Mathematics of Finance, Courant Institute, Fall 2015

http://www.math.nyu.edu/faculty/goodman/teaching/mathFin/index.html

Always check the class message board before doing any work on the assignment.

Sample questions for October 7, 30 minute quiz

Corrections: (None yet. See message board)

1. Does the following represent an arbitrage opportunity? Why or why not? This table it the prices of three assets at time $T = 1$ (tomorrow) Each asset has price 1 today ($T = 0$).

	asset	1	2	3
state				
1		1.2	.9	.9
2		1.2	1.1	1.2
3		1.2	.8	1.4

2. Suppose both assets have price 1 today and the prices in the table tomorrow. Calculate the risk neutral probabilities of states 1 and 2 tomorrow.

	asset	1	2
state			
1		1.2	1
2		1.2	1.5

3. Write an `R` script that calculates $S = 1 + 2 + \cdots + n$ and prints the result.

4. Write an equation that determines the yield to maturity of a bond that had coupon payments c once a year starting in year 1 and continuing until year $n = 1$ and then has a principal payment of size P. The price today of the bond is $P_0 = 1$. Do not solve the equation.

5. Let V_n be the value of an asset after one year (starting with value 1 today) with interest rate r compounded n times. Write an approximate formula for $e^r - V_n$ that is valid when n is large.

6. Suppose T is an exponential random variable with rate parameter λ.

   (a) What is $\Pr(T > 1)$?

   (b) What is the PDF of T?

   (c) What is the CDF of T?

   (d) What is $\mathrm{E}(T)$?

   (e) What is $\Pr(T < 0)$?

(f) Suppose $S = T^2$. What is the PDF of S?

7. Calculate the correlation of the two assets in the table.

	probability	asset1	asset2
state			
1	$\frac{1}{2}$	0	2
2	$\frac{1}{4}$	4	0
3	$\frac{1}{4}$	8	4

8. In each case state whether the statement is true or false and explain your answer in a few words or sentences.

   (a) Xf X is a random variable and $Y = aX + b$, then the correlation coefficient between Y and X is $\rho_{XY} = \pm 1$.

   (b) If X is a random variable and $Y = f(X)$, then $\rho_{XY} = \pm 1$.

   (c) In the two state model of the table, as long as $p \neq 1$ and $q \neq 1$ and $a \neq b$, then $\rho_{XY} = \pm 1$.

	probability	X	Y
state			
1	p	2	a
2	$q = 1 - p$	3	b

   (d) If random variables X and Y are independent, then they are uncorrelated.

   (e) If random variables X and Y are uncorrelated, then they are independent.