Seminar Notes: How to Value Stock Options in Divorce Proceedings

By Jerry Marlow

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In many divorces today, one spouse's employee stock options account for a significant portion of the marital wealth to be divided. Even so, courts have yet to establish or recognize standard and reliable procedures with which to value these assets.

Valuing employee stock options in divorce proceedings presents a number of difficulties: In financial professions, Black-Scholes and risk-neutral methodologies are widely used and accepted for valuing market-traded stock options, but— as usually explained— these methodologies can be difficult for the non-mathematician to understand. Depending on the factual context of a particular set of employee stock options, these methodologies may be applicable, may not be applicable, or may be applicable only as a starting point for the valuation of the options.

To add to the potential for confusion, what are commonly referred to as option grants often— in two respects— do not in fact grant options: What the grants define as options may not conform with the definition of a market-traded option on which accepted valuation methodologies rely. Even what the grants themselves define as options they may not actually grant to the employee at the time of the so-called grant.

Interspersed with some words being used to mean things other than what they mean, other words may carry different implications within the legal and financial professions. In the legal realm, if an attorney successfully lambastes a financial prospect as speculative or as an expectancy, a court may be inclined to regard the prospect as being of zero dollar value. By contrast, in the financial realm, a speculator is defined as someone who expects to profit by taking on exposures to risk. In the financial realm, every forecast is a probability distribution. An expected return is defined as the probability-weighted average return of a given forecast. While speculative ventures and expectancies may get thrown out of court, without speculators and expected returns the financial markets might grind to a halt.

Of a perhaps more esoteric but nonetheless real concern is whether and how courts regard risk in their valuations of employee stock options. The essence of stock options is *uncertainty* about the future market price of the underlying stock on which the option is written. Valuing options requires moving uncertain values across time. Accordingly, under the standard valuation methodologies, the value of an option is a probability-weighted present value. In a sense, the probability-weighted present values used to value options ignore how risk averse an employee may be to having a substantial portion of his or her wealth concentrated in an asset of highly uncertain future value. Does a high likelihood that the employee spouse may reap no payoff from the options somehow—rationally or psychologically— diminish the legitimacy of a probabilistic approach to valuing them?

