Student name:\_\_\_\_\_\_\_\_\_\_

**MULTIPLE CHOICE - Choose the one alternative that best completes the statement or answers the question.  
1)** Executives are prohibited from exercising their options during the \_\_\_\_\_\_\_\_ period.

1) \_\_\_\_\_\_

A) investing   
 B) freeze-out  
 C) valuation  
 D) guaranteed  
 E) strike

**2)** Executive stock options generally have all the following characteristics *except:*

2) \_\_\_\_\_\_

A) aligning executive goals with shareholder goals.   
 B) linking executive compensation to performance.  
 C) providing tax efficiency.  
 D) increasing executive base salaries.  
 E) putting executive pay at risk.

**3)** When compared to a call option on a comparable non-dividend-paying stock, the call option on a dividend-paying stock is:

3) \_\_\_\_\_\_

A) more valuable because of the dividend payments.   
 B) equal in value.  
 C) less valuable because cash dividends lower the stock price.  
 D) equal to the cost of the non-dividend paying stock option.  
 E) either equal to or greater than the value of the non-dividend paying stock option.

**4)** Which one of these is *not* a reason why executives place less value on employee stock options than their face value would indicate?

4) \_\_\_\_\_\_

A) The option’s value depends on the stock price exceeding the exercise price.   
 B) Options must generally be held for a period of time.  
 C) Options may create a highly undiversified portfolio for the executive.  
 D) Options always create taxable income for the executive when granted.  
 E) Options could be out of the money.

**5)** The value of an executive stock option will decrease if:

5) \_\_\_\_\_\_

A) the volatility of the firm's stock returns increases.   
 B) the executive improves firm performance causing the stock price to rise.  
 C) a freeze-out period is required.  
 D) the firm extends the option expiration date.  
 E) the strike price is lowered*.*

**6)** Investing in a negative NPV project today may be a feasible choice if:

6) \_\_\_\_\_\_

A) the project has future option alternatives.   
 B) all the project’s future options were included in the NPV analysis.  
 C) the current discount rate is low.  
 D) all the project’s future options will be ignored by decision makers.  
 E) the discount rate is expected to increase over time.

**7)** The main reason why the opportunity to defer investing in a project until a later date may have value is:

7) \_\_\_\_\_\_

A) the cost of capital may increase.   
 B) project cash flows may be lower in the future.  
 C) investment costs tend to increase over time.  
 D) the option to abandon may disappear.  
 E) market conditions may improve.

**8)** The main reason why permanently rejecting an investment project today may be a poor decision is:

8) \_\_\_\_\_\_

A) the size of the firm will be less than it would be with the project.   
 B) there are always errors in the estimation of NPVs.  
 C) the management team may be replaced.  
 D) the company is foregoing all future options.  
 E) the firm may not have any other investment opportunities.

**9)** Which of the following factors is frequently ignored during net present value analysis?

9) \_\_\_\_\_\_

A) Project risk   
 B) Cash flows after the depreciable life of the asset expires  
 C) The time value of money  
 D) Some or all of a project’s options  
 E) Startup costs

**10)** When valuing a project using the Black-Scholes option pricing model, *R* is set equal to the:

10) \_\_\_\_\_\_

A) historical real market rate of return.   
 B) annually compounded risk-free rate.  
 C) expected future real market rate of return.  
 D) continuously compounded risk-free rate.  
 E) project’s CAPM rate of return.

**11)** Which one of the following statements is true?

11) \_\_\_\_\_\_

A) If virtually all projects have embedded options, then ignoring these options does not affect the value of the projects.   
 B) Every business will benefit if it exercises its expansion option.  
 C) The option to abandon a project lowers the project’s value.  
 D) Startup businesses do not have any options until they have succeeded for one year.  
 E) Every business idea has at least two possible outcomes.

