monte Carlo sizing can incorporate things like streakiness, fat tails, etc., giving a more realistic safety check than ideal formulas.	- *Computationally Intensive:* Requires running many simulations and possibly complex coding or software. Not easily done by hand. - *Only as Good as the Model:* Monte Carlo outputs depend on the assumptions (win rate, distribution of returns). If those inputs are off or if market conditions change, the "safe" size determined might prove unsafe. - *No Single Answer:* Unlike a formula that gives one optimal fraction, Monte Carlo yields a probability distribution. You still have to choose a trade-off (e.g. 95% confidence of <30% drawdown). This involves judgment; it's not fully automated.
CPPI (Capital Protection)	- *Downside Protection:* You have a guaranteed floor (e.g. never less than $X or never lose more than Y% of initial capital, in theory), because if equity falls, the model shifts entirely to safe assets once cushion is zero. This is attractive for capital preservation – you live to trade another day. - *Upside Participation:* Unlike a static stop-	- *Gap Risk:* CPPI isn't foolproof – a sudden overnight gap or a rapid crash could breach the floor before allocation can adjust. If a loss larger than cushion occurs quickly (exceeding 1/M in one interval), the floor can be violated. Futures gaps or limit moves can thus defeat CPPI guarantees. - *Opportunity Cost:* Capital in the "safe" asset (e.g. T-bills

Position Sizing Model	Pros	Cons
	loss of capital, CPPI lets you continue to invest (in scaled proportion) as long as there is cushion, so you can still capture upside of risky assets, with the multiplier providing leveraged exposure when conditions are favorable. - *Discipline and Automation:* It imposes a systematic rebalancing that can remove emotion – you don't have to guess when to cut risk; the CPPI formula does it based on cushion.	or cash) earns little compared to trading. In prolonged stable markets, CPPI might keep too much in safe asset due to a high floor, limiting returns. - *Parameter Choice:* The floor level and multiplier M are critical. Setting floor too high or M too low leads to very conservative posture (little participation in risk asset). Too low a floor or high M increases chance of hitting floor or big swing. Requires careful calibration, often based on backtests.
Time-Based Scaling	- *Prevents Premature Scaling:* By requiring a period of proven performance (e.g. X months) before increasing size, it can filter out lucky streaks or flukes. The trader earns the right to trade bigger by showing consistency. - *Psychological Ease:* Gradual scheduled increases (like every quarter) are easier to handle mentally than adjusting every trade. The trader can plan for the increase and prepare psychologically. - *Suits Prop Trading/Goals:* Many prop firms use time or profit milestones (e.g. "double your account in 6 months to get more capital"). This method aligns with those structures and encourages steady trading habits.	- *Ignoring Real-Time Equity Info:* Waiting for a time interval might be suboptimal – if you're doing very well early, you stay small longer than necessary (under-utilizing edge). Or if you do poorly but just squeak by time-wise, you might increase size when your equity is actually lower. - *Step Risk:* Similar to pyramiding, when the time comes to scale up, it's a step change in risk. If the timing coincides with a rough market period, the larger size can cause a setback. There's no guarantee that the end of a period is the "right" time to increase. - *Arbitrary Time Frames:* The choice of 3 months vs 6 months, etc., is heuristic. A system might degrade before the next scale-up date and yet you'd still increase size due to the calendar, which could be harmful.

Position Sizing Model	Pros	Cons
Reserve Capital Model	- *Cannot Lose Everything:* By always keeping, say, 20–30% of capital completely safe, you ensure a bad trading stretch won't wipe you out. It's a form of self-imposed leverage limit. - *Lower Emotional Stress:* Knowing you have reserve funds can reduce fear and emotional trading. You're effectively trading with an amount you're more comfortable risking, which can improve decision-making. - *Optional Reinforcement:* The reserve can be used strategically (though this is optional) – for example, you might inject some reserve money back into the trading account after a huge drawdown to help recovery, or conversely, move profits from the trading pool to the reserve periodically to lock them away.	- *Lower Returns:* You are not using all your capital to generate returns. If 30% is idle, your growth is slower than it could be if fully invested or if using that as margin. - *No Formal Mechanism:* Unlike CPPI, the reserve model is simplistic – it doesn't actively adjust positions; it just limits capital in play. So it's not a nuanced strategy, more a blunt reduction of exposure. - *Discipline Required:* One might be tempted to dip into reserves when trades are going well (thus negating the model), or conversely, hesitate to replenish trading capital from reserves when needed. It relies on trader's adherence to maintaining that reserve partition.

Next, we delve into each position sizing model in depth, with examples and formulas where applicable.

Fixed Lot Size (Constant Contracts)

What it is: Fixed lot size means you trade the **same number of contracts** on every trade, regardless of changes in account equity or market conditions. For example, a futures day trader might decide to always trade 2 contracts of the E-mini S&P (ES) on every setup. This is the simplest position sizing – effectively *no dynamic sizing* at all.

How it works: You determine a fixed position unit (e.g. 1 contract, or 5 contracts, etc.) and stick to it. If you have $100k and you decide on 1 ES contract per trade, you risk will depend on the trade's stop loss. One way to choose the fixed size is based on an initial risk preference. For instance, if 1 ES contract with a typical stop (say 10 points at $50/point) risks $500, that's 0.5% of $100k, which might feel comfortable. You then keep trading 1 contract every time. As the account grows, 1 contract represents a smaller and smaller fraction of the account (making your trading more conservative over time). If the account shrinks, 1 contract becomes a larger fraction (making your trading more aggressive relative to equity).

Example: Starting with $100,000, and always trading 1 NQ (Nasdaq) contract per trade. Suppose your strategy's average stop is 50 points and one NQ point is $20, so risk per trade is $1,000 (which is 1% of initial equity). If over 100 trades you net 20R (20 times your 1R risk), you'd make $20,000. The account would grow to $120,000. Now 1 contract at the same stop (still $1,000 risk) is only ~0.83% of equity. After 500 trades, maybe you net 100R = $100k profit; account = $200k, and 1 contract risk is 0.5% of equity. So risk exposure in percentage terms keeps dropping as you profit.

Key formula: There isn't much of a formula since it's constant. Position size = predefined constant number of contracts (or shares, lots, etc.). If using a stop-loss, you ensure that contracts × stop size × tick value = some fixed dollar risk (but if the stop size varies trade to trade, the dollar risk will vary too, unless you adjust contracts which you're not doing here).

- If one does want to roughly maintain a risk target in dollars with fixed contracts, you typically assume an average stop distance. For example: *Fixed 1 ES contract* with an average 2-point stop (2 points × $50 = $100 risk). But if a particular trade had a 4-point stop, you'd be risking $200 with 1 contract. So fixed lot doesn't strictly control dollar risk each trade unless you always use the same stop distance.

Pros: (see summary table) It's extremely simple – no calculations or changes needed. It imposes a consistent trading size which can simplify execution and psychology (every trade feels identical in size). It avoids "over-compounding" – your trade size never runs away to large levels, which keeps volatility in check.

Cons: It ignores the beneficial effects of compounding – your account grows linearly at best. It's not *adaptive*: it doesn't account for increased capital (missing out on potential higher profits) or decreased capital (which can become risky in a large drawdown). Over time, you're likely under-utilizing your capital if you're profitable.

When used: Fixed lot is common for beginners or small accounts (e.g. always trade 1 contract until comfortable increasing size) and in some systems testing (to isolate the effect of the strategy without compounding). It might also be used when external constraints require a fixed size (like prop firms sometimes cap size until certain conditions are met).

Considerations: Even if using fixed lots, one should revisit the lot size if the account changes significantly. For instance, if you lose 50% of your account, continuing with the same fixed size might now risk too large a % (time to reduce lot). Or if you double the account, you might decide to raise the fixed lot a bit. So in practice, “fixed” might be semi-fixed with occasional manual adjustment.

Fixed Dollar Risk per Trade

What it is: This method sets a fixed **dollar amount** to risk on each trade. For example, *“risk $500 on every trade.”* This means no matter the trade setup, you will size your position such that if your stop-loss is hit, the loss is $500. It’s similar to fixed % risk, but the risk amount is kept constant in absolute terms (dollars), rather than as a percentage of a changing equity.

How it works: Before each trade, you know your dollar risk target ($R). You also determine the trade’s stop loss in points or dollars per contract. Then you calculate the number of contracts that yields $R risk if the stop is hit. The formula is:

Contracts=$R(stop size in points×tick value).\text{Contracts} = \frac{\$R}{(\text{stop size in points} \times \text{tick value})}.Contracts=(stop size in points×tick value)$R.

You typically round down to the nearest whole contract. **Importantly**, $R is fixed and does *not* change as the account balance changes (unless you manually choose to adjust it periodically). So if your account grows from $100k to $150k, you might still be risking $500 per trade – which used to be 0.5% of equity, but is now ~0.33%. Conversely, if the account drops to $50k, $500 is now 1% of equity (a larger fraction).

Example: Starting with $100k, decide to risk $1,000 on each trade. If a trade on Gold (GC) has a stop $2.00 wide (Gold is $100 per $1.00 move for 1 contract), that’s $200 risk per contract. To risk $1,000, you take $1,000/$200 = 5 contracts. If another trade has a tighter $0.5 stop ($50 risk per contract), you could take $1,000/$50 = 20 contracts. In both cases, if the stop is hit, you lose $1,000. After 100 trades, suppose you made net +20R (20 × $1,000 = $20k profit), account = $120k. You still risk $1,000 next trade (now ~0.83% of equity). If account fell to $80k, you’d still risk $1,000 (~1.25% of equity) each trade.

