Multiple Choice Questions:

I. DEFINITIONS

OPTION TO ABANDON
a 1. The option to abandon is:
   a. a real option.
   b. usually of little value because of the cost associated with abandonment.
   c. irrelevant in capital budgeting analysis.
   d. nearly always less relevant the option to expand.
   e. All of the above.

   Difficulty level: Medium

SPECIAL OPTION
e 2. An example of a special option is:
   a. an executive stock options.
   b. the embedded option in a start-up company.
   c. the option in simple business contracts.
   d. the option to shut down and reopen a project.
   e. All of the above.

   Difficulty level: Medium

FREEZE-OUT PERIOD
b 3. Executives can not exercise their options for a fixed period of time, this is the:
   a. investing period.
   b. freeze-out period.
   c. valuation period.
   d. guaranteed growth period.
   e. strike period.

   Difficulty level: Medium

II. CONCEPTS

EMBEDDED OPTIONS
b 4. The NPV approach must be:
   a. augmented by added analysis if there are a few embedded options.
   b. augmented by added analysis if a decision has significant embedded options.
   c. jettisoned if there are any embedded options.
   d. computed carefully to identify the options.
   e. None of the above.

   Difficulty level: Medium
EXECUTIVE OPTIONS

d 5. Options are granted to top corporate executives because:
   a. executives will make better business decision in line with benefiting the shareholders.
   b. executive pay is at risk and linked to firm performance.
   c. options are tax-efficient and taxed only when they are exercised.
   d. All of the above.
   e. None of the above.

   Difficulty level: Medium

CALL OPTION ON DIVIDEND PAYING STOCK

c 6. The call option on a dividend paying stock compared to a non-dividend paying stock is:
   a. more valuable because of the extra dividend payment.
   b. equal in value because cash dividends are paid on stock only.
   c. less valuable because cash dividends are paid on stock only.
   d. less valuable if the dividend paying stock is in-the-money while the non-dividend paying stock if out-of-the-money.
   e. None of the above.

   Difficulty level: Challenge

EXECUTIVE OPTIONS

d 7. The value of the options awarded executives is much less than face value to the executives because:
   a. the value to the executive depends on the stock price being greater than the exercise price.
   b. the options must be held beyond the freeze-out period.
   c. a highly undiversified portfolio can have a large drop in value with high variance stocks.
   d. All of the above.
   e. None of the above.

   Difficulty level: Medium

EXECUTIVE OPTIONS

a 8. Corporations by rewarding executives with large option positions:
   a. cause the executives to hold highly undiversified portfolios.
   b. put the firm in a risky position to pay off the options.
   c. cause the value of the stock to fall because the options are theft.
   d. are really valueless because most options are never exercised.
   e. None of the above.

   Difficulty level: Challenge

NEGATIVE NPV PROJECTS AND REAL OPTIONS

d 9. Investing in a negative NPV project today is a feasible choice if:
   a. there are future option alternatives.
   b. investing is sequentially limited.
   c. the discount rate is low.
   d. Both A and B.
   e. Both A and C.

   Difficulty level: Medium
OPTION TO DEFER

10. The opportunity to defer investing to a later date may have value because:
   a. the cost of capital may decline in the near future.
   b. certainty may be reduced in the future.
   c. investment costs fluctuate in time.
   d. All of the above.
   e. None of the above.

   Difficulty level: Easy

REAL OPTIONS

11. Rejecting an investment today forever may not be a good choice because:
   a. the size of the firm will decline.
   b. there are always errors in the estimation of NPVs.
   c. the option value is negative.
   d. the company's foregoing the future rights or option to the investment.
   e. None of the above.

   Difficulty level: Medium

REAL OPTIONS

12. A financial manager who does not follow the general constraints of the NPV rule may:
   a. accept a negative project for fear of losing an investment opportunity.
   b. accept a marginally acceptable NPV project limiting the corporation's ability to choose a competing project.
   c. option the project to another firm.
   d. not take a positive NPV project even if the NPV is adequate reward to forego the option.
   e. None of the above.

   Difficulty level: Medium

INTEREST RATE VOLATILITY

13. The volatility of interest rates affect the value of the project by:
   a. increasing the value as volatility increase.
   b. increasing the value as volatility decrease.
   c. decreasing the value as volatility increase.
   d. interest rate volatility does not affect value.
   e. None of the above.