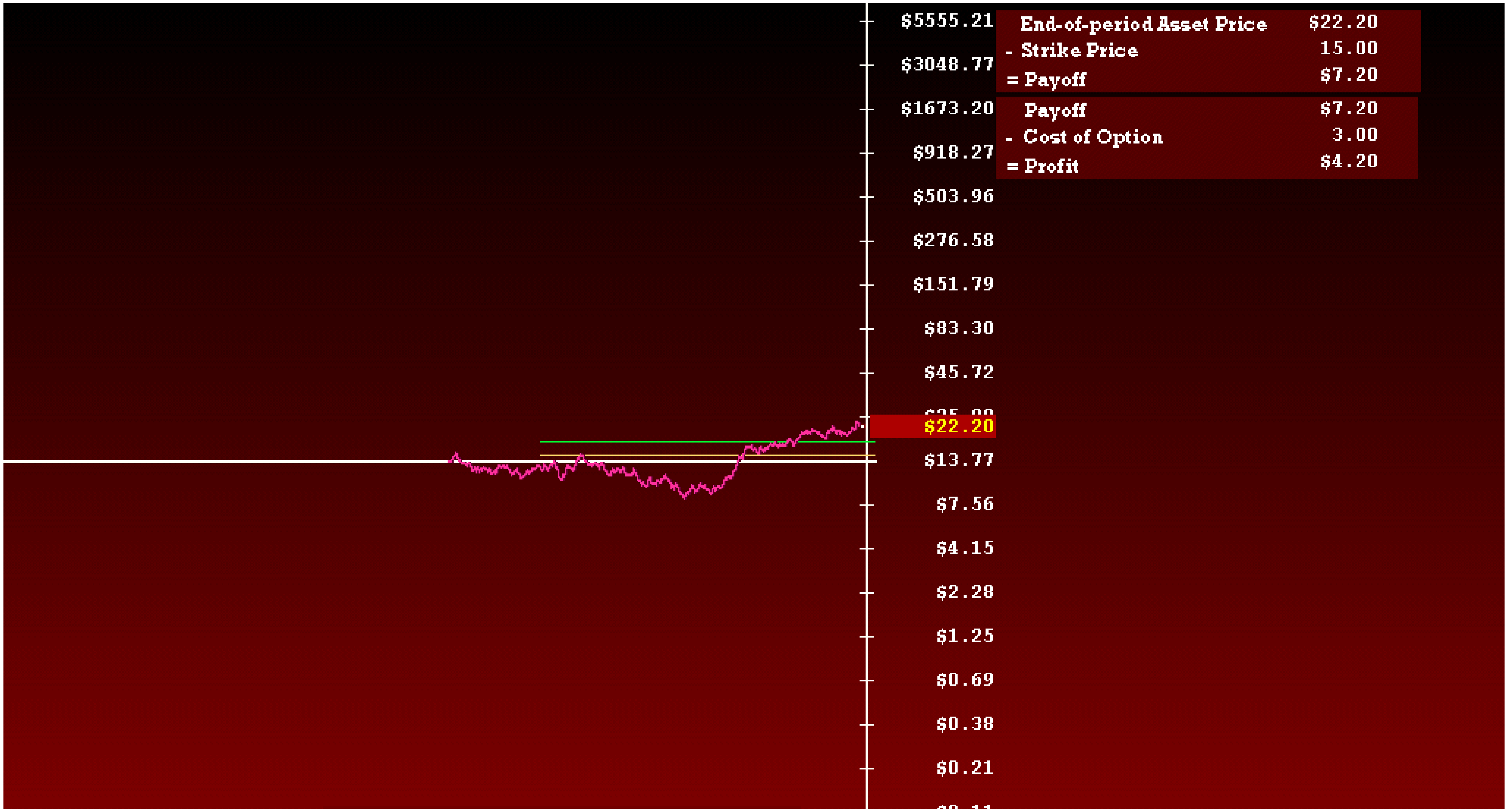
Even if a judge, the spouses' attorneys and their respective expert witnesses were working collaboratively to arrive at a fair valuation of employee stock options, the task could be daunting. Thrown into the adversarial process, the task has the potential to prove maddening to all.

To make it easier for judges, attorneys, valuation professionals and divorce financial planners to arrive at fair valuations of employee stock options, I here offer a conceptual context for thinking about the fair value of options and a sequence of steps for calculating that value. To begin, we look at how the potential payoffs of market-traded options translate into option values. Then we look at ways to apply these principles to employee stock options. Our goal is to calculate values for employee stock options that are consistent with the values of market-traded options and that compensate the employee spouse for his or her continued exposure to uncertainty.

An option's payoff is uncertain.

Up until its expiration, a market-traded call option gives its owner the right to buy the underlying stock at a stated strike price. If, during that time, the market price of the underlying stock goes above the strike price, the owner of the option can buy the stock at the strike price and sell it at the market price. The payoff is equal to the difference between the market price and the strike price. Hence the payoff of the option depends on where the market price of the underlying stock goes before the option expires.

To illustrate, let's simulate possible payoffs of a call option on XYZ stock, which is currently trading at $13.77. An investor buys an XYZ call option with a strike price of $15.00. The option costs $3.00. It expires in 365 days.