Pros: It provides consistency in *worst-case loss per trade*, which can help psychologically (you know exactly “I could lose $X at most on this trade”). It’s easier to plan for drawdowns as well – e.g. if you have a 10 trade losing streak, you’ll lose 10 × $R = $10k. In a sense it *automatically becomes more conservative* as you grow (since $R becomes a smaller fraction of a larger account).

Cons: The method doesn't capitalize on growth – your risk as % of equity keeps shrinking as equity increases, so your rate of return diminishes over time if you never update $R. Conversely, in a big drawdown, $R might become a larger % of what's left, potentially accelerating the drawdown if you don't adjust. Many traders do manually adjust $R after significant equity changes (making it more like a stepped fixed-fractional), but by definition pure fixed-$ does not adjust continuously. Another drawback: it doesn't adjust to volatility or probability – $1,000 risk on an extremely volatile trade might be more dangerous than $1,000 risk on a calm trade, but this model treats them the same in dollar terms.

Use case: Some traders use fixed-$ risk as a pragmatic way to start (e.g. "I am comfortable losing at most $200 on any trade, that's my line in the sand."). It's also common in certain algorithmic backtests for simplicity. Over time, one might increase the fixed $ risk in chunks as the account grows (e.g. raise to $1,500 per trade after hitting $150k equity), blending into a pseudo fixed-fractional approach.

Implementation note: You must calculate position size each trade based on the stop distance. If a trade has no well-defined stop (e.g. discretionary exit), you might use technical levels (like ATR or chart structure) to estimate the worst-case loss and size accordingly. Fixed-$ risk really only makes sense when you have a notion of risk per contract (like a stop).

Fixed Percentage of Equity (Fixed Fractional)

What it is: Fixed % position sizing means you risk a constant fraction of your **current account equity** on each trade. This is also called **fixed fractional** sizing. A common rule is "risk 1-2% of your account per trade." As your account equity changes, the dollar risk per trade adjusts accordingly. This method naturally compounds your returns (and losses) because position size increases with equity and decreases with drawdowns.

How it works: Before each trade, you compute your current account balance and take a set percentage of it as the allowed risk. For example, if you use 2% and have $100k, you can risk $2,000 on the next trade. If you have a stop of known size, you convert that $ risk into contracts (similar formula to fixed-$ but with $R = % × equity). After each trade, you update equity and the next trade's risk budget is recalculated. Thus, after wins the position size grows a bit (since equity is higher) and after losses it shrinks (since equity is lower).

Formula: If *f* is the fraction (in decimal) to risk (e.g. 0.02 for 2%), and *E* is current equity, and *$LossPerContract* is the dollar loss per contract if stop is hit, then:

$$\text{Contracts} = \frac{f \times E}{\$LossPerContract}.$$

Always round down to be safe. The risk in dollars = $f \times E$ will change each trade as E changes.

Example: Start $100,000, risk 2% each trade. First trade: equity $100k, risk budget $2,000. Suppose you're trading ES with a 10-point stop (10 points×$50/point=$500 risk/contract). Contracts = $2,000/$500 = 4 ES contracts. If that trade wins $1,000 (2R), new equity $101,000. Next trade risk = 2% of 101k = $2,020. If next trade has stop risking $500/contract again, you take $2,020/$500 = 4.04, i.e. still 4 contracts (slightly more risk leftover). After a string of winners to $120k equity, 2% risk = $2,400, position sizes will have increased (would be 4 → 4 → maybe 5 contracts as equity crosses certain thresholds). Conversely, if you went down to $80k, 2% = $1,600 risk, so you'd trade only 3 contracts for that same $500 risk/contract setup. This ensures each loss is ~2% of equity at that time.

Over a long run, fixed % leads to **exponential growth**. For instance, 10,000 trades at an average of +0.1% per trade in expectation (just hypothetically) would compound enormously. The chart below illustrates how fixed % (green line, 2% risk) leads to steeper growth than a fixed-size approach (black line, 1 contract) which grows linearly. It also shows how aggressive fractions (like Kelly ~16.7% red, or half-Kelly ~8% orange) grow faster but with more volatility:

Simulation of 10,000 trades with fixed position sizing vs. fixed fractional (2%) vs. aggressive fractions. Log scale used on Y-axis to compare growth rates. Fixed 1 lot (black) grows linearly; 2% equity risk (green) grows exponentially; half-Kelly (orange) and full Kelly (red) grow fastest but with wild swings. (Starting equity $100k, trade distribution assumptions: 50% win, 1.5:1 payoff).

In the above simulation, the fixed 1-lot strategy ends near $300k, whereas 2% fixed fractional ends near $1.5 million – a huge difference caused by compounding. However, notice the red Kelly curve's jaggedness: it achieves high growth but with massive interim drawdowns (the log scale dampens how scary those swings are in absolute terms).

To further illustrate the **volatility** introduced by higher fractions, consider a zoomed-in shorter simulation:

Example equity curves over 100 trades for different risk fractions (linear scale). Fixed $ risk (constant $1000 loss, ~1% at start, yellow) and 2% risk (orange) show relatively smooth, modest growth. 5% risk (red) and full Kelly ~17% (magenta) show increasing volatility and *higher growth – the Kelly curve experiences a sharp dip around trade 50 (nearly –45% drawdown) before skyrocketing. This underscores the trade-off between growth and drawdown.*

Pros: The fixed % approach keeps your risk **proportional** to your account size at all times. You'll never blow up from one trade because even if the account is small, you're taking a fraction of it. It naturally **compounds gains** – as you make money, your position sizes increase, which can lead to accelerated growth. It's a well-regarded strategy in trading literature for maintaining consistent risk management. Notably, using an optimal fixed fraction (like Kelly fraction) is theoretically the fastest way to grow an account (though with caveats on risk).

Cons: The flipside is that losses also compound (in percentage terms you always lose, say, 2%, but as the dollars grow, a 2% loss when equity is high hurts more in absolute $). This can lead to large dollar drawdowns after significant growth. Also, when you hit a drawdown, your position sizes shrink, which means gaining back losses takes longer. For example, if you lose 20%, your trade size drops 20%, and a subsequent +20% gain only brings you 16% up (because it was on a smaller base). In essence, **drawdowns mathematically hurt more** under compounding. Traders often find that fixed fractional can result in *very long recovery times* from deep drawdowns unless the win rate or edge is high. Another con: choosing the percentage is tricky – too low and you don't leverage your edge enough, too high and you risk big drawdowns or ruin. The "optimal" (Kelly) fraction can be calculated but is highly sensitive to errors; most opt for a conservative fraction well below Kelly (like <½ Kelly) to buffer against bad luck or incorrect stats.

Rule of Thumb: Many professionals recommend **1-2% risk per trade** as a reasonable fixed fraction for active trading. At 1-2%, drawdowns are manageable (a 20 trade losing streak at 2% risk each is –33% drawdown; at 1% each, –18% drawdown). Going above ~5% per trade is generally considered very dangerous (for perspective, full Kelly for a decent strategy might be in the 5-20% range; half Kelly in 2.5-10%). Bankroll management research (from gambling and trading) shows that long-term survival and success often comes from using a fraction of Kelly.

Additional notes: Fixed fractional was extensively discussed by Ralph Vince and others. It's foundational to many other models (Kelly, Optimal f are basically trying to find the ideal fixed fraction). One should periodically re-evaluate the strategy's win rate and payoff – if they change, the chosen fixed % might need adjusting (what was 2% Kelly before might be 4% or 1% Kelly in new conditions).

ATR-Based Position Sizing (Volatility Adjusted)

What it is: ATR-based sizing adjusts position size according to the market's **volatility**, typically using the Average True Range (ATR) indicator. The goal is to risk a fixed amount in terms of price movement. In other words, a trade in a volatile market (high ATR) will be taken smaller, and a trade in a quiet market (low ATR) can be taken larger. This way, the *dollar volatility* of each position is normalized.

How it works: A common approach is to determine the dollar risk per trade (either fixed $ or % of equity) and divide it by the ATR (or ATR * some factor) to get position size. For example, say you want to risk $1,000 on a trade and you use the 14-day ATR of the futures contract as your risk unit. If ATR = $10 (in whatever units, e.g. for ES, ATR of 20 points * $50/point = $1000, just an example), then you might risk 1 contract because one ATR move = $1,000 on 1 contract. If ATR later goes down to $5, you could take 2 contracts for the same $1,000 risk (since now 1 ATR move on 2 contracts is $1,000). If ATR doubles to $20, you would take 0.5 contracts (which means at most 1 contract, but perhaps skip trade or adjust ATR multiple).

More formally, if ATR (in $ terms per contract) is *ATR_$*, and you allow *N* ATRs of risk (like setting stop at N * ATR), and you have $R risk budget, then:

Contracts=$RN×ATR_$.\text{Contracts} = \frac{\$R}{N \times ATR_\$}.Contracts=N×ATR_$$R.

Often N=1 or 2 ATR for stops in many ATR-based systems (e.g. a trend-following system may set stop 2 ATR away; then position size = $R/(2*ATR)).

