Introduction to Mathematical Finance

Problem Sheet 1

Date due: 2025-03-31

1. LIBOR rates are determined:

A. by countries' central banks.
B. by money market regulators.
C. in the interbank lending market.

2. A market rate of discount for a single payment to be made in the future is:

A. a spot rate.
B. a simple yield.
C. a forward rate.

3. An analyst observes a 20-year, 8% option-free bond with semiannual coupons. The required yield-to-maturity on a semiannual bond basis was 8%, but suddenly it decreased to 7.25%. As a result, the price of this bond:

A. increased.
B. decreased.
C. stayed the same.

4. You are estimating a value for an infrequently traded bond with six years to maturity, an annual coupon of 7%, and a single-B credit rating. You obtain yields-to-maturity for more liquid bonds with the same credit rating:

5% coupon, eight years to maturity, yielding 7.20%.
6.5% coupon, five years to maturity, yielding 6.40%.

The infrequently traded bond is **most likely** trading at:

A. par value.
B. a discount to par value.
C. a premium to par value.

5. A floating-rate note has a quoted margin of +50 basis points and a required margin of +75 basis points. On its next reset date, the price of the note will be:

A. equal to par value.
B. less than par value.
C. greater than par value.

A. A 20-year, 10% annual-pay bond has a par value of $1,000. What is the price of the bond if it has a yield-to-maturity of 15%?

B. An analyst observes a 5-year, 10% semiannual-pay bond. The face amount is £1,000. The analyst believes that the yield-to-maturity on a semiannual bond basis should be 15%. Based on this yield estimate, the price of this bond would be:

C. A $1,000, 5%, 20-year annual-pay bond has a YTM of 6.5%. If the YTM remains unchanged, how much will the bond value increase over the next three years?

D. If spot rates are 3.2% for one year, 3.4% for two years, and 3.5% for three years, the price of a $100,000 face value, 3-year, annual-pay bond with a coupon rate of 4% is:

E. An investor paid a full price of $1,059.04 each for 100 bonds. The purchase was between coupon dates, and accrued interest was $23.54 per bond. What is each bond's flat price?

F. Based on semiannual compounding, what would the YTM be on a 15-year, zero-coupon, $1,000 par value bond that's currently trading at $331.40?

G. An analyst observes a Widget & Co. 7.125%, 4-year, semiannual-pay bond trading at 102.347% of par (where par is $1,000). The bond is callable at 101 in two years. What is the bond's yield-to-call?

H. The 4-year spot rate is 9.45%, and the 3-year spot rate is 9.85%. What is the 1-year forward rate three years from today?

I. Given the following spot and forward rates:
Current 1-year spot rate is 5.5%.
One-year forward rate one year from today is 7.63%.
One-year forward rate two years from today is 12.18%.
One-year forward rate three years from today is 15.5%.
The value of a 4-year, 10% annual-pay, $1,000 par value bond is :