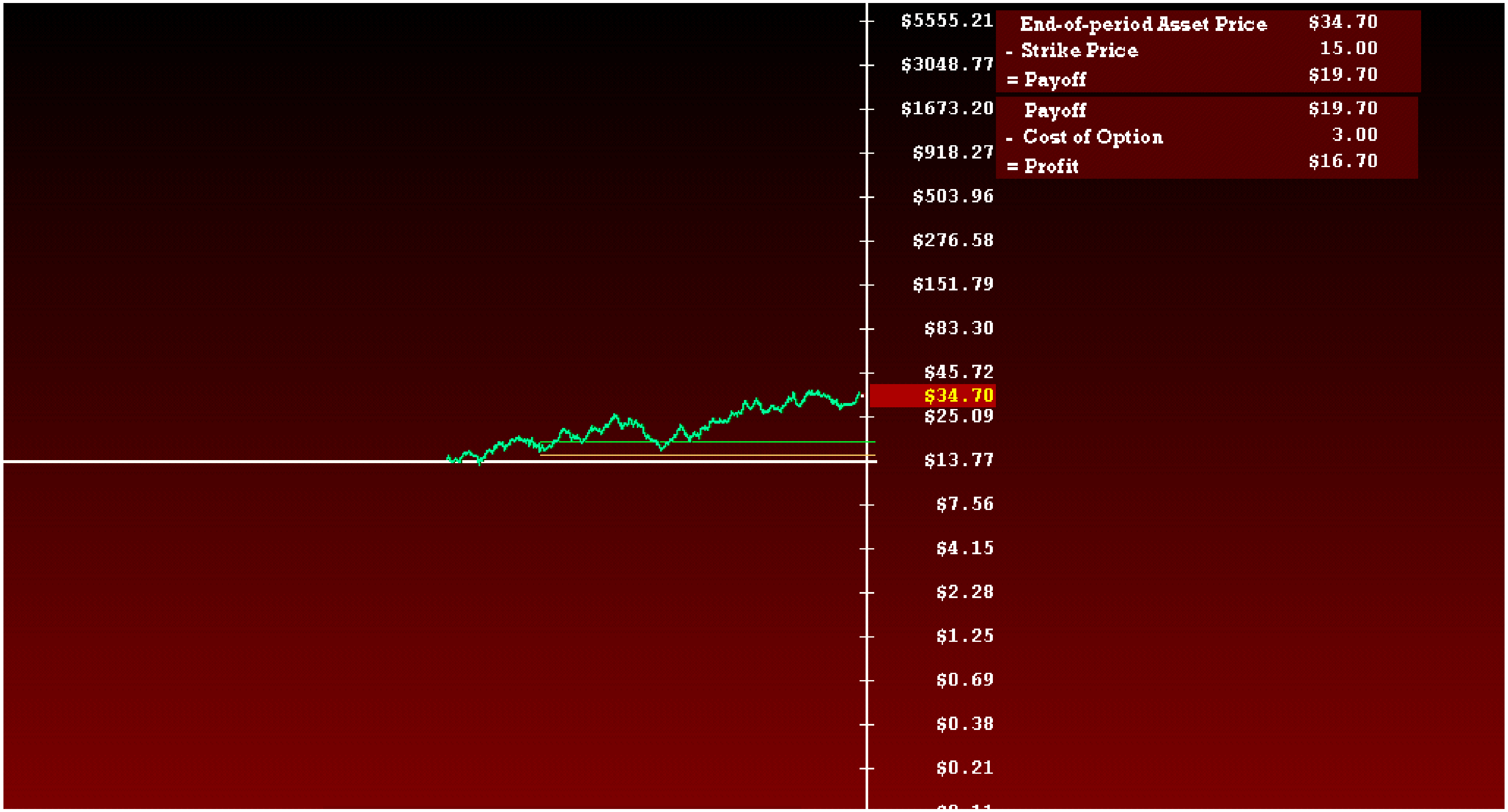


In the simulation, the yellow line at $15.00 represents the strike price. For the option to be in the money when it expires, the stock price must be above the yellow line.

