
Question 3: Derivatives Analysis and Valuation**(30 points)**

The table below shows the prices of zero coupon bonds (strips) and their yields (with simple-return annual compounding) in USD as of today:

Maturity (in years)	Yield on Zero Coupon Bonds	Implied Forward Rates	Zero Prices
1	2.40%	2.400%	0.97656
2	2.80%	3.202%	0.94627
3	3.20%	4.005%	0.90983
4	3.50%	4.405%	0.87144

Note: Implied Forward Rate is for one year period which ends at Maturity given in the left column.

Three years ago, your company entered into an interest rate swap, receiving 4% p.a. fixed (with annual compounding) and paying 12 month LIBOR on a notional of 100 million USD. The swap has a remaining life of 4 years. For simplicity, assume that all interest rates in this question are risk-free. i.e. you can ignore the credit-risk aspect. You can take the one-year forward rate as being equal to the 12-month “forward” LIBOR.

- A swap can be characterized as the difference between two bonds. What are the values of the two bonds involved (the floating and the fixed rate bond), assuming that both have just paid the coupons? What value of the interest rate swap results from this? Round your answers up to 2nd decimal points in millions USD. (8 points)
- Alternatively, a swap can be regarded as a portfolio of forward rate agreements. Show that the value of the swap is unchanged if you decompose it into a portfolio of forward contracts (forward rate agreements). Round your answers up to 2nd decimal points in millions USD. (12 points)
- What is the swap rate for a four-year generic interest rate swap using the same conditions as shown in the above table but starting today (this swap is at the current market rate, therefore has no initial market value)? Round your answers up to 2nd decimal points in percent terms. (10 points)

[Hint: You can use the same analysis as in a) above, but this time the value should be zero.]