Midterm
May , 2005

Name: _____

Instructions: Show all your work for full credit, and indicate your answers clearly.
There are eight (8) questions.

1. Companies A and B have been offered the following rates per annum on a \$20 million 10-year loan.

Company	Fixed Rate	Floating Rate
A	8.2	LIBOR + 0.4
B	7.2	LIBOR + 0.1

Company A requires a fixed-rate loan; company B requires a floating-rate loan. Design a swap that will net a bank, acting as an intermediary, 30 basis points, and that will appear equally attractive to A and B.

2. The current asset price is $40. The risk free rate is 5% (unless otherwise noted, all rates are continuously compounded). It costs, today, $2 to store the asset for 6 months. The asset is expected to pay a dividend of $5 in 3 months. A futures contract has a contract size of 10 assets. Compute the delivery price for one contract in 6 months.

3. The current price of 5CollegeInc is $50 per share. It has a volatility of 20% and an expected return of 10%. The risk-free rate is 8%. The stock does not pay dividends. It can be shown that the futures price for one share, to be delivered in 1 year, is approximately $54.16. Assume such futures contracts have contract size one share. This problem continues on the next page.

   (a) Compute the Black-Scholes price of a European call option on this stock, with strike price $48 and expiring in 9 months.

(b) The Darth is a derivative made up of the following financial instruments:

- two call options as described in part(a);
- one put with the same specifications as the call.
- 1000 nickels to be handed over in 6 months;
- a long position in one futures contract with delivery date in 1 year and delivery price of $54.16;
- and 2 shares of the stock, to be handed over in 15 months.

Compute the price of the Darth.

4. The stock price today, at $t = 0$ is $S_0 = \$30$. The stock price in 6 months, at $t = 1/2$, is expected to go up to $34 or down to $27. That is $S_{1/2}$ will be 34 or 27. The buick is a derivative whose payoff is $\$|S_t - 26 - 2t|$ where $|x|$ is the absolute value of x. But it is an American-style derivative, as the owner can decide when (at what t) to receive the pay-off. Assume the risk free rate is 5%. Compute today's price of the buick.

5. Let S_t be the price of a stock at time t with $t = 0$ being today. Assume $S_0 = \$80$. The volatility of the stock is 30% per annum. The expected return of the stock is 12%. The risk-free rate is 10%. Let $f(S_1) = 0$ if $S_1 \leq 70$, $f(S_1) = S_1 - 70$ if $70 \leq S_1 \leq 75$ and $f(S_1) = 5$ if $S_1 \geq 75$. This problem continues on the next page.

(a) Graph $y = f(S_1)$. What is the strategy (derivative) called whose pay-off is given by this graph?

(b) How do you construct this derivative? Be specific.

(c) Use Black-Scholes to price this derivative?

(d) Assuming Black-Scholes, compute the delta of this derivative.

6. Let S_t be the price of a stock at time t with $t = 0$ being today. Assume $S_0 = \$70$. The volatility of the stock is 20% per annum. The expected return of the stock is 12%. The risk-free rate is 10%. This problem continues on the next page.

(a) What is the expected stock price in 3 months?

(b) What is the standard deviation of the stock price in 3 months?

(c) Find an 86% confidence interval for the stock price in 3 months.

(d) What is the daily volatility of the stock?

7. A fund manager has a portfolio worth $1 million. The beta is 1.0. The current S&P 500 spot price is $1000. The volatility of S&P is 20%. The risk-free rate is 8%. The S&P does not expect to pay any dividends in the next year. One S&P futures contract has a contract size of 250 shares. The fund manager is wary of market movements over the next 6 months.

(a) If the manager wants to hedge against market movements over the next 6 months using S&P futures, what exactly should she do?

(b) If the manager wants to avoid losing more than $100,000 at the end of 6 months, and she wants to use options on the S&P, what exactly should she do?

8. Consider a stock, whose spot price is S_0 and which will pay a dividend between now and time T whose present value is $\$D$. Let C be the price of an American call expiring at time T for this stock with strike K. Let P be the price of an American put expiring at time T for this stock with strike K. Use a no-arbitrage argument to prove that $P + S_0 - D \leq C + K$.