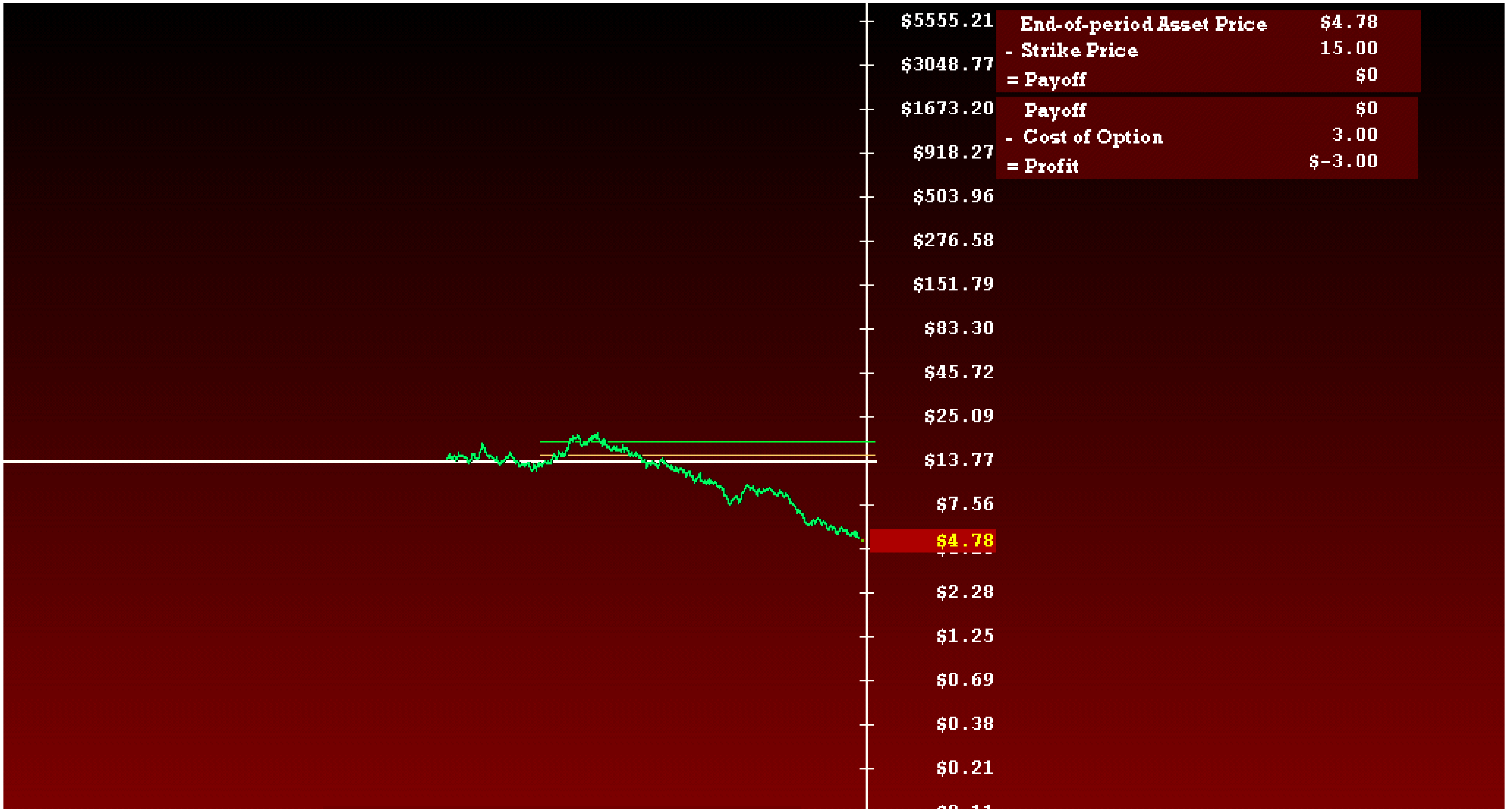
The distance from the yellow line to the green line represents the cost of the option. To produce a profit, when the option expires, the stock price must be above the green line.

In this simulation, over the course of the next 365 days, the stock price goes from $13.77 to $22.20. The end-of-period stock price minus the strike price of $15.00 gives a payoff of $7.20.

