Financial Instruments
Bus 35100 Spring 2013
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Midterm

INSTRUCTIONS:

- There are 4 questions. Question 1: 20 points, Question 2: 20 points, Question 3: 30 points, Question 4: 20.
- You have 90 minutes to complete the exam. The number of points for each question are exactly equal to the number of minutes you should spend on the question.
- The questions cover various aspects of the class material. Read all the questions and start from those that you feel more comfortable with.
- Answer all questions as well as you can.
- Do not get hung up on calculations. Sometimes, just setting up an equation or providing a good intuitive argument will be sufficient for partial credit Remember to keep moving!
- Approximate all your calculations to **2 decimal points**.
- **You must write your answers on this midterm. Use back pages for any calculations. No other piece of paper, besides your formula sheet, is allowed.**

Honor Code: I pledge my honor that I have not violated the Honor Code during this examination.

Name and ID number (Please print clearly):_____

Signature:_____

Problem 1. (20 points) True-False Questions (there are 4 of them). *Grade depends on completeness of answer.*

(a) (5 points) Suppose that you write a European call option on a stock. Since you are now implicitly short the stock, you hedge your exposure to the stock by buying an equivalent number of shares of the stock.

(b) XYZ airlines is committed to buying one million barrels of jet fuel next quarter. XYZ can hedge this position by going long futures contracts for one million barrels of oil.

(c) Option contracts may increase in value as they approach maturity.

(d) The current price of a security is given by the expected future price of that security discounted using the risk-adjusted required rate of return. A forward contract to buy that same security locks in the price at which you buy the security at maturity. Since risk is eliminated, the forward price reflects only the risk-free return. For this reason, the forward price of a security must be lower than the expected future price.

Problem 2. (20 points) Binomial trees. Suppose that stock JCH, whose current price is \$100, can either increase by $u = 1.05$ or decrease by $d = 1/(1.05)$ per year for the next 2 years. The continuously-compounded interest rate is 2% per year.

(a) (15 points) Suppose that you are *long* a call option that gives you the option to buy *100* shares JCH stock in two years at a strike price of \$95. How would you hedge your exposure to the price of JCH stock over the life of the option? What is the current price of your option position?

Extra space for problem 2.(a)

(b) (5 points) Consider a *binary* option on JCH stock that has maturity of two years. Under this option contract the holder of the option receives a share of JCH stock if in two years (maturity of the option) the stock is trading between \$85 and \$95. According to your assumptions, what would be an appropriate price for this option? (Hint: notice that I just asked you to price the option. No hedging required!)

Problem 3. (**30 points**) A few years ago your company a bond denominated in Euros. The bond has a face value of 1 million Euros and pays semi-annual coupons at an annual rate of 6%. You just made a coupon payment and the bond has one year left to maturity. In other words you owe a coupon payment in 6 months and payments of coupon along with principal in 1 year.

The current exchange rate is 1.3 dollars per Euro (USD/Euro). The current LIBOR rates (in continuously compounded units) are:

Maturity	USD	Euro
6 months	2%	2%
1 year	2.5%	3%

(a) (10 points) You would like to hedge your exposure to the Euro using forward contracts. How many and what maturities of forward contracts would you use? What would be the forward price of these contracts?

Extra space for problem 3.(a)

(b) (10 points) Suppose the day after you signed your forward contract in part (a) above, the spot exchange rate between dollars and Euros move to 1.29 dollars per Euro (USD/Euro). Yields in the LIBOR market are now:

Maturity	USD	Euro
6 months (less a day)	2%	2%
1 year (less a day)	2.5%	3.1%

What would be the new values of the forward contracts you signed in part (a)? (Assume that there are 360 days in a year.)

Extra space for problem 3.(b)

(c) (10 points) Let's return to the setting of part (a) where you owe a coupon payment in six months, and coupon and principal payments in one year. An investment bank offers you a contract where they will pay your Euro obligation under your bond obligation. In return, you will owe the bank US dollar denominated payments on a bond with one year to maturity, face value of $1.29 million, and semiannual coupon payments at an annual rate of 6%. Would you enter into this contract to hedge your exposure to the Euro? Why or why not?

Extra space for problem 3.(c)

Problem 4. (**20 points**) Through your investment in an index fund you are currently long 1,000 units of the S&P500. In addition, you are long a put option on the S&P500. The terms of this put option are:

- Underlying index: S&P500.
- Number of units of the underlying index: 750.
- Strike price of the put option (per unit of underlying): $1,000.
- Maturity of the put option: 2 years.

(a) (5 points) Why might you be holding the put option contract along with the S&P 500 index?

(b) (15 points) Make the following assumptions:

- Current value of the S&P500: \$1,200
- Risk-free rate: 1% continuously compounded.
- Dividend yield for the S&P500: 0%.
- Volatility of the S&P500: 30%. This will be constant over the life of the option.

Under these assumptions, what should be the value of your portfolio? What is the delta of your portfolio with respect to the S&P500?

Extra space for problem 4.(b)

Cumulative Normal Distribution

$\Phi(x) = \int_{-\infty}^{x} \frac{e^{-y^2/2}}{\sqrt{2\pi}} dy$

x	0	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998