

SIMON FRASER UNIVERSITY  
*Faculty of Business Administration*

**Final Examination**

BUS 316  
Derivative Securities

**EXAM INSTRUCTIONS:** Please record all answers in the examination book provided. Be as complete as possible in recording the calculations made to arrive at specific answers. Calculators with enhanced capabilities such as the ability to attach external drives, whether such drives are attached or not, are prohibited. Other than an admissible calculator, no books or other materials are permitted to be used during the examination.

**Do all Questions; be sure to answer all parts of the question. (100 Total Points)**

**1. Definitions and Basic Concepts (6 points each — total 24 points)**

- a) Provide 3 key differences between warrants and CBOE option contracts.
- b) Define the following terms: riskless hedge portfolio; rights issue; early exercise premium.
- c) Explain the difference between historical volatility and the implied volatility calculated from option prices.
- d) Describe the basic mechanics of the put-call parity arbitrage. (Hint: be sure to identify the short and long trades).

**2. Expiration Date Profit Diagrams (5 points each diagram – total 15 points)**

Using the attached option prices for the 02 Sep IBM call and put options, draw the expiration date profit diagrams for a written strangle, a purchased straddle and a ‘long’ vertical put spread. (This requires the appropriate values to be entered on the expiration date profit diagram for the exercise price, the breakeven point and relevant points on the vertical axis).

**3. Put-Call Parity (6 points)**

"An American call option on a non-dividend paying stock benefits from increases in the stock price and these increases can be very large. An American put option on the same non-dividend paying stock, with the same exercise price and time to expiration, benefits from stock price declines, but the stock price can only fall to zero. Therefore, the put must sell for less than the call." Do you agree or disagree? Explain making sure that you identify relevant restrictions on the underlying arbitrage.

**4. Binomial Option Pricing (10 points)**

You are currently in period 0. Consider the binomial option pricing model when the stock price is permitted to progress **two** periods into the future. The current (period 0) stock price is \$100. The stock price evolves by either rising 10% with probability of 60% or dropping by 10% with probability 40% each period. Assume that a European call is written on this stock with exercise

price X = \$95 and expiration date at the end of period 2.

- a) What are all the possible values for the stock price at the end of the first period and at the end of the second period? (Hint: It would be easiest to write down the appropriate two-step binomial tree.)
- b) Using the period 2 expiration date call option prices and stock prices, calculate the call option hedge ratio needed at end of the first period if the stock price increases in the first period. Calculate the call option hedge ratio needed at the end of the first period if the stock price declines in the first period. What are the call option prices applicable at the end of the first period?
- c) Calculate the period 0 call option price.

#### 5. Portfolio Insurance (10 points each – 20 points total)

- a) A long stock position can be "protected" by buying a put. How can the payoff on this portfolio of a stock and option be replicated using "dynamic hedging" strategies involving portfolios which combine only stock and bond positions?
- b) Describe the various forms of portfolio insurance. How would these various forms of portfolio insurance perform in the face of discontinuous movements in equity prices such as the July 2002 market break?

#### 6. Black-Scholes Valuation (10 points)

- a) Use the Black-Scholes option pricing model to calculate prices for European *call and put* option on a non-dividend paying stock. Be sure to state the formula and provide sufficient information about the calculations performed to arrive at the solution:

Current stock price: \$50    Exercise price: \$50    Time to expiration: 28 months  
Risk free interest rate: 5.5% per year    Variance of annual stock returns: 0.25

#### 7. Early Exercise (5 points each -- 10 points)

- a) Under what conditions will American *put* options on dividend paying stocks be exercised early?
- b) Explain why American calls on non-dividend paying stocks will not be exercised early.

#### 8. The Greeks (10 points)

**Describe** the delta, gamma and theta for a call option.

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**IBM (NYSE)**

Aug 12, 2002 @ 14:36 ET (Data 20 Minutes Delayed)

**71.49 -0.34**

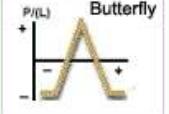
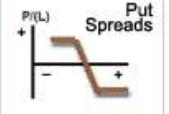
Bid N/A Ask N/A Size N/AxN/A Vol 3430600

Calls	Last Sale	Net	Bid	Ask	Vol	Open Int	Puts	Last Sale	Net	Bid	Ask	Vol	Open Int
02 Aug 65.00 (IBM HM-E)	7.70	pc	6.70	7.20	0	4991	02 Aug 65.00 (IBM TM-E)	0.15	-0.10	0.10	0.20	30	22180
02 Aug 70.00 (IBM HN-E)	2.70	--	2.35	2.65	210	18219	02 Aug 70.00 (IBM TN-E)	0.80	-0.05	0.70	0.75	437	24649
02 Aug 75.00 (IBM HO-E)	0.30	-0.05	0.25	0.35	764	30274	02 Aug 75.00 (IBM TO-E)	3.10	pc	3.30	3.60	0	10368
02 Aug 80.00 (IBM HP-E)	0.05	--	0	0.05	10	12383	02 Aug 80.00 (IBM TP-E)	8.10	pc	7.90	8.40	0	5886
02 Sep 65.00 (IBM IM-E)	8.50	--	8.10	8.60	10	1860	02 Sep 65.00 (IBM UM-E)	1.55	+0.05	1.40	1.65	97	10657
02 Sep 70.00 (IBM IN-E)	4.70	-0.50	4.70	5.00	62	11405	02 Sep 70.00 (IBM UN-E)	2.90	-0.10	2.80	3.10	134	9468
02 Sep 75.00 (IBM IO-E)	2.15	-0.05	2.10	2.40	75	13018	02 Sep 75.00 (IBM UO-E)	5.30	+0.30	5.10	5.60	25	700
02 Sep 80.00 (IBM IP-E)	0.80	-0.10	0.70	0.90	41	5655	02 Sep 80.00 (IBM UP-E)	8.80	pc	8.70	9.20	0	234

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