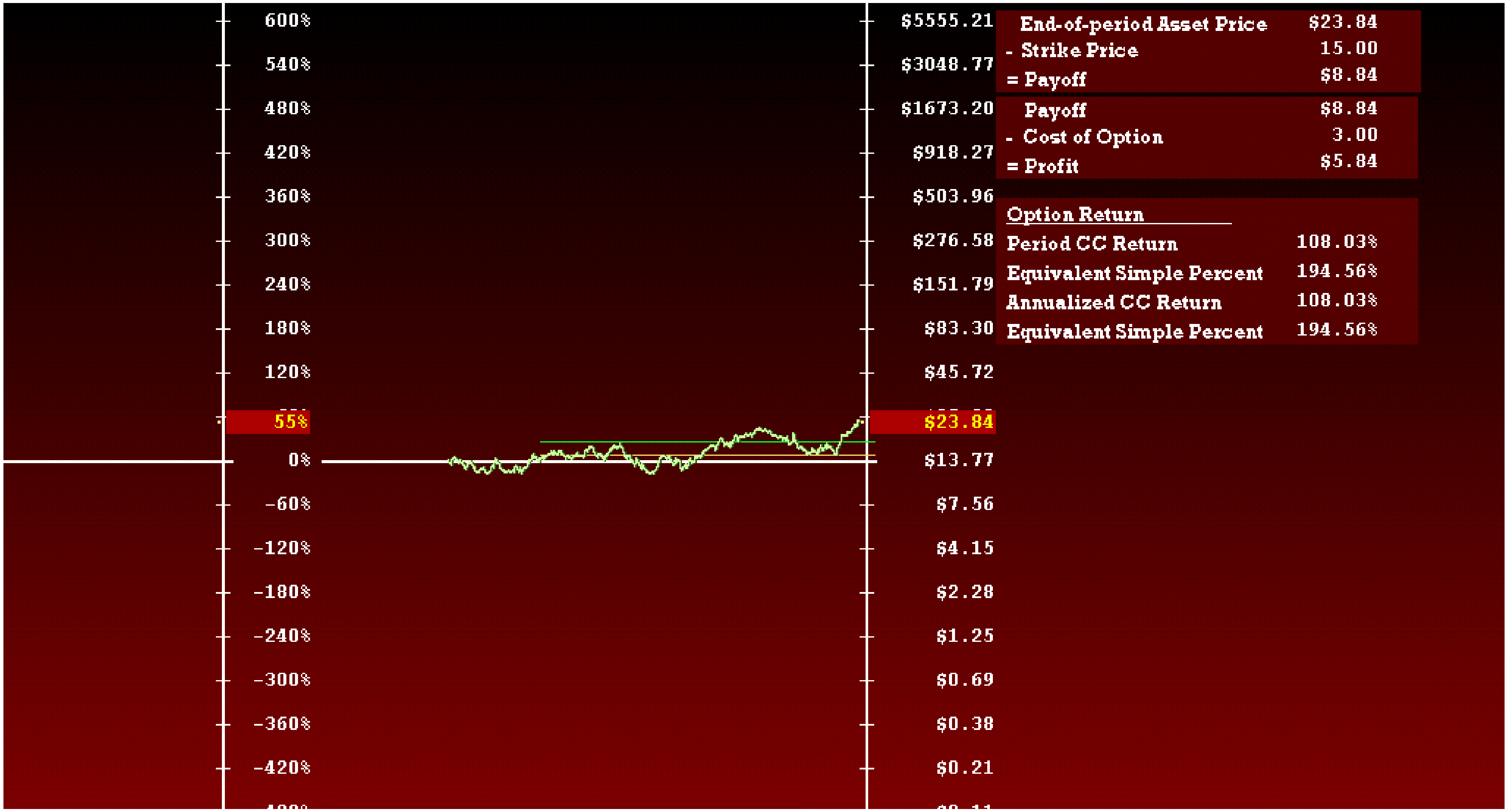
The payoff minus the $3.00 cost of the option gives the investor a $4.20 profit.



If, instead, over the next 365 days, the price of XYZ stock goes from $13.77 to $34.70, then the payoff on the option would be $19.70. The profit would be $16.70.