   Difficulty level: Medium

OPTION PRICING TOOLS

14. Which of the following statements is true?
   a. The Black Scholes model is the simplest to use and best used for complex situations.
   b. The Binomial model does not handle options with dividend payments prior to expiration date.
   c. The Black Scholes adequately handles the valuation of an American put.
   d. The Binomial model is better for complex situations and is the simplest tool to use.
   e. The Black Scholes model is simpler to use, but for complex situations, the binomial model is the necessary tool.

   Difficulty level: Medium
OPTIONALITY
a 15. If a project has optionality:
   a. the shorter the available life of the project the less valuable the project is.
   b. the longer the available life of the project the less valuable the project is.
   c. the shorter the available life of the project the more valuable the project is.
   d. available project life does not change optionality.
   e. None of the above.

   Difficulty level: Easy

VARIABILITY AND INFORMATION
e 16. The equal rate of price change from each subsequent up state and fixed rate price change from each subsequent down state are reasonable if:
   a. there is a constant variability.
   b. any new information impacting prices is similar period to period.
   c. interest or discount rates are constant.
   d. Both A and C.
   e. Both A and B.

   Difficulty level: Medium

VALUATION OF FUTURE PAYOFFS
c 17. The most correct method to determine the current value of future payoffs would be to:
   a. take the discounted expected value at the risk-free rate.
   b. take the expected value using the probabilities.
   c. take the discounted expected value using the risk-neutral probabilities and the risk free rate.
   d. sum the payoffs discounted at the risk free rate.
   e. None of the above.

   Difficulty level: Medium

VALUATION OF FUTURE PAYOFFS
d 18. The risk-neutral probabilities for an asset, with a current value equal to the present value of future payoffs are:
   a. given by the probability of each state occurring.
   b. given by the value of the underlying asset under good news and the risk free rate.
   c. given by the value of the underlying asset under good news and bad news.
   d. given by the value of the underlying asset under good news, bad news, and the risk free rate.
   e. None of the above.

   Difficulty level: Challenge
BINOMIAL MODEL

e 19. A branching tree for the binomial model:
   a. should captures all possible futures paths for the asset.
   b. has a move down followed by a move up on a subsequent branch to end at the same value as the
      reverse path.
   c. has a move down followed by a move up on a subsequent branch to end at a lower value than a
      move up then a move down.
   d. Both A and C.
   e. Both A and B.

   Difficulty level: Challenge

BINOMIAL MODEL

d 20. Increasing the number of intervals in the binomial model causes the price shift parameters to
   change. New estimates are related to:
   a. the standard deviation of the underlying asset.
   b. the up state multiplier equals the standard deviation divided root n.
   c. the number of intervals in a year.
   d. All of the above.
   e. None of the above.

   Difficulty level: Medium

BLACK SCHOLES OPTION PRICING MODEL

d 21. Which of the following is not part of the Black Scholes option pricing model?
   a. Standard deviation
   b. Time to maturity
   c. Exercise price
   d. Par value of the company’s stock
   e. Interest rate

   Difficulty level: Medium

BLACK SCHOLES OPTION PRICING MODEL

a 22. What are the u, the up state multiplier, and d, the down state multiplier, if there are monthly
   intervals and the standard deviation is .38?
   a. 1.1159; .8961
   b. .0317; 31.5789
   c. .0317; .9683
   d. .2193; .7807
   e. None of the above

   Difficulty level: Medium
EMBEDDED OPTIONS

d 23. On the notion of embedded options, which of the following is/are true?
   a. If virtually all projects have embedded options, ignoring options is likely to lead to serious undervaluation.
   b. There are two possible outcomes for virtually every business idea.
   c. Virtually every business has both the option to abandon and the option to expand.
   d. All of the above.
   e. Both B and C.

   Difficulty level: Medium

REAL OPTIONS

c 24. A firm in the extraction industry whose major assets are cash, equipment and a closed facility may appear to have extraordinary value. This value can be primarily attributed to:
   a. the potential sale of the company.
   b. the low exercise price held by the shareholders.
   c. the option to open the facility when prices rise dramatically.
   d. All of the above.
   e. None of the above.

