Session 4
Questions

Question 1

A 9-year Guaranteed Investment Contract (GIC) guarantees an interest rate of 4.70% per year on a bond-equivalent yield basis (interests compound semi-annually). Suppose that the payment made by the policyholder today to purchase the GIC is $50,000,000.

Suppose the market provide 5 bonds with the following characteristics:

BONDS	Coupon	YTM	Modified Duration
Bond 1	5%	6%	2.74
Bond 2	7%	8%	4.78
Bond 3	9%	9%	5.62
Bond 4	10%	8%	8.27
Bond 5	11%	6%	10.29

Face value for all bonds: $1,000
Coupons are paid semi-annually to all bonds.
Coupons and YTM are in annual basis.

a. With the information provided, construct a bond portfolio which aims to assure a return of 4.7% for a 9 years horizon (no short-selling allowed) irrespective of interest rate changes. Additionally bond 3 has to have a 30 percent weight in the bond portfolio created.

Question 2

A 10-year Guaranteed Investment Contract (GIC) guarantees an interest rate of 6.0% per year on a bond-equivalent yield basis (interests compound semi-annually). Suppose that the payment made by the policyholder today to purchase the GIC is $10,000,000.

Calculate:
a. The accumulated value for the life insurance company for the target yield of 6.0% on a bond-equivalent basis.

b. Suppose the market provide 5 bonds with the following characteristics:

BONDS	Coupon	YTM	Maturity
Bond 1	5%	6%	3
Bond 2	7%	8%	6
Bond 3	9%	9%	8
Bond 4	10%	8%	15
Bond 5	11%	6%	20

Face value for all bonds: $1,000
Coupons are paid semi-annually to all bonds.
Coupons and YTM are in annual basis. Maturity is in years.

With the information provided, construct a bond portfolio which aims to assured a return of 6% for a 10 years horizon irrespective of interest rate changes (note: it is required to explicitly calculate the amount invested in which bond).

Question 3

Suppose a Defined benefit Fund has the following schedule liabilities:

Year	Liability ('000 USD)
Year 1	$1,000
Year 2	$1,000
Year 3	$1,000
Year 4	$1,000
Year 5	$2,500
Year 6	$2,500
Year 7	$2,500
Year 8	$2,500
Year 9	$3,000
Year 10	$3,500

Additionally the following bonds are available in the market:

Maturity	Coupon Rate
1 year	3%
2 year	4%
5 year	5%
10 year	6%

All bonds have a $100 face value and are selling at the par.

Show with appropriate calculations a possible bond portfolio which will match the schedule liabilities. Highlight the limitations of the analysis undertaken.