**12)** Which one of the following factors is *not* included as an input for the Black-Scholes option pricing model?

12) \_\_\_\_\_\_

A) Standard deviation   
 B) Time to maturity  
 C) Exercise price  
 D) Par value  
 E) Continuously compounded interest rate

**13)** With the binominal option pricing model, it is reasonable to assume:

13) \_\_\_\_\_\_

A) there is a varying rate of price change from one time interval to the next time interval.   
 B) any new information impacting prices is similar from one interval to another interval.  
 C) the discount rate increases with each time interval.  
 D) the call price will only be usable if the time interval is extremely small.  
 E) that each project is limited to two outcomes over its life.

**14)** A branching tree depicting the binomial model of a projected investment:

14) \_\_\_\_\_\_

A) should capture all possible future paths the investment could take.   
 B) will have more up-branches than down-branches if there are two or more time intervals.  
 C) can only have one final point that has an option value of zero.  
 D) only depicts paths that will lead to acceptable project decisions.  
 E) should lead to the same result if you take an up-branch followed by a down-branch or a down-branch followed by an up-branch.

**15)** Under risk neutrality, the expected return on an asset will equal:

15) \_\_\_\_\_\_

A) the market risk premium.   
 B) the market rate of return.  
 C) zero.  
 D) the risk-free rate of interest.  
 E) the asset beta times the market risk premium.

**16)** The binomial option pricing model is:

16) \_\_\_\_\_\_

A) bell-curve shaped.   
 B) symmetrical.  
 C) hyperbolic.  
 D) asymmetric.  
 E) curvilinear.

**17)** If an infinite number of intervals is applied to the binomial option pricing model, then the value of a call is equal to:

17) \_\_\_\_\_\_

A) the risk-free rate of return.   
 B) zero.  
 C) the exercise price.  
 D) the Black-Scholes model’s call value.  
 E) the stock price.

**18)** An analyst is calculating the risk-neutral probabilities of a price increase and decrease. Accordingly, the analyst knows the expected return on the asset equals the:

18) \_\_\_\_\_\_

A) sponsoring firm’s cost of capital.   
 B) risk-free rate.  
 C) market rate of return.  
 D) annual inflation rate.  
 E) CAPM rate of return.

**19)** In the binomial option pricing model the:

19) \_\_\_\_\_\_

A) number of intervals required for convergence is quite large.   
 B) interval time span decreases as time moves forward.  
 C) result based on infinitesimally small intervals will differ significantly from the value developed by the Black-Scholes model.  
 D) percentage increase in price in each interval can differ from the percentage decrease in price.  
 E) value of *u* remains constant as the number of intervals increases.

**20)** Zefir owns an oil field with a number of producing wells. In the past, he has started and stopped production among these wells as the price of oil fluctuated. Assume the government imposes additional requirements on non-producing wells that are still production capable. These requirements are expected to increase the cost of stopping well production by 30 percent. As a result, Zefir should be:

20) \_\_\_\_\_\_

A) keeping all wells open continuously.   
 B) closing wells only if he plans to keep them closed permanently.  
 C) willing to keep wells operating at a lower level of profitability than he has in the past.  
 D) increasing the cost of capital he applies to his well evaluation analysis.  
 E) opening wells at a lower p*open* price.

**21)** Assume a firm in the surface mining industry has major assets consisting solely of cash, equipment, and a closed facility, yet the firm appears to have extraordinary value. This value is *least* apt to be attributable to the:

21) \_\_\_\_\_\_

A) low exercise price held by the shareholders.   
 B) option to open the facility when prices rise dramatically.  
 C) option to keep the facility closed for an extended period of time.  
 D) current operating cash flow.  
 E) potential sale of the firm.

**22)** If a project has both expansion and abandonment options, then the:

22) \_\_\_\_\_\_

A) shorter the available life of the project the less valuable the project is.   
 B) longer the available life of the project the less valuable the project is.  
 C) options will offset each other and therefore add no value to the project.  
 D) project life becomes irrelevant.  
 E) project should always be accepted.

