CHAPTER 16
Employee Stock Options

Practice Questions

16.1
This is questionable. Executives benefit from share price increases but do not bear the costs of share price decreases. Employee stock options are liable to encourage executives to take decisions that boost the value of the stock in the short term at the expense of the long term health of the company. It may even be the case that executives are encouraged to take high risks so as to maximize the value of their options.

16.2
Professional footballers are not allowed to bet on the outcomes of games because they themselves influence the outcomes. Arguably, executives should not be allowed to bet on the future stock price of their companies because their actions influence that price. However, it could be argued that there is nothing wrong with a professional footballer betting that his team will win (but everything wrong with betting that it will lose). Similarly there is nothing wrong with executives betting that their companies will do well.

16.3
If a stock option grant had to be revalued each quarter, the value of the option of the grant date (however determined) would become less important. Stock price movements following the reported grant date would be incorporated in the next revaluation. The total cost of the options would be independent of the stock price on the grant date.

16.4
It would be necessary to look at returns on each stock in the sample (possibly adjusted for the returns on the market and the beta of the stock) around the reported employee stock option grant date. One could designate Day 0 as the grant date and look at returns on each stock each day from Day –30 to Day +30. The returns would then be averaged across the stocks.

16.5
There should be no impact on the stock price because the stock price will already reflect the dilution expected from the executive's exercise decision.

16.6
The notes indicate that the Black–Scholes–Merton model was used to produce the valuation with T, the option life, being set equal to 5 years and the stock price volatility being set equal to 20%.

16.7
The price at which 10,000 options can be sold is $30. B, D, and F get their order completely filled at this price. A buys 500 options (out of its total bid for 3,000 options) at this price.

16.8
The options are valued using Black–Scholes–Merton with $S_0 = 40$, $K = 40$, $T = 5$, $\sigma = 0.3$ and $r = 0.04$. The value of each option is \$13.585. The total expense reported is $500,000 \times \$13.585$ or \$6.792 million.

16.9
The problem is that under the current rules the options are valued only once—on the grant date. Arguably, it would make sense to treat the options in the same way as other derivatives entered into by the company and revalue them on each reporting date. However, this does not happen under current accounting rules unless the options are settled in cash.

16.10
The expected life at time zero can be calculated by rolling back through the tree asking the question at each node: "What is the expected life if the node is reached?" This is what has been done in Figure S16.1. It is assumed that 5% of employees leave at times 2, 4, 6, and 8 years. For example, at node G (time 6 years) there is a 81% chance that the option will be exercised (80% chance that the holder chooses to exercise and a 5% times 20% chance that the holder chooses not to exercise but leaves the company after 6 years) and a 19% chance that it will last an extra two years. The expected life if node G is reached is therefore $0.81 \times 6 + 0.19 \times 8 = 6.38$ years. Similarly, the expected life if node H is reached is $0.335 \times 6 + 0.665 \times 8 = 7.33$ years. The expected life if node I or J is reached is $0.05 \times 6 + 0.95 \times 8 = 7.90$ years. The expected life if node D is reached is

$$0.43 \times 4 + 0.57 \times (0.5158 \times 6.38 + 0.4842 \times 7.33) = 5.62$$

Continuing in this way, the expected life at time zero is 6.76 years. (As in Example 16.2 we assume that no employees leave at time zero.)
The value of the option assuming an expected life of 6.76 years is given by Black–Scholes–Merton with $S_0 = 40$, $K = 40$, $r = 0.05$, $\sigma = 0.3$ and $T = 6.76$. It is 17.04.

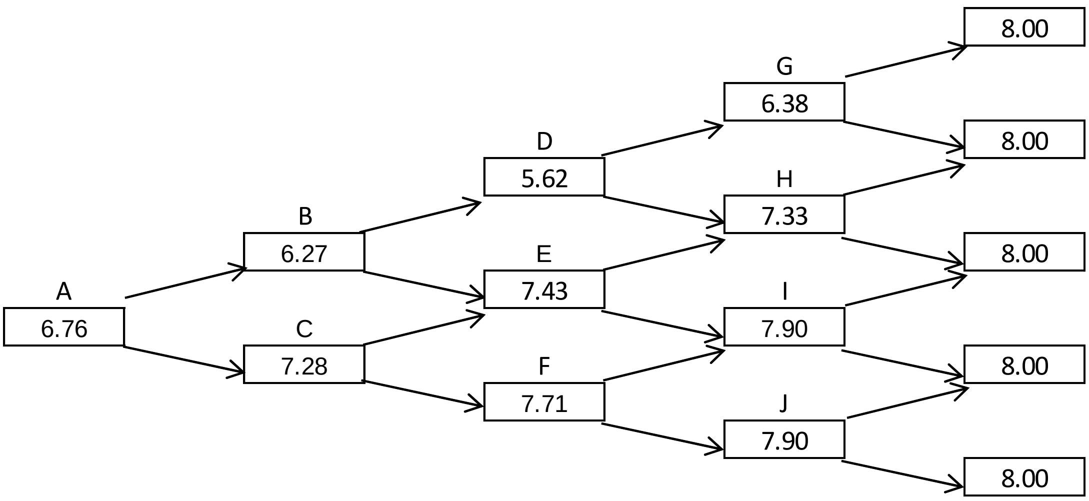

Figure S16.1: *Tree for calculating expected life in Problem 16.10*

16.11
The options are valued using Black–Scholes–Merton with $K = 60$, $T = 6$, $\sigma = 0.22$, $r = 0.05$. The present value of the dividends during the six years assumed life is

$1 \times e^{-0.05\times0.5} + 1 \times e^{-0.05\times1.5} + 1 \times e^{-0.05\times2.5} + 1 \times e^{-0.05\times3.5} + 1 \times e^{-0.05\times4.5} + 1 \times e^{-0.05\times5.5} = 5.183$

The stock price, S_0, adjusted for dividend is therefore 60 −5.183=54.817. The Black–Scholes model gives the price of one option as $16.492. The company will therefore report as an expense 2,000,000 × 16,492 or $32.984 million.

16.12

(a) Suppose that K is the value of the fund at the beginning of the year and S_T is the net value of the fund at the end of the year (after fees and expenses). In addition to the management fee, the hedge fund earns

$$\alpha \max(S_T - K, 0)$$

where α is a constant.

This shows that a hedge fund manager has a call option on the net value of the fund at the end of the year. One parameter determining the value of the call option is the volatility of the fund. The fund manager has an incentive to make the fund as volatile as possible! This may not correspond with the desires of the investors. One way of making the fund highly volatile would be by investing only in high-beta stocks. Another would be by using the whole fund to buy call options on a market index. Amaranth provides an example of a hedge fund that took large speculative positions to maximize the value of its call options.

It is interesting to note that the managers of the fund could personally take positions that are opposite to those taken by the fund to ensure a profit in all circumstances (although there is no evidence that they do this).

(b) An executive who has a salary plus options has a remuneration package similar to that of the hedge fund. The hedge fund's management fee corresponds to the executive's salary and the hedge fund's investments correspond to the stock on which the executive has options. In theory, granting the executive options encourages him/her to take risks so that volatility is increased in the same way that the hedge fund's remuneration package encourages it to take risks. However, while examples such as Amaranth show that some hedge fund managers do take risks to increase the value of their option, it is less clear that executives behave similarly.