Example: You have $100k. You decide to risk 1% of equity ($1,000) per trade. You will use a 14-day ATR for the instrument to size trades, with stop = 1 × ATR (for simplicity). If trading Crude Oil (CL) and current ATR(14) = $1.50 (meaning roughly $1.50 range per day, and 1 CL contract is $1,000 per $1 move, so ATR per contract ≈ $1,500), then one ATR risk on 1 contract is $1,500 which exceeds $1,000. So you would take $1,000/$1,500 = 0.66, i.e. **0 contracts** (position too small, you might skip or use a micro contract if available). If ATR drops to $1.00, one contract ATR risk = $1,000, so you can take 1 contract ($1,000/$1,000 =1). If ATR drops to $0.5, one contract = $500 ATR risk, you can take $1,000/$500 = 2 contracts. Thus, in more volatile periods you are either not trading or trading small; in calmer periods you trade larger size.

As another example: E-mini S&P (ES) with equity $100k, risk 1%. Suppose recent daily ATR = 40 points. Each point is $50, so ATR per contract = $2,000. If stop = 1 ATR, risk per contract $2k, so position = $1,000/$2,000 = 0.5 → 0 contracts (again too volatile to risk only $1k). If ATR later is 10 points ($500), $1,000/$500 = 2 contracts. If ATR falls to 5 points ($250), you could do 4 contracts for the same risk. Essentially you are inversely scaling position with volatility. **Volatility targeting** is similarly achieved, just at a portfolio level (ATR-based is typically per trade sizing).

Pros: The biggest advantage is **consistent risk in volatile vs calm markets**. You won't accidentally take a huge loss just because the market was more volatile than usual – ATR has you scale down in those times. It smooths out equity curve volatility. Also, ATR is instrument-specific, so it inherently accounts for differences between markets (e.g. you'll naturally trade more contracts of a low-volatility market and fewer of a high-volatility one, achieving a risk parity-like effect across instruments). Many trend following systems (like the famous Turtle Trading rules) used ATR for position sizing to ensure each trade risked ~1-2% of capital and to normalize risk across different futures contracts.

Cons: It requires calculation and monitoring of ATR or volatility. ATR is usually an average over a period (like 14 days), so sudden volatility spikes can still catch you – ATR will lag a bit. If a market's volatility regime changes drastically, your sizing might adjust after the fact. There's also the possibility of "over-adjusting": in whipsaw markets, ATR might expand, you cut size (right when maybe you could take advantage of big moves, albeit at higher risk), then ATR contracts, you increase size (maybe right before a volatility burst). So it's not a free lunch; it just manages risk. Another con: if you combine ATR sizing with tight stops (like much smaller than ATR), you might not utilize the full risk budget (because formula assumed a full ATR stop). One must align the ATR usage with how stop-loss is set.

Implementation detail: You typically recalc ATR regularly (daily or intraday). For day trading, one might use intraday ATR or volatility measures. Also, ensure ATR is converted to dollar terms per contract for futures (point value times ATR in points).

When to use: ATR sizing is popular in swing and positional trading where volatility varies over time. For pure day trading (flat by end of day), volatility might not change drastically day-to-day, but even intraday volatility cycles (morning vs afternoon) could be managed by adjusting size (though that's less common). Many systematic multi-market traders consider ATR-based sizing essential to equalize risk across markets like ES, NQ, bonds, commodities, etc.

Volatility Targeting (Percentage Portfolio Volatility)

What it is: Volatility targeting is a technique where you **adjust leverage to achieve a desired overall volatility** of your trading returns. Unlike ATR per trade, this typically looks at the **entire portfolio or strategy volatility** (e.g. standard deviation of daily returns) and increases or reduces position size to keep that volatility around a target level.

How it works: You estimate your strategy's recent volatility (say the standard deviation of daily returns over the last 20 days). Then, based on a target (for example annualized 10%

volatility), you scale your position up or down. If recent vol is lower than target, you increase position size until projected vol = target; if recent vol is higher, you scale down. This is commonly used by funds: e.g. if a strategy is quiet lately, they leverage it up to hit their risk target, and if it's swinging wildly, they dial it down.

In practice for a single futures strategy, one could do:

Position Scale Factor=Target VolRealized Vol.\text{Position Scale Factor} = \frac{\text{Target Vol}}{\text{Realized Vol}}.Position Scale Factor=Realized VolTarget Vol.

Then apply that to your baseline position (like baseline might be fixed contracts or fixed %). For example, if your strategy normally risks 1% per trade but realized volatility has only been ~5% annualized and you want 10%, you might double your position sizes (since 10/5 = 2). Conversely, if realized vol is 20% and you want 10%, you'd halve positions (0.5 factor).

Example: You trade ES and NQ throughout the month. At month's start, you target 8% annualized volatility. Suppose $100k account. 8% annual vol roughly means ~8%/√252 ≈ 0.5% daily stddev. If your current positions (maybe 2 ES or a mix) are yielding only 0.25% daily volatility (maybe markets were calm), you'd consider doubling size. If that yields ~0.5% daily moves, you're on target. If later volatility picks up and your daily swings become 1% (annual ~16%), you cut position maybe to half or so to bring daily swings back near 0.5%. This can be done continuously or with some buffer (so you're not constantly changing on noise).

For a more concrete number: say over last 1 month your trading P/L had stddev = $500 per day on average (0.5% on $100k). Your target was $1000 stddev per day (1%). You'd scale up positions by 2×. If your typical trade risk was 1%, maybe bump to 2% per trade until volatility of returns reaches desired level.

Pros: Your account volatility stays *consistent* over time. This is great for risk management at a portfolio level. It avoids situations where your strategy suddenly becomes much more volatile than you're prepared for – you will cut exposure proactively. It can also improve risk-adjusted returns: many strategies have higher Sharpe ratios when volatility-targeted, meaning you remove some "excess" risk and drawdowns without sacrificing much return (especially if the strategy has periods of high volatility with not commensurately higher returns). Many institutional strategies use volatility targeting as a core principle.

Cons: It assumes you can accurately measure volatility and that it mean-reverts to some extent. During abrupt regime shifts, volatility targeting might adjust too late or too slowly. For instance, if a market crash comes, your realized vol was low right before – you might have leveraged up (since things were calm) only to get hit by the crash at high exposure (this happened to some vol-targeting funds in 2018's volatility spike). There's also a potential to churn positions by adjusting too frequently on small vol changes. And if your strategy's edge correlates with volatility (for example, maybe it actually performs better in volatile times), cutting exposure in volatile times might cut your returns disproportionately. In day trading, implementing this requires computing daily P/L variance – which may be tricky if trades are not daily.

Use case: Common in *portfolio management*, e.g. risk parity funds and managed futures funds often use a vol target (like target 10% vol). For an individual trader, you might use a simpler approach: for example, set a maximum notional position such that if volatility (ATR or VIX etc.) goes beyond a threshold, you reduce all positions. In a way, ATR-based sizing per trade is a micro version, whereas vol targeting is macro (ensuring overall equity curve volatility is stable).

Risk Parity (Equal Risk Contribution)

What it is: Risk Parity is an approach mostly for portfolios: allocate capital such that each asset or strategy contributes equally to overall portfolio risk. In position sizing terms, if you trade multiple futures or strategies, you size each position so that **each one's volatility or VAR contribution is the same**.

How it works: The simplest form is Equal Volatility: make position sizes proportional to 1/volatility of the asset. E.g., if Gold has twice the volatility of Treasuries, invest half as much in Gold as in Treasuries. This equalizes the *stand-alone* vol of each position. A more rigorous risk parity considers correlations too (Equal Risk Contribution, ERC). The procedure typically is:

1. **Estimate risk (vol) of each asset** (e.g. recent stdev or ATR).
2. **Allocate inverse to volatility:** initial weights w_i ~ 1/σ_i.
3. **Adjust for correlations** if doing ERC: solve for weights such that each asset's marginal risk contribution (w_i * Covariance * w (portfolio)) are equal. In practice, numerical solvers or iterative methods are used.
4. **Leverage** (scale all weights) to desired total risk (this overlaps with vol targeting).

For a simpler understanding: if trading ES and NQ concurrently and NQ is 1.5× more volatile than ES, risk parity might say allocate 1.5× more capital to ES than NQ. So if you have $100k, you might allocate $60k worth of ES positions and $40k worth of NQ positions such that each produces similar volatility. The idea is your portfolio is not dominated by NQ's swings or ES's swings, both contribute equally.

Example: You have a strategy that trades ES, GC (Gold), and CL (Crude Oil) futures. You want each to contribute ~1/3 of portfolio risk. Suppose vol estimates (perhaps daily ATR% or stdev of returns) are: ES ~0.8%/day, GC ~1.2%/day, CL ~1.6%/day. Simplest equal-vol allocation would weight them proportional to 1/vol: ES weight ~1/0.8=1.25, GC 1/1.2=0.833, CL 1/1.6=0.625. Normalize weights: sum=2.708, so ES 46%, GC 31%, CL 23%. So you'd trade position sizes such that 46% of your risk is in ES, 31% in Gold, 23% in Crude. If using capital, maybe $46k allocated to ES contracts, $31k to Gold, $23k to Crude (notional or risk-based). After implementing, each should contribute ~equal risk (because 46%*0.8 ~ 0.37, 31%*1.2 ~0.37, 23%*1.6 ~0.37, roughly equal weighted risk). If one asset's volatility changes, you rebalance. For instance, if Gold volatility surges, its weight should be cut down to maintain parity.