   Difficulty level: Medium

III. PROBLEMS

Use the following information for problems 25-30.

Note: Correct answers to later questions is dependent on correct answers to earlier questions.
Ima Greedy, the CFO of Financial Saving Techniques has been granted options on 200,000 shares. The stock is currently trading at $22 a share and the options are at the money. The volatility of the stock has been about .20 on an annual basis over the last several years. The option mature in 3 years and the risk free rate is 4%.

BLACK SCHOLES OPTION PRICING MODEL

d 25. What is \( d_1 \)?
   a. .1842
   b. .4102
   c. .4583
   d. .4909
   e. .5412

   Difficulty level: Medium

BLACK SCHOLES OPTION PRICING MODEL

c 26. What is \( d_2 \)?
   a. .0121
   b. .0252
   c. .0326
   d. .0452
   e. .0525

   Difficulty level: Medium
BLACK SCHOLES OPTION PRICING MODEL

27. What is $e^{-rt}$?
   a. .6087
   b. .7087
   c. .7952
   d. .8476
   e. .8869

   Difficulty level: Medium

BLACK SCHOLES OPTION PRICING MODEL

28. Calculate $N(d_1)$.
   a. .5054
   b. .6508
   c. .6882
   d. .7047
   e. .8096

   Difficulty level: Medium

BLACK SCHOLES OPTION PRICING MODEL

29. Calculate $N(d_2)$.
   a. .5130
   b. .5578
   c. .6085
   d. .7085
   e. .7142

   Difficulty level: Medium

BLACK SCHOLES OPTION PRICING MODEL

30. What is the value of a call option?
   a. $4.14
   b. $4.86
   c. $5.13
   d. $5.62
   e. $6.16

   Difficulty level: Medium
IV. ESSAYS

The following information should be used for problems #31-32.

Walter Maxim, the CEO of Digital Storage Devices has been granted options on 300,000 shares. The stock is currently trading at $27 a share and the options are at the money. The volatility of the stock has been about .15 on an annual basis over the last several years. The option mature in 5 years, become exercisable in 3 years, and the risk free rate is 4%.

31. What is the value of Mr. Maxim's options?

Using Black Scholes option pricing mode, one $C = 27(.74668) – 27 e^{-20(.41992)} = $10.88
Total Value = 300,000 ($10.88) = $3,264,000

32. If Mr. Maxim earned $500,000 in regular annual salary why might why might he prefer to have $1,500,000 in straight salary versus salary and options?

Mr. Maxim likely has a large portion of his wealth tied up in Digital Storage Devices. If he is in a very undiversified position and his pay-off is dependent on the firm stock doing well to make the options pay-off, he is exposed to a large amount of risk. If the stock price falls, he will suffer a large decrease in wealth. Mr. Maxim must also wait the 3 year freeze-out period before exercising the options and while price may rise it can also fall drastically.

33. The Nu-Tech Company has a new project available to it at a cost of $6,000,000. The project that they can sell 13,000 personal organizers at $172 in net cash flow for each of the next five years. Nu-Tech's discount rate is 15%. What is the NPV of the investment? The executives of Nu-Tech are concerned about the potential of future competition and a subsequent drop in sales and price. If after two year you can dispose of the asset for $1,000,000 at what price would it make sense to abandon the project?

\[ NPV = -6,000,000 + (13,000 \times 172) A_{0.15}^{5} = -6,000,000 + 7,495,418.80 = 1,495,418.80 \]

\[ Abandon: \ 0 = -6,000,000 + 2,236,000 * A_{0.15}^{2} + 1,000,000 * (1/1.15)^{2} + X (A_{0.15}^{3})(1/1.15)^{2} \]

\[ X = 800,627.60; \text{ if they sell } 13,000 \text{ units they should abandon the project if the price drops below } $61.59 \text{ in years three and out.} \]
34. The CEO of NuValue was granted 1,000,000 options. The stock price at the time of the granting of the options was $45 and the options are at the money. The risk free rate was 5% and the options expire in 5 years. The variance on the stock is .04. What is the value of the options contract? If he had negotiated a larger salary and only 10,000 options, what would be the value of the options contract?