**23)** The option to abandon is:

23) \_\_\_\_\_\_

A) a real option.   
 B) usually of little value because of the costs associated with abandonment.  
 C) irrelevant in capital budgeting analysis.  
 D) generally ignored.  
 E) of no value to a project.

**24)** Which one of the following statements is true?

24) \_\_\_\_\_\_

A) The Black-Scholes model is most applicable to complex situations.   
 B) The binomial model is limited to a two-period time sequence.  
 C) The binomial model is limited to ten time intervals for any single analysis.  
 D) The binomial model is basically equivalent to the Black-Scholes model when there is a single time interval.  
 E) The Black-Scholes model is simpler to use, but for complex situations the binomial model is preferred.

**25)** Giovanna has just been granted at-the-money options on 500,000 shares of her employer’s stock. The options expire in three years. The stock is currently trading at $22 per share, the volatility of the returns as measured by standard deviation is 19 percent, and the continuously compounded risk-free rate is 3.6 percent. What is the value of *d*1 as it is used in the Black-Scholes option pricing model?

25) \_\_\_\_\_\_

A) .1842   
 B) .4102  
 C) .4583  
 D) .4927  
 E) .5412

**26)** Assume you are being granted at-the-money stock options today when the stock is trading at $32 per share. These options mature in one year, the continuously compounded risk-free rate is 4.2 percent, and the volatility of the stock’s returns is 22 percent. What is the value of *d*2 as it is used in the Black-Scholes model?

26) \_\_\_\_\_\_

A) .0927   
 B) .0752  
 C) .0809  
 D) .0847  
 E) .0936

**27)** Shreya has been granted options on 300,000 shares. The stock is currently trading at $27 per share and the options are at the money. The standard deviation of returns averages 28 percent. The options mature in 5 years and the risk-free rate is 2.36 percent. What is the value of *e*−*Rt*?

27) \_\_\_\_\_\_

A) .0239   
 B) .1252  
 C) .8887  
 D) .1180  
 E) .9818

**28)** Mustafa has been granted options on 50,000 shares. The stock is currently trading at $17 per share and the options are at the money. The volatility of the stock returns averages 16 percent. The options mature in 2 years and the risk-free rate is 3.45 percent. N(*d*1) is .662055 and N(*d*2) is .576052. Given this information, what is the value of a call option on one share of this stock?

28) \_\_\_\_\_\_

A) $2.11   
 B) $1.70  
 C) $1.89  
 D) $2.28  
 E) $2.21

**29)** Reddy stock is currently trading at $34.50 per share and the 6-month call options are at the money. The stock returns have a standard deviation of 21 percent and the risk-free rate is 4.21 percent. What is the price of the call option per share given that N(*d*1) is .585508 and N(*d*2) is .526913?

29) \_\_\_\_\_\_

A) $1.07   
 B) $2.79  
 C) $1.38  
 D) $2.40  
 E) $1.64

**30)** A stock has a market price of $25 and a standard deviation of returns of 24 percent. The $25 call option matures in 4 months and the risk-free rate is 2.89 percent. N(*d*1) is .555198 and N(*d*2) is .500096. What is the value of the call option per share of stock?

30) \_\_\_\_\_\_

A) $1.71   
 B) $1.86  
 C) $1.50  
 D) $1.62  
 E) $2.16

**31)** Meera is analyzing an expansion project for a new business and has developed this input for a Black-Scholes model. Stock price = $7,365,000, exercise price = $12,400,000, time period = 3 years, standard deviation = 14.5 percent, and the continuously compounded interest rate = 4.2 percent. What is the value of *d*1 as it is used in the model?

31) \_\_\_\_\_\_

A) .1945   
 B) .5487  
 C) −1.4102  
 D) .4593  
 E) −1.4470

**32)** Grant is analyzing an expansion project for a new business and has developed this input for a Black-Scholes model. Stock price = $4,186,300, exercise price = $7,250,000, time period = 4 years, standard deviation = 13.8 percent, and the continuously compounded interest rate = 3.84 percent. What is the value of *d*2 as it is used in the model?