Pros: The portfolio is more balanced – you're not putting all eggs in the low-vol basket or getting blindsided by the high-vol asset. Historically, risk parity portfolios (like balancing stocks vs bonds by risk) have shown smoother returns. In a multi-strategy or multi-market trading business, this ensures that each strategy/market has a voice and none overwhelms the total P/L variability.

Cons: One downside is it doesn't consider expected return. You might end up allocating a lot to something stable but with low return (because it's low vol) and less to a high-return but higher vol asset, potentially reducing overall returns. Also, risk parity can lead to leveraging up traditionally safe assets (like bonds) – which introduces leverage risks. In futures trading, all assets have high leverage potential, so risk parity might mean you take quite large positions in historically low-volatility markets (which could be dangerous if regime changes). There is also maintenance: you must recalc vols and covariances, and trade to rebalance the weights.

For a single instrument trader, risk parity isn't directly relevant (since there's only one asset). But if you trade multiple instruments even not concurrently (like you might allocate capital to one of several systems), you could use risk parity ideas to allocate more to systems with lower volatility or lower risk.

Relation to ATR sizing: ATR sizing across instruments with same % equity risk is actually a form of risk parity – each trade risks equal % so in effect equal risk per trade. But risk parity usually refers to continuous allocation in a portfolio context.

Fixed Ratio Position Sizing (Ryan Jones)

What it is: Fixed Ratio is a method introduced by Ryan Jones in *The Trading Game (1999)* specifically for futures contract scaling. It's a **profit-based pyramiding** approach with a twist: the amount of profit needed to add each additional contract follows a fixed schedule determined by a parameter called *Delta*. Unlike fixed % which considers account equity (and thus both profits and losses), fixed ratio focuses **only on net profit accumulation** to trigger size increases.

How it works: You set a **Delta** amount (in dollars). This Delta is the profit interval per contract. You start with 1 contract. Once you have accumulated $Delta in profits, you increase to 2 contracts. To add a third contract, you need another larger increment of profit, often *multiple* of Delta (the increments typically form a series). Specifically, the formula for the number of contracts N based on net profit P is given by Jones as:

N=0.5(1+8PΔ+1)N = 0.5 \left(\sqrt{1 + \frac{8P}{\Delta}} + 1 \right)N=0.5(1+Δ8P+1)

rounded **down**. This formula comes from solving for triangular numbers. In simpler terms, the profit thresholds to go from n contracts to n+1 contracts grow as a linear series: 1Δ, 3Δ, 6Δ, 10Δ, etc. (These are triangular numbers: $T_n = \frac{n(n+1)}{2} \Delta$ is the total profit needed to reach n+1 contracts).

To illustrate:

- Start at 1 contract.
- Profit needed to get to 2 contracts: $Δ.
- Profit needed (from start) to get 3 contracts: $3Δ (not 2Δ; the *additional* profit after the first Δ would be 2Δ, totaling 3Δ).
- Profit for 4 contracts: total 6Δ.
- For 5 contracts: total 10Δ, and so on.

After reaching a new level, if you lose some profit, you typically do *not* reduce contracts (Jones' method doesn't scale down on losses, it's one-way upward sizing; though a trader could impose their own rule to scale down if a big drawdown happens after adding contracts).

Example: Let's say $Delta = $5,000. (Jones suggests Delta might relate to account size and risk tolerance; smaller accounts might use smaller Deltas like $1k or $2k, larger accounts bigger.) Starting at 1 contract:

- When profit > $5,000, go to 2 contracts.
- To go to 3 contracts, total profit must exceed $15,000 (3Δ).
- To go to 4 contracts, profit > $30,000 (6Δ).
- 5 contracts requires > $50,000 profit (10Δ), etc.

So initially you need \$5k profit to add the second contract. But to add a third, you need another \$10k (so 15k total). The gap to add the 4th is \$15k more (30k total). The intervals between adding contracts are growing: +\$5k, then +\$10k, then +\$15k, … increasing by \$5k each time.

If you were trading ES and making say \$500 per trade on average, it could take quite a number of trades to hit each threshold. The idea is that as your account grows, the pace of reaching the next level might quicken (since you're trading more contracts, you accumulate profits faster – if the strategy continues to perform).

Jones often contrasted this with fixed fractional: fixed ratio disregards percentage or equity size and purely looks at profits. It means for smaller accounts it tends to be more conservative initially (since you start 1 contract and stick to it until you have Δ profit, regardless of if your account doubled due to one big win… because you consider realized profit, not balance). For larger accounts, at some point fixed ratio can become more aggressive than fixed % (because as account grows large, fixed % would have you maybe at more contracts than fixed ratio if profits haven't been "booked" continuously).

Pros: It is very **structured and easy to follow** – you know exactly at what profit milestones you will scale up. It encourages a *gradual pyramid*: you only add when profits justify it, which can be psychologically reassuring (you're "using profits" to finance more contracts). It's particularly touted for small accounts to grow without taking on too much size too soon. The risk per trade doesn't explicitly increase just because equity increased; it increases when you've shown an ability to accumulate profit. This can keep leverage in check during early growth stages.

Cons: A potential drawback is that it **ignores losses in the formula** – it's possible your account equity is much lower than your cumulative profit tally (e.g., you had profits, scaled up, then lost some). Pure fixed ratio would say as long as your *net* profit is above thresholds, you keep the higher size, which could lead to trading too large during a drawdown (since it doesn't scale down). It's a one-way ratchet unless you manually intervene. Also, determining Delta is somewhat arbitrary and critical: too low Δ and you'll scale up too fast (over-leverage), too high and you'll hardly ever scale. Jones suggested using something like Delta in relation to worst loss or drawdown (some recommend Δ ~ maximum loss or a multiple of it). Additionally, fixed ratio *does not consider percentage risk or probability* – it's a blunt profit-trigger method, so it might not be optimal in terms of growth or risk (more like a rule-of-thumb approach).

Comparison with Fixed %: Fixed ratio starts slower. For example, a \$100k account with Δ \$5k: you need \$5k profit (5%) to go to 2 contracts. Fixed 2% might have increased size earlier (because as soon as you have slightly more equity, it trades slightly more). But later on, fixed ratio might have you at, say, 5 contracts after $50k profit (account maybe $150k), whereas fixed 2% at $150k equity would likely be around 3 contracts (because 2% of 150k = $3k risk, if one contract risk is $500, then 6 contracts… wait depending on stop risk. Actually, let's say one contract risk $500, at $150k, 2% = $3k risk, that would allow 6 contracts theoretically. So fixed % can overtake after some time). It really depends on the profit trajectory. Jones noted that at very large account sizes, fixed ratio becomes impractical (needing enormous profit to justify further scaling), and one might switch to fixed % at some point.

Use case: This method is often mentioned in futures trading education materials. It's appealing for those who want a clear plan to scale up a small account. For example, a day trader starting with $10k might set Δ $2k: start 1 contract, after $2k profit (account 12k) go 2 contracts, after total 6k profit (account 16k) go 3 contracts, etc. It gives tangible goals. It's also sometimes used in prop firm trading plans, where you can only add size after earning a certain amount.

Pros and Cons Summary: (from table) The pros are controlled growth and simplicity; cons are that it doesn't adapt to risk per trade or volatility, and lacks a downscale mechanism.

Drawdown-Based Throttling (Dynamic Risk Reduction)

What it is: Drawdown-based throttling is a dynamic strategy to **reduce your position size when your account is in a drawdown**. In essence, you "hit the brakes" on risk after losing a certain amount, to prevent accelerating losses. It's like a safeguard: when things go poorly, trade smaller until you stabilize.

How it works: You establish rules tied to drawdown levels. For example: *"If I'm down 10% from my peak equity, I cut my position size in half."* Or a tiered approach: *5% down → reduce size 10%; 10% down → reduce 50%; 15% down → go back to minimum size (or stop trading temporarily)*. These are just illustrative – traders can set any thresholds and reduction amounts. The point is as equity declines from its high, you progressively risk less in dollar terms.

This can be implemented on top of any base sizing method. E.g., you might normally do 2% risk per trade, but once you hit 10% drawdown, you switch to 1% risk per trade (halved). Or if trading fixed contracts, maybe you drop from 3 contracts to 1 contract when in drawdown, etc.

Some traders tie it to losing streaks as well (e.g., after X consecutive losses, drop size by Y%), which is related since losing streak often equates to drawdown.

Example: Account started $100k, rose to $120k, then started dropping. You set: at –10% from peak (which would be $108k, since –10% of 120k down to 108k), cut risk. Let's say you were trading 4 contracts earlier; at 108k you cut to 2 contracts. If it keeps going down to –20% from peak (down to $96k), maybe cut to 1 contract or stop until you paper trade your way back. Now, suppose you stabilize at $95k and then start winning again. Some will say not to increase back until you recover at least part of the drawdown (maybe at least above $108k or $110k before going back to full size). Others might gradually scale back up as equity increases off the bottom (like a mirror of how they cut).

An example rule-set could be:

- 5% drawdown: reduce position size by 25%.
- 10% drawdown: reduce size by 50%.
- 20% drawdown: reduce to minimum (like 1 contract or 0.5% risk).
- Only resume original size after recovering to within 5% of prior equity high.

These are arbitrary but illustrate a pattern.

