1. Let spot rate be

$$r(t) = 4\%, t = 0, 0.5, \ldots 29.5, 30$$

The key rate I choose is 2,5,10,30 year swap rate. For example, two year key rate shift of size 1bps is given as follow.

$$\Delta y^{2year} = \begin{cases} 1 & T \le 2 \\ \frac{5-T}{5-2} & 2 \le T \le 5 \\ 0 & 5 \le T \end{cases}$$

Please compute the key rate of size 1 basis point shift $DV01^{2year}$ of \$1m face amount 2 year swap.

2. For the 10 year swap, why the 2 year, 5 year and 30 year Key rate 01 are 0?

3. Suppose $\frac{D_2}{D_1} < \frac{C_2}{C_1}$, build a duration neutral portfolio with positive convexity.

4. Today is May 15, 2001. The price of bond 6's of 5/15/2002 is 100, and tomorrow the yield will increase by Δy, where

$$\Delta y \text{ is a random variable with mean } 0, \text{and standard deviation } \sigma$$

What is the variance of tomorrow's bond price?

5. If current discounting factor is $d(0.5) = 0.99479, d(1) = 0.98937, d(1.5) = 0.98375, d(2) = 0.97793$ The key rate I choose is 2,5,10,30 year swap rate. The 2 year key rate shift is defined to be

$$\Delta y^{2year} = \begin{cases} 1 & T \le 2 \\ \frac{5-T}{5-2} & 2 \le T \le 5 \\ 0 & 5 \le T \end{cases}$$

If only the 2 year key rate **increase** by 1 bps, what is new d(0.5) and d(1)
(you only need to write down the procedure ; you don't need to do any numeric computing)

6. par yield is flat 2%, calculate

	KV01			
	2 year	5 year	10 year	30 year
2 year swap				
5 year swap				
10 year swap				
30 year swap				

7. You are a market maker in long-term EUR interest rate swaps. You typically have to hedge the interest rate risk of having received from or paid to a customer on a 20-year interest rate swap. Given the transaction costs of hedging with both 10s and 30s and the relatively short time you wind up having to hold any such hedge, you consider hedging these 20-year swaps with either 10s or 30s but not both. To that end you run two single-variable regressions, both with changes in the 20-year EUR swap rates as the dependent variable, but one regression with changes in the 10-year swap rate as the independent variable and the other with changes in the 30-year swap rate as the independent variable. The results over the period July 1, 2009, to July 3, 2010, are given in the following table.

NUMBER OF OBSERVATIONS	259			
Independent variable	Change in 10-year	Change in 30-year		
R-squared	89.9%	96.3%		
Standard Error	1.105	.666		
Regression Coefficients	Value	Std. Error	Value	Std. Error
Constant	−.017	.069	−.008	.042
Independent variable	1.001	.021	.917	.011

As the swap market maker, you just paid fixed in 100 million notional of 20-year swaps. The DV01s of the 10-, 20-, and 30-year swaps are .0864, .1447, and .1911, respectively. Were you to hedge with 10-year swaps, what would you trade to hedge? And with 30-year swaps?

8. One year ago you paid fixed on $10,000,000 of a 10-year interest rate swap at 4.75%. The nine-year par swap rate now is 5.25%, and the nine-year discount factor from the current swap rate curve is 0.6. Assume that the next floating payment has just been set. Will you pay or receive money to terminate the swap? How much money will be exchanged in the termination?

9. Given the current spot rate r(0.5)=4%, r(1)=5%, compounding semiannually. Consider the discrete model that describe the evolution of 0.5 year spot rate:

$$r_t - r_{t-0.5} = \lambda(t-0.5)\Delta t + 0.01\sqrt{\Delta t}\epsilon_B \quad t = 0.5, 1, 1.5 \ \ldots$$
$$\Delta \mathrm{t} = 0.5$$

Where ϵ_{B} take ± 1 with equal probabilities (risk neutral probability)

Price a 0.5-year call option on a 1-year zero-coupon bond with face value $1,000, with strike price $965.