32) \_\_\_\_\_\_

A) .01338   
 B) 1.2784  
 C) 1.2953  
 D) −1.5713  
 E) −1.0293

**33)** Ryan is evaluating some options for a firm. If the rate is 2.46 percent and the time period is 6 months, what is the value of *e*−*Rt*?

33) \_\_\_\_\_\_

A) .9783   
 B) .9878  
 C) .9876  
 D) .9757  
 E) .9520

**34)** What are the values of *u*, the up state multiplier, and *d*, the down state multiplier, if there are monthly intervals and the standard deviation is .38?

34) \_\_\_\_\_\_

A) 1.1159; .8961   
 B) .0317; 1.0327  
 C) .0317; .9683  
 D) .2193; .7807  
 E) 1.1159; −.1159

**35)** The price of flax is currently at $20 but you expect it to either increase by 18 percent or decrease by 7 percent over the next 6 months. The 6-month risk-free rate of interest is 1.98 percent. What is the probability that the price will increase?

35) \_\_\_\_\_\_

A) 32.47%   
 B) 36.03%  
 C) 38.06%  
 D) 35.92%  
 E) 37.94%

**36)** A potential client of Midway Signs would like to buy a 6-month option to purchase 500,000 electronic signs for $119 each. These signs currently sell for $110 each. Assume *u* equals 1.0994 and *d* equals .9096. What price should Midway charge for the option if the annual risk-free rate is 3.2 percent? Round your answer to the nearest $100.

36) \_\_\_\_\_\_

A) $338,400   
 B) $421,900  
 C) $598,100  
 D) $479,900  
 E) $533,600

**37)** A customer of Slice Cutlery would like to obtain a 3-month option to purchase additional units of a product for $77 each. This product currently sells for $76 each. Assume *u* equals 1.1502 and *d* = .8694. *Approximately* what price per unit should Slice charge for this option if the annual risk-free rate is 2.8 percent?

37) \_\_\_\_\_\_

A) $4.79   
 B) $5.98  
 C) $6.17  
 D) $6.02  
 E) $5.07

**ESSAY. Write your answer in the space provided or on a separate sheet of paper.  
38)** Lauren has just been granted at-the-money company options on 300,000 shares. These options expire in 5 years and are exercisable after 3 years. The options are valued at $1.2 million. It is normal for her to receive annual option grants such as this. She also receives a current salary of $550,000. Why might Lauren prefer to receive a straight annual salary of $1.5 million rather than this salary and option combination?

**39)** A CEO is being granted 1,000,000 at-the-money options. The current stock price is $45, the continuously compounded risk-free rate is 5 percent, and the variance on the stock’s return is .04. The options expire in 5 years. What is the value of the options contract? If the CEO had negotiated a larger salary and only 10,000 options, what would be the value of that options contract?

**40)** Why would a company pay an executive in options as opposed to salary?

**41)** You want to become a very successful entrepreneur. Your desire is to operate a business from a single location without becoming so large you lose personal touch with all the firm’s employees and the day-to-day operations. Before determining what type of business you want to open, you have decided to compile a list of options that would add value to whatever business you select. Identify options that you would include in this list.