Pros: The main benefit is protecting your capital (and confidence) when the strategy might be underperforming. It limits the potential depth of drawdown – because as you lose more, you're betting smaller, so incremental losses have less impact, theoretically preventing a tailspin to ruin. Many traders find this psychologically comforting; it enforces discipline to not "chase losses" with the same or higher size. If your strategy has variability, this could stop a bad run from wiping you out, allowing you to live to see the next profitable period.

Cons: It can also **lock in a drawdown** or at least prolong it. If you cut size after losses, when the strategy rebounds, you're making less money (since you're trading small), so it takes longer to climb out. In fact, if you cut size too aggressively, you might never recover to the original peak if the edge is slight. For example, if you drop to one-quarter size after a loss streak, you now need a much larger number of wins to make back the same money. Another potential con: it's somewhat arbitrary and could undermine the strategy's expectancy. If your system is profitable long-term, you're essentially deviating from optimal betting during the slump – what if the best trades come after 15% drawdown? You'd be on small size and miss out. There's also a chance that by reducing size, you psychologically "freeze" and have trouble ramping back up, leaving you stuck in cautious mode even when performance is good.

Consideration: Some traders use *time-based reset* with this: e.g., if X days pass or if you have evidence the strategy is working again (maybe a new equity high), then you restore original size regardless of drawdown. Otherwise you risk permanently trading at smaller size than you could.

When to use: Throttling is often employed by traders concerned with *survival above all*. It's common in prop firms or fund mandates to cut trading size after hitting a drawdown threshold (risk managers enforce it). If one's trading strategy is uncertain or in development, a trader might impose drawdown rules to protect against unknown risk. It's also used by algorithmic traders who run multiple systems – if one system goes into drawdown beyond a limit, they allocate capital away from it (which is like throttling that system's trades).

Conclusion on this: It's a defensive technique. It sacrifices some potential recovery speed in exchange for safety. Ideally, if your strategy's edge is solid, you wouldn't need this; but because of uncertainty and human factors, many consider it prudent.

Pyramiding on Growth Milestones

What it is: This refers to **increasing position size in steps as your account grows**, typically at specific *milestones*. It's akin to fixed ratio but could be done less formally. The idea is to *pyramid* your trading size as you *reach new equity highs* or profit benchmarks.

How it works: You set equity or profit milestones – for example, "when my account grows by 20%, I will add one more contract to my trading size." Or "each $10k increase in equity, increase trade size by 1 contract (or by 0.5% risk)." These milestones could be percentage-based or absolute dollars (hence *growth milestones*). Unlike fixed fractional which increases continuously (even after a $100 gain, risk budget goes up a hair), pyramiding in this sense uses *discrete jumps*. You hold size constant until you clearly hit the next level, then you jump.

This is very similar to how many traders might organically scale up their account. For instance, a day trader might trade 1 contract until they've made $5k profit, then start trading 2 contracts, etc.

Example: Starting $50,000 account, trading 1 E-mini contract. Set rule: for every $10,000 increase in equity, add 1 contract to base size. So:

- From $50k to $60k, trade 1 contract.
- Once account ≥ $60k, trade 2 contracts.
- Once ≥ $70k, trade 3 contracts, … and so on.

If a drawdown occurs, one might optionally scale back down or one might hold at the current level (varies by trader). A cautious approach could also include: if equity falls back below a milestone threshold, drop size back (so it introduces a bit of throttling on the downside). Some traders though only pyramid upward and not downward (except maybe after a catastrophic drop they might reset entirely).

Another example: You manage $200k. You decide to allocate an extra 1% of equity risk per trade for each 10% account growth. Initially risk 1% per trade. When account hits $220k (+10%), start risking 2% per trade. When $242k (+10% from 220k, which is overall +21%), risk 3% per trade, etc. This is an aggressive scheme (the risk % itself compounds).

Pros: It's straightforward and provides clear targets to motivate disciplined trading. Like fixed ratio, it ensures you're only scaling up after proving success (i.e., reaching a profit milestone). It avoids constantly changing size on every little account fluctuation – size changes happen only at significant points, which can simplify the trading process. Psychologically, maintaining one size for a stretch allows you to adjust to that size's P/L swings, and then you deliberately increase after a win streak, which can align with confidence (just be cautious of overconfidence). It also inherently means you're using *profits* to trade bigger, which traders often like because it feels like you're leveraging house money.

Cons: The jump points can be somewhat arbitrary and cause disproportionate impact if a loss happens right after a jump. E.g., you were trading 1 contract, you hit $60k and go to 2 contracts, then next trade is a loss of, say, $2k (assuming $1k risk per contract). That's a $2k loss which erased a big chunk of the $10k gain that got you there. So one loss at new size can knock you back below the milestone. This volatility around thresholds can be whipsawing. Another con: it's not as "optimal" as continuous compounding – you're under-invested just below a milestone and then maybe slightly over-invested right above one (like in above example, at $59k you're still 1 contract, at $60k you suddenly double size – a discrete jump, whereas fixed % would've gradually increased through that range). This on-off can reduce overall returns compared to a smooth fractional approach, or conversely, if not managed, could increase risk at the wrong times.

Also, if you never scale down on drawdowns, you might stick with a higher size even as equity falls, which could deepen drawdowns (so one should consider a policy for that, possibly combine with drawdown throttling logic).

Use case: Many traders do this informally – e.g. "once I double my account, I'll trade double size." It's also used in combination with funding programs or risk management rules. For instance, a trader might say each time I withdraw profits or each quarter, I'll evaluate if I can increase my lot size based on new equity. It's a middle ground between pure fixed fraction (too granular) and fixed lot (too stagnant). In essence, fixed ratio is a specific pyramiding scheme (profit milestones derived from Delta), so pyramiding on growth is a broader concept that can include fixed ratio or simpler linear increments.

Tip: Ensure milestones aren't too widely spaced that you hardly ever scale, or too narrow that you're constantly changing sizes. The choice might depend on strategy volatility (a volatile strategy might need larger milestones to avoid ping-ponging above/below them).

Kelly Criterion (and Fractional Kelly)

What it is: The Kelly Criterion is a formula from gambling theory that gives the **optimal fraction of capital to wager** on each bet to maximize long-term growth rate of wealth. In trading, it translates to an optimal position size as a fraction of account. **Fractional Kelly** means using a fraction of that optimal size (e.g., half-Kelly) to reduce risk.

How it works: For a simple win/lose scenario, Kelly's formula is:

f∗=pq−1bf^* = \frac{p}{q} - \frac{1}{b}f∗=qp−b1

where:

- *p* = probability of win,
- *q* = probability of loss (q = 1 – p),
- *b* = payoff ratio (ratio of win amount to loss amount, i.e. if you risk $1 to win $2, then b = 2).

In another common form: f∗=p−qbf^* = p - \frac{q}{b}f∗=p−bq. This yields the fraction of your bankroll to risk each trade (assuming fixed odds each time).

For example, if your strategy wins 60% of the time (p=0.6) and the average win/loss ratio is 1:1 (b=1, meaning you win as much as you lose on average each trade), then: f∗=0.6−0.41=0.2f^* = 0.6 - \frac{0.4}{1} = 0.2f∗=0.6−10.4=0.2 or 20%. That suggests bet 20% of capital each trade. If b was different, say wins are twice the size of losses on average (b=2) with p=0.4 (40% win rate, which is common in trend trading), then f∗=0.4−0.62=0.4−0.3=0.1f^* = 0.4 - \frac{0.6}{2} = 0.4 - 0.3 = 0.1f∗=0.4−20.6=0.4−0.3=0.1 or 10% of capital.

There is also a more general Kelly formula for a distribution of outcomes (not just binary win/loss). It basically involves maximizing the expected log of wealth. For multiple outcomes or continuous distributions, one can compute Kelly fraction via iterative or analytical methods (Ralph Vince's Optimal f is related in that vein, focusing on the worst loss as a key factor). But for most trading approximations, the simpler formula or some adaptation is used.

Full Kelly vs Fractional: Full Kelly maximizes growth but with high variance. Fractional Kelly means you take a fraction of the recommended f* – e.g. half Kelly (0.5 * f*). This gives up some growth speed in exchange for smoother ride (lower drawdowns). The **half-Kelly** has been shown to often yield about 75% of the CAGR for much less volatility – a sweet spot for many.

Example: Suppose a day trading strategy on NQ has 55% win rate. Average win = $1100, average loss = $1000 (so payoff ~1.1:1). Then p=0.55, q=0.45, b = 1.1. Plugging in: f∗=0.55−0.45/1.1≈0.55−0.409=0.141f^* = 0.55 - 0.45/1.1 ≈ 0.55 - 0.409 = 0.141f∗=0.55−0.45/1.1≈0.55−0.409=0.141. So about 14.1% of capital is Kelly. That's extremely high! If you started with $100k, Kelly says risk $14,100 per trade (which could be ~14 contracts if $1k loss per contract). That would likely lead to huge swings.

Indeed, if one did that, a string of 5-6 losses (~45% drawdown) is possible. Most would not do that. A more practical approach: perhaps use quarter Kelly (25%) of that → ~3.5% of capital per trade. That is still somewhat aggressive but much saner.

Let's do a scenario: The chart earlier (the magenta "Full Kelly ~17%" vs orange "Half Kelly ~8%" lines in

) was essentially demonstrating this. Full Kelly skyrockets fastest but with wild fluctuations; half Kelly grows a bit slower but far more steadily.