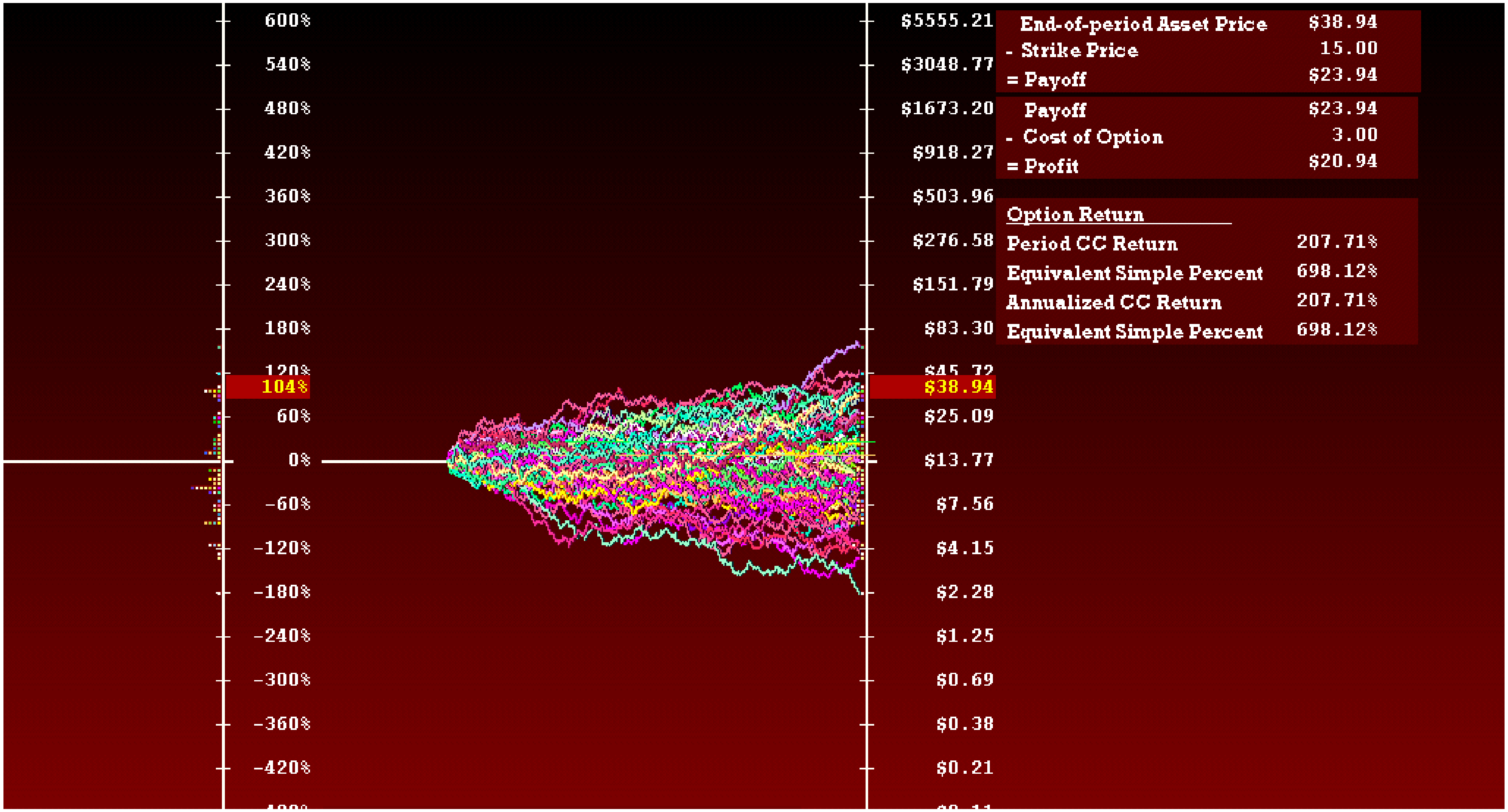


On the other hand, if, over the next 365 days, the price of XYZ stock goes from $13.77 to $4.78, then the option finishes out of the money. The payoff is zero. The investor has a loss equal to the cost of the option.



In addition to simulating price paths, we can record the stock returns that the price paths produce. A price change from $13.77 to $23.84 would produce a continuously compounded rate of return of 55%. In the simulation, we tabulate the return with a little square at the height of 55% on the return axis.