**42)** Why is straight NPV analysis flawed as compared to models that include option pricing in the analysis?

**43)** In what instances is the binomial option pricing model superior to the Black-Scholes option pricing model?

**Answer Key**Test name: Chapter 23

1) B

2) D

3) C

4) D

5) C

6) A

7) E

8) D

9) D

10) D

11) E

12) D

13) B

14) E

15) D

16) B

17) D

18) B

19) D

20) C

21) D

22) A

23) A

24) E

25) D

*d1* = [(*R* + .5σ2)(*t*)]/(σ2*t*).5  
 *d*1 = {[.036 + .5(.192)](3)}/[.192(3)].5  
 *d*1 = .4927

26) C

*d1* = [(*R* + .5σ2)(*t*)]/(σ2*t*).5  
 *d*1 = {[.042 + .5(.222)](1)}/[.222(1)].5  
 *d*1 = .3009  
   
 *d*2 = *d*1 − (σ2*t*).5  
 *d*2 = .3009 − [.222(1)].5  
 *d*2 = .0809

27) C

*e*−*Rt* = *e*−.0236(5)  
 *e*−*Rt* = .8887

28) A

*C* = SN(*d*1) − *Ee*−*Rt*N(*d*2)  
 *C* = $17(.662055) − $17(*e*−.0345(2))(.576052)  
 *C* = $2.11

29) D

*C* = SN(*d*1) − *Ee*−*Rt*N(*d*2)  
 *C* = $34.50(.585508) − $34.50(*e*−.0421(.5))(.526913)  
 *C* = $2.40

30) C

*C* = SN(*d*1) − *Ee*−*Rt*N(*d*2)  
 *C* = $25(.555198) − $25(*e*−.0289(4/12))(.500096)  
 *C* = $1.50

31) E

*d1* = [ln(*S*/*E*) + (*R +* *.5*σ2)(*t*)]/(σ2*t*).5   
 *d*1 = {ln(7,365,000/12,400,000) + [.042 + .5(.145)2](3)}/[.1452(3)].5  
 *d*1 = −1.4470

32) D

*d1* = [ln(*S*/*E*) + (*R* + .5σ2)(*t*)]/(σ2*t*).5  
 *d*1 = (ln(4,186,300/7,250,000) + {[.0384 + .5(.1382)](4)})/[.1382(4)].5  
 *d*1 = −1.2953  
   
 *d2* = *d1* − (*σ2t*).5  
 *d2* = −1.2953 − [.1382(4)].5  
 *d2* = −1.5713

33) B

*e*−*Rt* = *e*−.0246(.5)  
 *e*−*Rt* = .9878

34) A

*u* = *e σ/ √n*  
 *u* = *e* .38/√12  
 *u* = 1.1159  
   
 *d* = 1/*u*  
 *d* = 1/1.1159  
 *d* = .8961

35) D

*r*f = Probability of increase(Increase percent) + (1 − Probability of increase)(Decrease percent)  
 .0198 = Probability of increase(.18) + (1 − Probability of rise)(−.07)  
 Probability of rise = .3592, or 35.92%

36) E

% increase = *u* − 1  
 % increase = 1.0994 − 1  
 % increase = .0994, or 9.94%  
   
 % decrease = *d* − 1  
 % decrease = .9096 − 1  
 % decrease = −.0904, or −9.04%  
   
 Price with increase = $110(1.0994)  
 Price with increase = $120.934  
   
 Price with decrease = $110(.9096)  
 Price with decrease = $100.056  
   
 *rf* = Probability of rise(Increase percent) + (1 − Probability of rise)(Decrease percent)  
 .032(6/12)= Probability of rise(.0994) + (1 − Probability of rise)(−.0904)  
 Probability of rise = .5606, or 56.06%  
   
 Probability of fall = 1 − .5606  
 Probability of fall = .4394, or 43.94%  
   
 Payoff if price increases = $120.934 − 119  
 Payoff if price increases = $1.934  
   
 Payoff if price decreases = $0  
   
 Expected payoff = .5606($1.934) + .4394($0)  
 Expected payoff = $1.0842  
   
 Option value = $1.0842/[1 + .032(6/12)]  
 Option value = $1.0671  
   
 Contract value = 500,000($1.0671)  
 Contract value = $533,600

37) E

% increase = *u* − 1  
 % increase = 1.1502 − 1  
 % increase = .1502, or 15.02%  
   
 % decrease = *d* − 1  
 % decrease = .8694 − 1  
 % decrease = −.1306, or −13.06%  
   