Pros: Kelly is **optimal in theory** – if you had many trials and knew your strategy's exact edge, betting the Kelly fraction maximizes your end wealth almost surely over the long run. It's rooted in solid math (maximizing log-growth). It also inherently accounts for both win rate and payoff, which simple heuristics might not. It's a useful guideline; even if you don't bet Kelly, knowing it can tell you the upper bound of aggressiveness. For instance, if Kelly is 10%, you definitely shouldn't risk 20% per trade – that would be overbetting and mathematically ruinous.

Cons: Overestimation risk: If your inputs (p, b) are off, Kelly could be fatal. Many traders don't have a stable edge or mis-measure it. Betting full Kelly on an overestimated edge will lead to severe losses. Also, **sequence risk:** Kelly doesn't eliminate drawdowns; in fact, it *incurs the largest possible drawdowns you'd tolerate* because it's at the edge of maximizing gain vs ruin. It's common to see 50% or larger drawdowns with full Kelly even if the strategy is profitable – those are "expected" in a sense. Most humans can't tolerate that. Practically, transaction costs, changing market regimes, etc., all violate Kelly's assumptions. So full

Kelly is seldom used outright in trading (except perhaps by some automated high-frequency systems where edge and distribution are extremely well-defined).

Fractional Kelly is the norm if using Kelly at all. Many trading desks might use 0.5 or 0.33 Kelly as their sizing model, which gives a safety margin. Fractional Kelly still requires knowing Kelly, so it inherits the need for stats.

In futures context: Kelly often comes out high because of leverage. Using Kelly on something like ES (with high leverage) can suggest very high contract counts if edge exists. It's better as a theoretical benchmark.

Use case: Typically discussed in **systematic trading**. Some quantitative traders compute approximate Kelly fractions from backtest performance (though a robust method might be doing a Monte Carlo and finding fraction maximizing median outcome, etc.). Casual/personal traders might not formally calculate Kelly but intuitively they pick something far under the theoretical optimum (hence the common 1-2% rules, which for many strategies is around ¼ Kelly or less).

Summary: Kelly is the theoretically best fixed fraction – but in practice, due to uncertainty, fractional Kelly is recommended. It's common to see advice like *use half-Kelly to drastically reduce risk of ruin with only slight decrease in return*. The Kelly criterion underscores why overbetting is dangerous: if you bet more than Kelly, your growth expectation actually goes down and risk of ruin skyrockets. It's better to err on smaller side. Even Kelly himself and other proponents often said *most should use a fraction of Kelly*.

Optimal f and Secure f (Ralph Vince's Models)

What they are: These are position sizing metrics introduced by Ralph Vince. **Optimal f** is essentially the fraction of equity that would have maximized your account growth *historically*, given the worst loss observed. It's similar in spirit to Kelly but derived differently (Kelly came from known probability distributions; Optimal f uses actual trade result series, focusing on the largest loss). **Secure f** (by Leo Zamansky & David Stendahl building on Vince's work) is a modification that incorporates a drawdown constraint – essentially finding the fraction that maximizes growth under a cap on drawdown.

How Optimal f works: Vince's formula for Optimal f involves iterating through possible fractions to find which yields the highest ending equity (or highest compounded growth) on the historical sequence of trades, assuming you bet that fraction each time and re-invest (compounding). Importantly, it uses the **largest loss** in the sequence as a key factor: in fact, a simpler way to approximate Optimal f is:

fopt≈1largest lossstarting equityf_{opt} \approx \frac{1}{\frac{\text{largest loss}}{\text{starting equity}}}fopt≈starting equitylargest loss1

if all trades were the same fraction. For example, if your worst single trade loss was 10% of the account, Optimal f might turn out to be around 10% – because beyond that, that worst trade would have lost more than the account. More formally, Vince gave a formula that ties to maximizing terminal wealth relative to worst loss.

To illustrate: if your biggest loss in backtest was $5,000 on a $100k account (5%), then Optimal f won't be much more than 0.05 (5%), because any higher and that trade would have caused over 100%*f of account (in simulation, if you bet more than that fraction, the worst loss would have more than wiped out your account's fraction capital allocated, I recall an interpretation like that).

Optimal f is often found via simulation: you simulate equity growth for a range of fractions and see which fraction gave highest end equity. This ends up heavily influenced by the largest loss because if f is too high, that largest loss causes a huge drawdown which the compounding might not overcome, whereas just below that threshold might maximize the geometric growth.

How Secure f works: Secure f solves: maximize net profit or growth *subject to* drawdown <= some allowed %. In other words, it introduces a constraint (like "don't exceed 20% drawdown"). Then it finds the fraction that gives the best growth without breaking that rule. The Secure f will always be ≤ Optimal f (and equals it if the optimal growth fraction happened to also be under the DD limit; otherwise it's the fraction at the DD bound). Secure f is essentially a risk-constrained optimum.

In practice, one might use secure f by first deciding the max tolerable drawdown (say 30%), then calculating the fraction that would have led to 30% drawdown in the historical worst case, and use that as position size fraction. That ensures historically you'd never have exceeded 30% DD; presumably this gives a safety margin going forward too.

Example: Your backtest of 10,000 trades on a strategy shows:

- Win rate 45%, payoff 1.8:1.
- Maximum peak-to-valley drawdown in backtest was 25% when risking 1% per trade.
- The largest single trade loss was 2% (because risking fixed 1%).

If you try higher fractions, maybe at 2% risk the max DD would have been ~50% (not linear, but double risk roughly double DD). Perhaps at ~1.2% risk, the max DD would have been

~30%. So Secure f(30% DD) might be ~1.2% in that sense. If you wanted to cap at 20% drawdown, maybe 0.8% risk per trade.

Optimal f might say, based on that distribution, maybe 3% was the mathematical optimum (with a huge theoretical drawdown, maybe even beyond 50%). But secure f at 20% DD constraint would pick ~0.8%. Traders often prefer using secure f logic because it aligns with *personal risk tolerance (max DD)* rather than a purely mathematical optimum that might be uncomfortable.

Pros: These methods tailor the position size to the actual performance profile of the strategy. Optimal f directly maximizes the *actual observed performance*, not an assumed distribution, so some consider it more practical than Kelly (which originally was for known probability bets). It inherently accounts for variable win sizes, etc. Secure f adds a layer of risk control that's very intuitive (cap the drawdown). Together, they provide a way to optimize growth *with a safety net*. They are useful for analyzing a strategy's leverage sensitivity: e.g., by simulation, you can see how final equity and max DD change with different fractions and pick a good trade-off point (which is essentially what secure f formalizes).

Cons: The elephant in the room is that these are based on historical or assumed data. **If the future worst loss or distribution is worse than past, Optimal f will be too high.** And often, the future *will* surprise with a worse loss or longer losing streak. So Optimal f is notorious for suggesting very high fractions (if your historical largest loss was not that big, it thinks you can bet big). It shares the problem of Kelly – often too aggressive. Vince himself noted that optimal f often results in intolerable drawdowns, and should be used more as an academic exercise. Secure f is only as good as the chosen drawdown limit – which is arbitrary. And if you pick a drawdown like 50%, secure f might just give same as optimal f because maybe optimal f already had ~50% drawdown. If you pick too low a DD, secure f gives a very small fraction that maybe underutilizes the strategy.

Moreover, the calculation and understanding are a bit complex. Not many individual traders go through the full exercise; they might approximate by using Monte Carlo or simpler calcs.

One key difference from Kelly: Optimal f emphasizes the **worst loss**. If your worst loss is big relative to typical, Optimal f will be smaller than Kelly might suggest. If worst loss is moderate, Optimal f might coincide with something near Kelly anyway. In practice, many consider Kelly and Optimal f to often be in the same ballpark for a given data set. A well-known anecdote: Larry Williams supposedly used Kelly/Optimal f to turn $10k into $1 million in a trading championship, but with a near-95% drawdown at one point – illustrating how gut-wrenching full optimal f can be (Williams was down to a few hundred bucks before making it back – that's the kind of swings you risk).

Use case: If you have a *long track record or backtest* with consistent strategy, you might derive Optimal f. Many system developers will look at the equity curve and find which fraction would have been best historically. But then they usually do *not* trade at that fraction – they scale it down (like 0.5 f or so) to be safer. Secure f might be used by risk-averse fund managers to decide on leverage that ensures with high confidence not breaching a certain drawdown (e.g., a fund promised to keep DD under 20%, they might compute secure f to satisfy that historically with margin).

Summary: Optimal f and Kelly are conceptually similar – both find the growth-maximizing fraction. Secure f addresses risk control. They're powerful in theory but dangerous if taken literally. Most traders treat them as reference points and then cut size significantly below those levels.

Monte Carlo-Based Position Sizing

What it is: Using Monte Carlo simulation to determine position size means you rely on **simulated trading outcomes** (randomly generated based on your strategy's stats) to evaluate the risk of different sizing choices. Essentially, you stress-test various position sizing percentages to see their likely impact on drawdowns, and choose a size that meets your risk criteria.

How it works: You gather statistics from your trading or strategy: distribution of wins/losses, win rate, etc. Then for a given position sizing rule (say X% risk per trade), you simulate many runs (random sequences of trades) and observe metrics like maximum drawdown, final equity, etc. You then adjust X until the simulations show an acceptable risk profile.