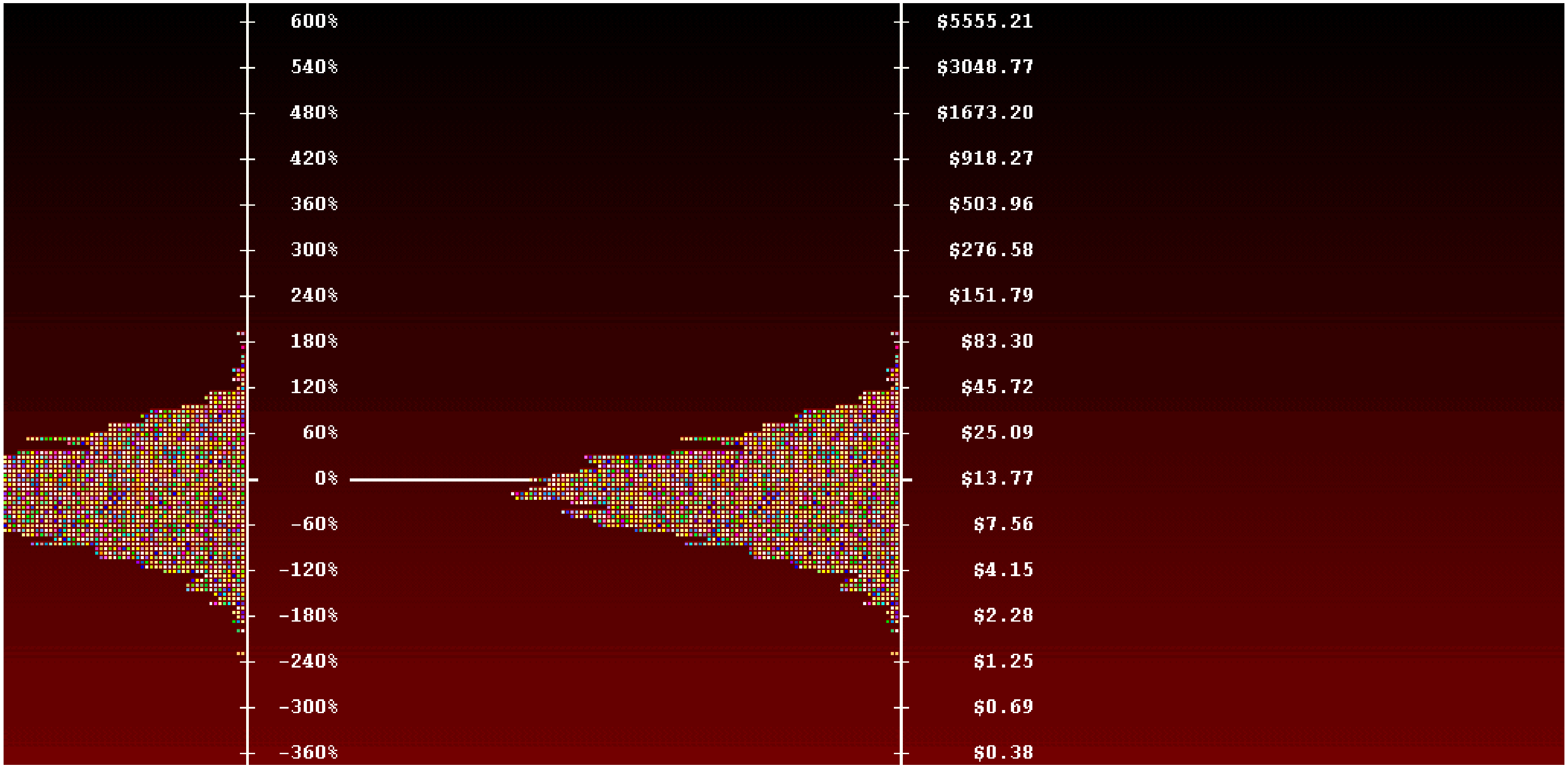
We also can calculate the rate of return that investing in the stock option produces. A profit of $5.84 on an investment of $3.00 would be a continuously compounded rate of return of 108.03%—which is equivalent to a simple percentage return of 194.56%.



An option's value is related to its potential payoffs and the probability of those payoffs.

We can simulate any number of possible paths that a stock price *might* follow. Each possible price path would produce a payoff. If the final price is above the strike price, the payoff will be positive. If the final price is below the strike price, the payoff will be zero.

