

# Sample Exam 1

# Problem 1 – Zero Rates

- Find the c.c. zero rates for the corresponding periods.

Period (yrs)	Coupon	Price (\$)	Principal (\$)
1	0	97	100
2	0	96	100
3	0	94	100

# Problem 2 - Bootstrap

- Calculate the c.c. zero rates for various maturities

Bond Principal	Time to Maturity (yrs)	Coupon per year (\$)	Bond price (\$)
100	0.25	0	98.0
100	0.50	0	96.0
100	1.00	0	92.0
100	1.50	6	96.0
100	2.00	10	101.0

# Problem 3 – Zero Rate

- A 6 year 10% coupon bond is trading at \$117.
- A 6-year 5% coupon bond is trading at \$103.
- Both bonds pay annual coupons
- What is the 6-year zero rate?

# Problem 4 – Discount Curve

- Using the discount curve below calculate the price of a bond with principal value \$100 that has a semiannual coupon payment of 6% for 2 years.

T	coupon	Price	$Z(t,T)$
0.5	0.00%	\$96.80	0.9680
1.0	5.00%	\$99.00	0.9422
1.5	6.00%	\$101.20	0.9269
2.0	7.00%	\$102.33	0.8928

# Problem 5 - Forward Rates Discrete Compounding

- Current 1-year spot rate is 7%, 2-year spot rate is 7.5%, and 3-year spot rate is 8%.
- Calculate the 1-year forward rate for a loan starting 2 years from now.

# Problem 6 - Forward Rates Continuous compounding

Year (n)	Zero rate for n-year investment (% per annum)	Forward rate for nth year (% per annum)
1	5.0	
2	5.3	?
3	6.0	?
4	6.7	?
5	7.0	?

# Problem 7 - Rolling The Yield Curve

Year ( $n$ )	Zero rate for n-year investment (% per annum)	Forward rate for nth year (% per annum)
1	?	3
2	?	3.5
3	?	4
4	?	4.5
5	?	5



# Problem 8 - Forward Rate Agreement

- The forward rate for a three-month period starting in one year is 8.0%.
- What is the value of an FRA that enables the holder to earn 8.2% for a three-month period starting in one year on a principal of \$1,000,000?
- The zero rate for the 1.25 year period is 7.0% continuously compounded.

# Problem 9 - Swap Applications

- LongRange Bank made \$80 million of fixed rate 15-year home mortgage loans at 8% in the past month.
- The bank finances its loan portfolio with six month CDs paying an interest rate equal to six-month LIBOR plus 20 basis points.
- Citibank is quoting 15-year interest rate swaps at 7.05% - 7.10%.
- Show with a diagram how LongRange Bank can hedge its interest rate exposure and calculate its fixed spread on the structured transaction.

# Problem 10 - Swap Applications

- Suppose a pension fund issued \$150 million of five-year Guaranteed Investment Contracts that commit it to pay a fixed rate of 7% semi-annually.
- Suppose the company is able to invest \$150 million in a five-year semi-annual floating rate instrument yielding 6-month LIBOR plus 15bp.
- Citibank is quoting 5-year interest rate swaps at 7.25% - 7.30%.
- Show with a diagram how the pension fund can use this swap to hedge its interest rate exposure and calculate its fixed spread on the structured transaction

# Problem 11 – The Swap Rate

- Given the data in the table below compute the swap rate for a 1-year swap. Assume 360 days in a year. Swap is settled quarterly.

Maturity	Discount factor
90-day	0.982
180-day	0.970
270-day	0.961
360-day	0.950

# Problem 12 – Valuing a IR Swap

- You entered into a 1 year interest rate swap to pay 5.2% fixed versus 3-month LIBOR on a quarterly basis on a notional amount of \$10 million.
- Assume that 240 days have passed since a 1-year swap was originated. The 90-day LIBOR at last settlement (day180) was 4.0%. Using the discount factors below find the current value of the swap.

Maturity	Discount factor
30-day	0.9972
120-day	0.9811

# Problem 13 – Valuing a Currency Swap

- You entered into a currency swap to pay 5% fixed on \$100 million versus receiving 3% fixed on ¥14 billion on a semi-annual basis.
- Today USD LIBOR/swap rates are 6% (semi-annual comp) and Japanese LIBOR/swap rates are 2.5% (semi-annual comp).
- The Swap will last for 2 more years and the current exchange rate is 140 yen per dollar.
- Calculate the value of the currency swap.

# Problem 13 – Valuing a Currency Swap KEY

Period	Cash Outflow(\$)	\$Rate	PV(\$)	Cash Inflow(Yen)	Yen rate	PV(Yen)
1	0.025	0.03	0.024271845	0.015	0.0125	0.014814815
2	0.025	0.03	0.023564898	0.015	0.0125	0.014631916
3	0.025	0.03	0.022878541	0.015	0.0125	0.014451275
4	0.025	0.03	0.022212176	0.015	0.0125	0.014272864
4	1	0.03	0.888487048	1	0.0125	0.951524275
Total			0.981414508			1.009695145
		Value	2,828,063.70			