For example, you might simulate 1000 paths of 10,000 trades each for a strategy at 2% risk per trade. If, in 95% of those simulations, the max drawdown was under 30% and none went to ruin, you might deem 2% acceptable. If you try 3% and see a significant portion of simulations have 50%+ drawdowns or some account blowouts, you might decide that's too high. This method accounts for the **randomness of trade sequences** – something fixed formulas can't fully capture.

Example: Let's say your strategy: 50% win rate, wins avg +1.5R, loss = -1R (so expectancy +0.25R). If you risk X% each trade, what's a safe X? You simulate:

- At 5% risk per trade: simulation might show that there's a small but non-negligible chance of ruin (balance going near zero) over 10k trades, and perhaps 30% of simulations had drawdowns worse than 50%. That's scary.
- At 2% risk: maybe none of the 1000 sims went bust, worst drawdown was say 40%, median drawdown 25%, and median final wealth is high.
- At 1% risk: maybe worst drawdown 20%, very low risk of ruin, but final wealth median is obviously lower than with 2%.

Using these, you might choose 2% as a balance. Or if you're very risk-averse, maybe 1%.

Another example: If you have a more skewed strategy (say low win% but high payoff), Monte Carlo can show you the probability of long losing streaks and how big a fraction would survive them. If strategy has, say, 30% win rate, you *will* get streaks of 10+ losses. Monte Carlo might show that 5% risk leads to a high chance of a 50%+ drawdown because 10 losses in a row (which happens) would cut you nearly in half (since $0.95^{10} \approx 60\%$ left). If that's unacceptable, you'd lower X until, say, the 99% worst drawdown is within what you can stomach.

Pros: Monte Carlo simulation is very **flexible** and can incorporate all aspects of the strategy distribution – including fat tails, varying trade sizes, etc. It directly answers *"What might happen if I trade this strategy with size X?"* by giving a probability distribution of outcomes. This helps avoid the fallacy of averages; you see the range of possibilities. It's especially good for revealing tail risks – e.g., maybe average outcome is fine but there's a 5% chance of extreme loss. Using that info, you can choose a sizing that brings that tail risk down to an acceptable probability. In essence, it's a empirical way to find a near-"secure f" solution without an explicit formula, just by simulating and observing.

Cons: It requires doing some computational work. Also, you need enough data or a good model of your trade outcomes – garbage in, garbage out. If you mis-specify the distribution (like not accounting for regime changes or rare events), the simulation might be too optimistic. Monte Carlo also gives probabilistic answers; one must decide "acceptable risk" somewhat arbitrarily (is 5% chance of 50% drawdown okay or not?). Also, it often assumes independence of trades (random shuffling), which might not hold if there are trends/clustering in performance. If your wins and losses aren't IID (independent identically distributed), you have to incorporate that cleverly.

It's also possible to simulate a very long series that might be more extreme than you'll ever actually trade – sometimes leading to very cautious sizing if you insist on near-zero chance of large drawdown. In other words, if you simulate 1 million trades, even a 1% risk might show some huge drawdown at 0.001% probability – but in a realistic horizon of maybe 1000 trades in your career, that wouldn't have happened. So one should tailor simulation length to realistic scenarios.

Use case: Many algorithmic and quant traders use Monte Carlo to validate their risk settings. After backtesting a strategy, they'll simulate many random re-orderings of trades (bootstrapping) to see distribution of outcomes – this helps set position size or capital allocation. For discretionary traders, doing a Monte Carlo of historical results or expected performance can be very eye-opening to understand variability and risk of ruin.

As an example, a trader might say "I want less than 1% chance of a drawdown worse than 30% in the next 3 years." They can simulate and find that maybe at 1.5% risk per trade that condition is met, whereas at 2% risk it's 5% chance of >30% DD. They might choose 1.5%. This is essentially designing sizing around a risk appetite.

Conclusion on MC sizing: It's one of the more robust modern ways to answer sizing questions. It doesn't give a neat formula, but it gives insight. It complements formulas like Kelly – often you'll find the Kelly fraction is where median final wealth is maximized, but you'll see the distribution's spread is huge; whereas a smaller fraction yields a tighter, safer distribution. It puts numbers on the intuitive pros/cons of risk.

CPPI (Capital Protection Model)

What it is: CPPI stands for **Constant Proportion Portfolio Insurance**. It's a mouthful, but essentially it's a method to allocate between a risky asset (like your trading positions) and a safe asset (cash or T-bills) in a way that **guarantees a floor value** for the portfolio. It's like having an airbag: you can make sure you don't lose more than a certain amount, by dynamically adjusting exposure to risk.

How it works: You set a **floor value** – the minimum portfolio value you want to protect (often initial capital or some % of it). The difference between current equity and the floor is called the **cushion**. You also choose a **multiplier M** which dictates how aggressively to allocate to risk. The rule is: invest **M × cushion** in the risky asset, and the remainder in safe asset.

- If the cushion is big (i.e., you're well above the floor), you allocate a lot to risk (maybe even use leverage if M > 1 and cushion equals equity minus floor).
- If the cushion shrinks (you near the floor), you drastically cut exposure.

If the cushion hits zero (meaning portfolio = floor), then M×0 = 0 in risky asset – you put everything in safe asset, effectively locking in the floor.

As the portfolio value changes, you continually adjust to maintain that proportion.

Example: You have $100k and you decide your floor is $80k (meaning you're only willing to lose at most $20k). So initial cushion = 20k. Choose multiplier M = 2 (common range might be 2 or 3 for CPPI). Initially, allocate M × cushion = 2 × $20k = $40k to trading (risky asset), and the rest $60k in safe asset (e.g., short-term bonds or just not used in trading account). Now say your trading portion sees some gains, portfolio rises to $110k. Floor still $80k (floor can be fixed or some may ratchet it up once you have profits – but classical CPPI keeps floor fixed or possibly grows at a guaranteed rate). Now equity 110, cushion = 30k. Now allocate 2 × 30k = $60k to risk. So you'd move money: now $60k in trading, $50k in safe (because total 110).

If market keeps going up, cushion grows, you allocate more to risk (up to a point you could be nearly fully invested if cushion is a large portion of equity).

If market falls: suppose from 100k it drops to 90k (a 10k loss in risky asset portion). Now equity 90, floor 80, cushion = $10k. Now allocate 2×10k = $20k to risk, $70k safe. You'd pull money out of trading positions to make sure only 20k at risk now. If another hit happens: say from 90k to 80k, cushion goes to 0. Then allocate 0 to risk – you shift everything to safe asset. You've hit the floor, and you do not trade further (or in practice, you'd trade minimally or something). You guaranteed you don't go below 80 (aside from some small potential "gap risk" if trades gap down before you can adjust, see below).

This mechanism creates a convex payoff akin to having a put option protecting your floor.

Pros: The obvious benefit – you **cap your downside** (in theory). You can participate in upside because when you're doing well, you allocate more to risk, but if things go badly, you systematically yank your exposure such that you should never crash through the floor (if executed continuously in frictionless markets). It gives peace of mind: e.g., "I will not lose more than 20% of my account because CPPI will put me 100% in cash if I reach that -20% point." It's also rules-based, taking emotion out – it's like an autopilot that de-risks in bad times.

In professional fund context, CPPI was used to create "capital guaranteed funds" which promise investors that worst-case they get their initial investment (floor) back, while still investing in stocks for growth.

Cons: There are a few catches:

- **Gap Risk:** If the market moves too fast, CPPI might not adjust in time. For example, overnight your portfolio drops from 90k to 75k (big gap). You only had 20k at risk, but a huge crash could technically eat into the floor because you couldn't sell fast enough to stop at 80k – maybe it overshot to 75k. In highly liquid markets and checking often, gap risk is small but never zero (especially in futures, limit moves, etc., can cause jumps).

- **Transaction Costs and Practicality:** Constantly adjusting means frequent trades. CPPI often is implemented with daily or monthly rebalances to limit cost. But if you do it in real time, you might churn your account, especially in whipsaw markets (market down, you cut risk, then it bounces, you add risk, etc. – could whipsaw around the floor boundary).
- **Reduced Returns in Calm Periods:** If your floor is high, you always keep a chunk in safe asset that's not generating big returns. If markets go straight up, CPPI underperforms a fully invested strategy because you were partially in cash especially at the start. It's a trade-off for protection.
- **Choosing M and Floor:** M dictates how aggressively you expose to risk. A higher M means more aggressive (at 3 or 4, you allocate more to risk for a given cushion, which means more upside but also faster approach to floor if loss happens). If M is too low, you might be too conservative (not enough participation in risky asset). There is some science to picking it (often related to max drop tolerated in risky asset between allocation checks).

For trading one's own account, implementing CPPI implies possibly moving money between your trading account and a bank account or something (safe asset) frequently, which is not always seamless. Alternatively, one might keep all money in account but only trade with the portion (M×cushion) – essentially same concept but you mentally earmark only part of equity as "at risk" capital.

Use case: CPPI is more known in investment management (e.g., for funds that guarantee principal). A trader might emulate CPPI by always risking only the difference between their account and a certain reserve. In fact, **Reserve Capital Model** (discussed next) can be seen as a simplified CPPI with M=1 (always trade with cushion = equity - reserve, without leveraging it). CPPI with M>1 effectively uses some leverage on cushion. For instance, M=2 means if you have $20k cushion, you'll risk $40k (which could mean using margin or leverage – common in futures since not all cash is needed to control a position).