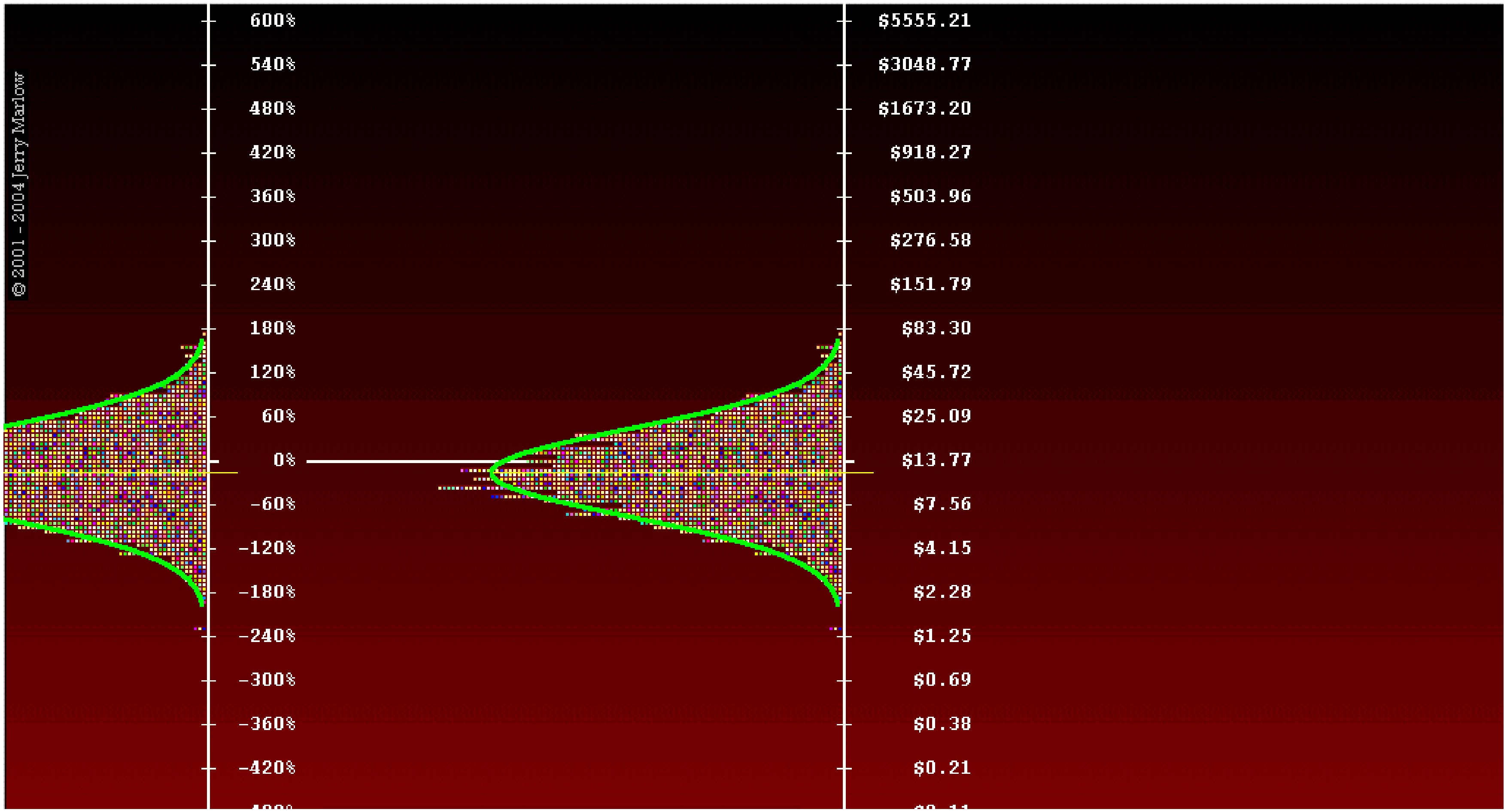
An option's value is related to its potential payoffs and the probability of those payoffs. How can we evaluate all the potential payoffs and their probabilities in a systematic way?



If we tabulate the outcomes of thousands of price-path simulations with little squares, the squares form a pattern.

To start, instead of drawing the entire price path for each simulation, we can tabulate the outcome of each simulation with a little square.

When we run a couple of thousand price-path simulations and tabulate each outcome with a little square, we see that the little squares form a pattern.



Every financial forecast is a probability distribution. A stock forecast is a bell-shaped curve.

The pattern of prices at the end of the investment period approximates a bell-shaped curve—otherwise known as a normal distribution. Black-Scholes options pricing theory and other standard option-valuation methodologies assume that the likelihood of a stock's future price is distributed in this way.

Every financial forecast is a probability distribution. Graphically, a stock forecast is a bell-shaped curve. Every outcome in the bell-shaped curve produces an option payoff. Hence, one way we can calculate the value of an option is to find the probability-weighted present value of all the payoffs produced by the outcomes in the bell-shaped curve.