**The Black-Scholes Option Pricing Model**

The same idea as the Two-State Model, but it is much more general. There can be an unlimited number of possibilities of the price of the stock at expiration.

There are five variables in the equation – the same five we looked at earlier.

S = Current stock price

E = Exercise (strike) price of the call

r = Annual risk-free rate of return with continuous compounding

σ2 = Variance (per year) of the continuous return on the stock

t = Time (in years) to the expiration date

The formula:

C = S N(d1) – Ee-rt N(d2)

Where: d1 = [ln(S/E) + (r + 1/2 σ2)t] / 

d2 = d1 - 

Note that N(d) is the probability that a random variable will be less than or equal to d in a standardized normal distribution (you learned this in statistics).

Example:

Stock Price is currently $50

Strike Price is $49

Risk-free interest rate is currently 7% (.07)

Time to maturity is 199 days – (199/365 = .5452 of a year)

Variance of the stock is expected to be 0.09 per year

First, calculate d1 and we find that it is 0.3742

Second, calculate d2 and find that it is 0.1527

Third, calculate N(d1) and N(d2) using a table or Excel [=Normsdist()]

N(0.3742) = 0.6459

N(0.1527) = 0.5607

Fourth, Solve for ‘C’ – the price of the call option.

This works out the same as with the Two-State Model:

Value of Call = (Stock Price) (Delta) – Amount Borrowed

Because N(d­1) = Delta

and Ee-rt N(d2) = Amount Borrowed