If a trader says "I will never trade with more than half my account; the rest stays in cash or unrelated investments until needed", that's a form of floor (50% floor) with a given multiple (somewhat like M=2 if they always use the other half fully). CPPI formalizes this dynamic: you use more of that reserve as you profit and less as you lose.

In summary: CPPI allows for **protected trading** – at the extreme, if you set floor = initial capital, you'd essentially trade only profits and once any profit is gone you stop (floor =

initial, cushion = profit). Usually floor might be slightly below initial if one is willing to risk some capital. It's like having a self-imposed stop-out on account level, but one that gradually kicks in vs all at once.

Time-Based Scaling

What it is: Time-based scaling is a strategy of **increasing position size only after a certain time period or sustained performance period has passed**, rather than immediately due to equity or trade outcomes. It's somewhat akin to *probation periods* or *phases* in trading.

How it works: You set time checkpoints or evaluation periods (weekly, monthly, quarterly). If by those checkpoints your trading results are satisfactory (or at least not disastrous), you then allow yourself to increase size for the next period. It's an approach often used in prop trading evaluations. Essentially, you **graduate to larger size over time**, assuming you survive and ideally profit in the smaller size.

For example, a rule could be: "Trade 1 contract for the first 3 months. If after 3 months you are profitable (or even regardless, just 3 months have passed with discipline), then trade 2 contracts for the next 3 months. After 6 months, go to 3 contracts..." etc. Or it could be more conditional: "Only increase size after 3 consecutive profitable months."

Another approach is incremental over a long time: e.g. "increase risk allocation by 0.5% every quarter until reach X% target risk." Or in a fund context: "ramp up the capital allocated to a new strategy linearly over a year, regardless of immediate performance, to allow time to validate it."

Why time? The idea is that *time filters out luck*. If you can perform consistently over a period, it's safer to scale up. It also prevents scaling too quickly just because of a short-term lucky streak. Conversely, even if you had a rough start, you don't reduce size immediately (like drawdown-based would) – you give it some time to see if performance stabilizes.

Example: A futures day trader starts with a relatively low leverage for the first month – say trades 1 ES contract. After one month, she reviews: if she didn't break risk rules and things went okay, next month she'll allow 2 contracts. She keeps 2 contracts for another month or two. After 3 months, steps to 3 contracts. This continues until maybe 6 or 12 months later she's at her desired max size (say 5 or 10 contracts). If at any stage she hit a major snag (maybe losing month beyond a threshold), perhaps she pauses increases or even steps down.

Another scenario: a trader allocated 50% of his capital to trading and left 50% in reserve initially (so effectively M=1 CPPI or reserve model). Then every 6 months, he shifts an additional 10% from reserve to trading, slowly increasing exposure to full over 3 years – this is not performance-based, purely time-based. The rationale might be to gradually ease into markets or to allow skill to grow with capital.

Pros: It enforces **patience and consistency**. The trader focuses on trading well for the period, not on flipping size day to day. It can avoid rash up-scaling after a few wins which might backfire. It's also good for learning phases – a new strategy or trader trades small for a predetermined time to gain experience, then only size up once that time passes, ensuring they don't blow up in the volatile early stage. Many prop firms do exactly this: they won't increase your buying power or contracts until you've traded X days or months profitably. From a psychological perspective, it can remove pressure to increase size immediately when doing well – you know *no matter how well I do this week, I'm not increasing size until next quarter*, so you focus on process.

Cons: It is inflexible in reacting to actual performance. If you're doing extremely well and your account is much larger, a time rule might keep you unnecessarily small for too long (opportunity cost). If you're doing poorly, time rule might not cut you off soon enough (though one could have risk limits to override – e.g., if down more than X, cut size regardless of time). It can feel artificial – market doesn't care about your calendar. Also, if one's edge is time-sensitive (works now but might not later), waiting might reduce the benefit of exploiting it at larger size.

In flat time schedule (increase every 3 months regardless), you might increase after a terrible month just because time's up, which could be adding risk at a bad time. So often time-based scaling is combined with performance criteria (like "and not in a drawdown").

When to use: Common for **new traders, new strategies, or prop trading evaluation**. It's a conservative approach to scaling that emphasizes proving consistency *over time* rather than a certain profit target. For instance, a rule might be "don't double your trading size until you've had at least 6 months of live trading experience," which many would find prudent.

Real world example: A proprietary futures firm might give a trader a $50k account with max 2 contracts for first month. If metrics are good, next month allow 4 contracts, next 6, etc. Or consider someone trading their own retirement account – they might start at low risk and plan to increase risk exposure gradually each year as they get comfortable.

Summary: Time-based scaling is about pacing your growth in size. It's like leveling up in a game after playing a certain amount of time rather than after achieving a score – it ensures you gain experience at each size level and don't skip ahead too quickly.

Reserve Capital Model

What it is: The Reserve Capital model means you **intentionally keep a portion of your trading capital unused (in reserve)** to protect against total loss and to provide dry powder if needed. It's less a formal sizing algorithm and more a risk management principle: never risk all your money at once.

How it works: You decide on a certain percentage of your total capital to actually deploy in trading, and keep the rest completely out of play (perhaps in a bank, or just mentally segregated if in the same account). Commonly, a trader might say "I'll only trade with 70% of my account, and 30% stays in cash as a reserve". Or even more extreme, trade with 50%, hold 50% back.

This means all position size calculations (like fixed % risk) are done on that **trading portion** only. The reserve sits idle unless something significant happens.

There are a few ways to use the reserve:

- **Buffer against ruin:** If your trading portion gets wiped or severely drawn down, the reserve ensures you aren't actually at zero – you could use some of it to restart or at least you haven't lost everything.
- **Scaling in on opportunity:** Some might keep reserve to add to account after a big drawdown (like a re-capitalization) or to take advantage of exceptional opportunities (say a market crash where you want to deploy extra capital).
- **Peace of mind:** Knowing you have, say, 30% of your funds untouched can reduce the psychological fear of losing it all.

Example: You have $100k total. You decide to put $30k in a savings account as untouchable reserve. Trade with $70k. You might even open your trading account with only 70k. Now, if you risk 2% per trade, it's 2% of 70k = $1,400 risk per trade. Worst-case if you blew up the trading account, you still have $30k left (30% of original).

Alternatively, some do: keep full money in account but only ever risk 1.4% of total (which is 2% of 70%). It's equivalent.

If over time the trading goes well and grows to $140k on its own, maybe at some point you skim off or reallocate – like now maybe keep $60k reserve (still ~30% of new total 200k). Or some might keep the reserve fixed and let it become a smaller % as account grows.

If trading goes poorly and hits, say, $50k, you might decide whether to dip into the reserve to top up back to $70k or not. Conservative approach might say: no, just keep trading small with what's left. Or if you have confidence, you could move some reserve in to bring trading capital back up.

Pros: It **limits catastrophic loss** to a fraction of your wealth. This model acknowledges that trading is risky and ensures you always have a plan B. It can reduce stress because not everything is on the line. For someone reliant on capital, preserving part of it may be critical. It also can instill discipline: you know you have a cap on how much you're allowed to lose (the active portion). Another benefit is if opportunities arise, you have extra capital you could inject – though that becomes more like strategic use rather than pure reserve.

Cons: By not using all your capital, you are **lowering your potential returns**. If your strategy has a positive expectancy, trading with only part of your money means slower growth (essentially like running a portfolio at less than full allocation). If reserve just sits in cash, inflation or opportunity cost is a factor. Also, one could argue if you're at the point of possibly using the reserve (like your active capital is lost), maybe the strategy wasn't good – adding more might just lose more. So reserve should not be seen as something you definitely will add later, it might just remain idle, making your effective return on total capital lower.

Additionally, the line between active and reserve might tempt some: e.g., after losses, a trader might impulsively break into the reserve to "make it back" (which could be dangerous). It takes discipline to truly keep it aside. In essence, reserve model is a blunt tool; it doesn't dynamically adjust positions except by constraining starting size.

Use case: It's common advice: "don't put all the money you're willing to invest into the trading account at once." Many traders start with a portion of savings and keep the rest elsewhere, adding only if they see success. For example, a trader with $50k saved might only fund $25k to begin trading and see how it goes, keeping the other $25k as reserve in case of need or for other uses. Some treat it as an emergency fund for life or a future stake to try again if first attempt fails.

Another angle: some strategies purposely only use a fraction of account margin – e.g., they say only 50% max margin usage; effectively the other 50% is reserve (though typically done to reduce leverage). For prop or fund contexts, risk managers may only allocate a portion of capital to a new strategy until it proves itself, effectively reserving the rest unallocated.

Relation to CPPI: As noted, reserve model is like CPPI with M=1. Example, floor = 70% of current equity (meaning you always keep 30% reserve). Cushion = 30%, allocate 1× cushion (30%) to risk, rest 70% safe. If equity changes, you may rebalance but if you stick to a fixed percent aside, you are implicitly doing a constant proportion.

Summary: Reserve capital model is straightforward: "I will not gamble all my money." It ensures survival. The downside is you are playing with a smaller bankroll, which for a highly positive expectation could mean slower wealth accumulation. Many traders find this acceptable because avoiding ruin is rule #1. Over time, if confidence grows, one might increase the portion in play (effectively moving the reserve threshold).