\[
d_1 = \frac{.05 + (.50 \times .04)(5)}{\sqrt{.04}} \approx .7826
\]

\[
d_2 = d_1 - \sqrt{\sigma^2 t} = .7826 - \sqrt{.04 \times 5} = .3354
\]

\[
N(d_1) = .50 + .2841 = .7841
\]

\[
N(d_2) = .50 + .1314 = .6314
\]

\[
e^{-.05(5)} = .7788
\]

\[
C = $45 \times .7841 - $45 \times .7788 \times .6314 \approx $13.16 per share
\]

The value of the options contract for 1,000,000 options is

\[
1,000,000 \times ($13.16) = $13,160,000
\]

The value of the options contract for 10,000 options is

\[
10,000 \times ($13.16) = $131,600
\]

35. The CFO of NuValue was granted 1,000,000 options. The stock price at the time of the granting of the options was $20 and the options are at the money. The risk free rate was 4% and the options expire in 5 years. The variance on the stock is .05. What is the value of her options contract? If she had negotiated a larger salary and only 10,000 options, what would be the value of the options contract?

\[
d_1 = \frac{.04 + (.50 \times .05)(5)}{\sqrt{.05}} \approx .65
\]

\[
d_2 = d_1 - \sqrt{\sigma^2 t} = .65 - \sqrt{.05 \times 5} = .15
\]

\[
N(d_1) = .50 + .2422 = .7422
\]

\[
N(d_2) = .50 + .0596 = .5596
\]

\[
e^{-0.04(5)} = .8187
\]

\[
C = $20 \times .7422 - $20 \times .5596 \times .8187 \approx $5.68 per share
\]

The value of the options contract for 1,000,000 options is

\[
1,000,000 \times ($5.68) = $5,680,000
\]

The value of the options contract for 10,000 options is

\[
10,000 \times ($5.68) = $56,800
\]
36. The executive janitor of NuValue was granted 1,000,000 options. The stock price at the time of the granting of the options was $25 and the options are at the money. The risk free rate was 3% and the options expire in 3 years. The variance on the stock is .04. What is the value of the options contract?

\[ d_1 = \frac{.03 + (.50 \times .04)(3)}{\sqrt{.04}} \]
\[ d_1 = .15 / .3464 = .433 \]
\[ d_2 = d_1 - \sqrt{\sigma t} \]
\[ = .433 - \sqrt{(.04)3} \]
\[ = .433 - .3464 = .0866 \]
\[ N(d_1) = .50 + .1686 = .6686 \]
\[ N(d_2) = .50 + .0353 = .5353 \]
\[ e^{-0.03(3)} = .9139 \]
\[ C = $25 \times .6686 - $25 \times .5353 \times .9139 \]
\[ = $16.715 - $12.23629 \]
\[ = $4.48 \text{ per share} \]

The value of the options contract for 1,000,000 options is

\[ 1,000,000 \times ($4.48) = $4,480,000 \]

37. Why would the company pay the executive in options as opposed to salary?

There are several benefits to paying executives in options including alignment of executive and shareholder interest, reduced fixed cost of salary, aligning incentive to increase performance vis-à-vis stock price by lacing their pay at risk if the stock price does not rise, and delayed compensation. Finally, options are a tax-efficient way to pay employees. Currently at the money options are not considered taxable income, a huge incentive for the executive in a high tax bracket. The taxes are incurred when the options are exercised, thus giving a delay and choice in timing of tax incurrence.
SOLUTIONS TO TEST BANK PROBLEMS

Chapter 23

25. \( d_1 = [0.04 + (0.50 \times 0.07)(3)]/\sqrt{(0.07)}3 \)
    \( d_1 = 0.225/0.4583 = 0.4909 \)

26. \( d_2 = d_1 - \sqrt{\sigma^2t} \)
    \( = 0.4909 - \sqrt{(0.07)(3)} \)
    \( = 0.4909 - 0.4583 = 0.0326 \)

27. \( e^{-d_1^2} = 0.8869 \)

28. \( N(d_1) = 0.50 + 1.882 = 0.6882 \)

29. \( N(d_2) = 0.50 + 0.0130 = 0.5130 \)

30. \( C = 22 \times (0.6882) - 22 \times (0.5130) \times 0.8879 \)
    \( = 15.14 - 10.01 \)
    \( = 5.13 \text{ per share} \)