QUESTION:

Yara Inc is listed on the NYSE with a stock price of $40 - the company is not known to pay dividends. We need to price a call option with a strike of $45 maturing in 4 months. The continuously-compounded risk-free rate is 3%/year, the mean return on the stock is 7%/year, and the standard deviation of the stock return is 40%/year. What is the Black-Scholes call price?

SOLUTION:

$$C = P_a . N(\theta_1) - P_e . N(\theta_2) e^{-rt}$$

where:

C = *black – scholes call price* = ?

P_e = *Excise or Strike Price* = 45

P_a = *Current Stock Price* = 40

r = *risk free rate of return* = 0.03 *or* 3%

t = *time of maturity (in years)* = $\frac{4}{12}$

S = *standard deviation (volatility rate)* = 0.4 *or* 40%

N = *Normal distribution* = ?

$$\theta_1 = \frac{\ln\left(\frac{P_a}{P_e}\right) + (r + 0.5s^2)t}{s\sqrt{t}}$$

$$\theta_2 = \theta_1 - s\sqrt{t}$$

$$\theta_1 = \frac{\ln\left(\frac{45}{40}\right) + (0.03 + 0.5(0.4)^2)\frac{4}{12}}{0.4 \cdot \sqrt{\frac{4}{12}}}$$

$$\theta_1 = 0.67$$

$$\theta_2 = 0.67 - 0.4 \cdot \sqrt{\frac{4}{12}}$$

$$\theta_2 = 0.44$$

... *From the standard statistical table*:

$$N(\theta_1) = N(0.67) = 0.7486$$

$$N(\theta_2) = N(0.44) = 0.6700$$

$$\ldots C = P_a . N(\theta_1) - P_e . N(\theta_2) e^{-rt}$$

$$C = (45 \cdot 0.7486) - (40 \cdot 0.67) e^{-\left(0.03 \cdot \frac{4}{12}\right)}$$

$$= 33.687 - 26.533$$

$$C = 7.1526 \approx 7.15$$