 Price with increase = $76(1.1502)  
 Price with increase = $87.42  
   
 Price with decrease = $76(.8694)  
 Price with decrease = $66.07  
   
 *rf* = Probability of rise(Increase percent) + (1 − Probability of rise)(Decrease percent)  
 .028(3/12)= Probability of rise(.1502) + (1 − Probability of rise)(−.1306)  
 Probability of rise = .49, or 49%  
   
 Probability of fall = 1 − .49  
 Probability of fall = .51, or 51%  
   
 Payoff if price increases = $87.42 − 77  
 Payoff if price increases = $10.42  
   
 Payoff if price decreases = $0  
   
 Expected payoff = .49($10.42) + .51($0)  
 Expected payoff = $5.1037  
   
 Option value = $5.1037/{1 + [.028(3/12)]}  
 Option value = $5.07

38) Lauren most likely has a large portion of her wealth tied up in company stock. If this is true, she has a very undiversified position and is highly dependent on the firm's stock doing well to make the options pay off. Thus, she is exposed to a large amount of risk as there is no guarantee on the stock price. She must also wait for the 3-year freeze-out period to lapse before exercising her options. Thus, she may prefer a lower fixed amount now rather than accept the risks associated with the options.

39) *d*1 = [(R + .5σ2)(*t*)]/(σ2*t*).5  
 *d*1 = {[.05 + .5(.04)](5)}/[.04(5)].5   
 *d*1 = .78262  
   
 *d*2 = *d*1 − (σ2*t*).5  
 *d*2 = .78262 − [.04(5)].5   
 *d*2 = .33541  
   
 N(*d*1) = .50 + .28308  
 N(*d*1) = .78308  
   
 N(*d*2) = .50 + .13134  
 N(*d*2) = .63134  
   
 *e−Rt* = *e*−.05(5)   
 *e−Rt* = .77880  
   
 *C* = SN(*d*1) − E*e−Rt*N(*d*2)  
 *C* = $45(.78308) − $45e−.05(5)(.63134)  
 *C* = $13.112379  
   
 For 1,000,000 options:  
   
 Value = 1,000,000($13.11238)  
 Value = $13,112,379  
   
 For 10,000 options:  
   
 Value = 10,000($13.11238)  
 Value = $131,123.79

40) There are several benefits to paying executives in options including alignment of executive and shareholder interests, reduced fixed cost of salary, placing part of the executive’s salary at risk, and delaying compensation. Finally, options are a tax-efficient means of payment as they are generally taxed when exercised which provides flexibility in the timing of taxable income.

41) Keeping in mind that you want to maintain a hands-on approach and a single location, you might consider options such as franchising and licensing arrangements, internet services, and other options that will generate income for your firm but which will not require intense involvement on your part. Of course, the options to expand, to modify, and to abandon should to be included also. Since this is an open-end question, students may also list other options they find appealing.

42) Straight NPV analysis is flawed in that it ignores embedded options which commonly leads to undervaluation of a project’s potential. For example, both the option to expand a successful project and the option to abandon one that becomes unsuccessful add value to the project. Embedded options add complexity but including them in the analysis both improves managers understanding of an investment and also improves the evaluation of the potential outcomes of that project. Remember that an option is the right, but not the requirement, to move in a different direction. Thus, options that are not past expiration always have value. Ignoring a component that has a positive value in capital budgeting will nearly always lead to undervaluation of the capital budgeting project.

43) The binomial option pricing model is amenable to simulations where there is a decision tree type of focus in analysis. Further, the Black-Scholes model cannot properly handle options with dividend payments prior to the expiration date nor does it adequately handle the valuation of an American put option. In these instances, the binomial model is superior in theory and execution. It is important to recognize that both models are important; the Black-Scholes model is simpler in calculation, but in areas where it does not work well, the binomial model should be used.