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SAMPLE PROBLEMS

**1. Basic Time Value of Money – Price a Bond**

1. What is the price of a six-year 5 % annual coupon bond with a face value of \$1000 if the discount rate is 6%, compounded monthly?

**2. Inflation and Real and Nominal**

2. If the inflation rate is 2% and the real rate is 3%, what is the nominal rate? Assume all numbers are expressed as an EAY.

**3. Wall Street Journal**

3. Describe what is going on with the London Stock Exchange.

**4. Market Rates**

4. What did the Dow Jones Industrial Average close at yesterday or today? You must be within 50 points.

DJIA close yesterday: \_\_\_\_\_

Or

DJIA close today: \_\_\_\_\_

**5. Forward Rates**

- A. Go to the last page and find the photocopy from the *Wall Street Journal*. Use the data on the last page to answer the questions below. Pretend that today is February 28th and that all of these bonds mature on the last day of the month. Also, assume that all yields or rates on the last page are expressed as an Effective Annual Rate (EAR).

**Circle all bonds/notes/bills/issues/security that you use for the questions below. I need to be able to see which bond/note/bill/issue/security you used on the last page for which questions. Failure to circle the bonds will result in a loss of points.**

1. Based on the information on the photocopied page, what do you expect the interest rate to be on a four-year bond issued three years from now? Express your answer as an EAR. (5 points)

**6. Derive Duration**

- B. Start with the price of a bond and use calculus to derive the duration formula.

**7. Calculate Duration**

- C. Assume that you own a four-year, 10% annual coupon bond with a face value of \$1000. The appropriate discount rate for this bond is 8% EAR.
1. What is the duration of the bond? (5 points)

**8. Use Duration to estimate how much a bond's price will change**

4. Assume a bond has a price of \$950 and a duration of 7.65. If interest rates move from 7% EAR to 6% EAR, what is the new price of the bond based on its duration?

**9. Calculate duration of a portfolio**

5. What is the duration of a portfolio with \$100 in Bond A and \$300 in Bond B? Bond A's duration is 1.5; Bond B's duration is 4.

**10. Price of a Stock**

6. What is the price of a stock where the next quarterly dividend is \$1.50, if dividends are expected to grow at 4% EAY and the appropriate discount rate is 12% EAY?

**11. Limit Order Books**

3. What is the difference between a limit order and a market order?  
B. Here is some real data for IBM from the Archipelago limit order book:

**IBM**

ID	Price	Size	Time	ID	Price	Size	Time
ARCAEX	92.34	100	14:28:41	ARCAEX	92.38	1100	14:28:42
INET	92.34	600	14:28:40	INET	92.38	1300	14:28:42
ARCAEX	92.32	800	14:27:59	ARCAEX	92.40	1100	14:28:42
ARCAEX	92.31	1600	14:27:55	INET	92.40	1100	14:28:42
INET	92.31	1900	14:28:17	ARCAEX	92.41	1600	14:28:40
ARCAEX	92.20	400	14:27:55	INET	92.41	1600	14:28:40
ARCAEX	92.02	5000	10:59:16	ARCAEX	92.43	800	14:27:46
ARCAEX	91.78	2000	13:52:57	ARCAEX	92.61	400	09:43:15
INET	91.78	2000	13:52:57	ARCAEX	92.84	2000	14:27:37
ARCAEX	91.61	100	09:41:59	INET	92.84	2000	14:27:37

Answer the following questions independent of one another.

1. What is the current quote for IBM? Give both prices and amounts. (2 points)

BID PRICE/Depth: \_\_\_\_\_ ASK PRICE/Depth: \_\_\_\_\_

2. What is the cumulative depth on the ask side to 92.40? (3 points)

Cumulative Depth Answer: \_\_\_\_\_

3. If a limit order to buy 500 shares at 92.30 arrives, how does the limit order book change? What is the bid-ask spread after this new order arrives? Give both prices and amounts. (3 points)

**12. Stock Markets**

4. Explain the pertinent differences between the NYSE and Nasdaq.

**13. IPOs**

5. Describe two primary differences between a preliminary prospectus and a final prospectus.

**14. Calculate Payments on a Mortgage**

1. Assume you want to buy a condo in Wellesley for \$1,000,000. You will have to put 20% down and finance the rest. Assume that you can borrow money at 7% (EAY) on a 15 year mortgage where the equal payments are made monthly, but you need to pay 2 points to get it.
  - A. How much of the 60<sup>th</sup> payment is for interest? (5 points)

**15. Calculate remaining balance on a mortgage**

- B. What is the remaining balance on the loan after you make the 60<sup>th</sup> payment above?

**16. Covered Interest Parity**

1. Look at the information from *The Wall Street Journal* attached to this exam. (Assume all numbers in the WSJ are expressed as an EAY.)
  - A. If you are going to borrow in the US and lend in Switzerland for three months, what do you need to charge in Switzerland on your loan if you want to make a 2% spread? (5 points)

**17. Value of a Call option or a Put option**

2. Describe the difference between options, futures, and forwards. (5 points)

**18. Calculate the number of futures needed to immunize a bank from changes in interest rates.**

2. Currently, a bank has \$50,000,000 in cash and one bond as assets, a three year 8% annual coupon bond with a face value of \$150,000,000. The bank also has liabilities currently worth \$125,000,000. Assume that the current interest rate on all bonds/loans/liabilities is 10%, and that the duration of the liabilities is one year.
- A. If interest rates rise by 1%, by how much will the equity of the bank change? (10 points)
- B. Assume that there exists a six-month treasury bond future selling for \$96,000 where the underlying treasury bond is a 10-year 7% annual coupon bond with a face value of \$1000 which has a duration of 6 years. How many futures do you need to either buy or sell to hedge the interest rate exposure of the bank? (5 points)

**19. Understand mutual funds**

3. Explain how to calculate Net Asset Value