

Problem set I M DUE IN CLASS MONDAY OCTOBER 20

Ground rules: The “recommended problems” from the book (RWJ or BKM) and listed in the lecture notes are for practice, and are not to be turned in. The questions in Problem Sets 1, 2, 3 and 4 are at or sometimes above the level of the book problems. These problems are to be turned in. Although you may discuss these problems with others, you should calculate everything yourself (just to make sure that you can get your calculator to give the same answers that everyone else is getting). Your solutions must be written up by yourself: you must turn in the original. If you won't be in class on the day the problem set is due, you can fax me a solution or email me a pdf, and turn in the original at the next meeting.

1. Robert is putting \$20,000 in a retirement account that will compound at 4.5% for ten years. At that point, he will begin a series of five equal annual withdrawals (with the first withdrawal at the end of year 11). What is the size of the withdrawals?
2. Twenty years ago, we invested \$10,000. Twelve years ago we shifted the money into an account paying 4%. Today we have \$31,909 in the account. What was the interest rate over the first eight years?
3. Avner and Irina bought a house, taking out a \$200,000 mortgage at an interest rate of 8% (APR, compounded monthly). There are to be monthly payments over five years.
 - a. If the loan is to be repaid in equal monthly payments, what is the size of each payment?
 - b. Now suppose that the loan is structured so that all payments except the last are equal to \$3,500. What is the size of the last payment? (HINT: Recall that the solution to part a involves setting the amount of the loan equal to the present value of the payments.)
4. On March 17, 2008, Amy sold short 1000 shares of Lehman (ticker symbol LEH) at \$26 per share. Her account had an initial margin of 50% and a maintenance margin of 30%. A few days later (March 20) Lehman peaked near \$49 per share.
 - a. What was the minimum amount of cash (“net worth”) did Amy have to put up initially to arrange the short sale?
 - b. At what price should Amy have expected to get a margin call? I.e., when is the maintenance margin hit? (Hint: it is below \$49)
 - c. Assume that Amy met the margin call (and all subsequent margin calls), but that when Lehman reached \$45, Amy got nervous and covered her short position (repurchased the shares), at \$45. What were her total losses? (Ignore interest income/expense).
 - d. Lehman is now (October 6) trading around \$0.35 per share. If Amy had managed to hold on to her short position, closing it out at \$0.35, what would her profits have been?

1. At the end of 10 years Robert will have \$31,059 (20,000 PV; 10 N; 4.5 I/YR; FV→31,059)
Each of the 5 withdrawals will be \$7,074.98 (31,059 PV; 5 N; 4.5 I/YR; PMT→7,074.98)
2. Twelve years ago, the size of the investment was \$19,930.27 (31,909 FV; 12 N; 4 I/YR; PV→19,930.27)
This represents the FV of a \$10,000 investment, compounded over 8 years at 9.00% (-10,000 PV; 19930.27 FV; 8 N; I/YR→9.00)
3.
 - a. 12 P/YR; 200,000 PV; 8 I/YR; 60 N; PMT→4,055.28
 - b. The PV of the first 59 payments is 170,265.28 (3,500 PMT; 59 N; 8 I/YR; PV→170,265.28).
I.e., these payments would fully payoff a loan of 170,265.28. The actual amount of the loan is 200,000, so $200,000 - 170,265.28 = 29,734.72$ is the remainder of the amount borrowed. This loan will get paid off in a single payment at the end of the 60th month. The size of the payment is 44,300.15 (29,734.72 PV; 8 I/YR; 60 N; FV→44,300.15)
4.
 - a. The market value of the securities sold short is $1,000 \times 26 = 26,000$. Amy had to put of 50% of this, or 13,000 (with the remainder coming from the margin loan).
 - b. $0.3 = NW / (\text{Mkt value of assets sold short}) = (39,000 - 1,000 \times P) / (1,000 \times P) \rightarrow P = \30 per share.
 - c. She lost $45 - 26 = \$19$ per share. On 1,000 shares, her total losses were \$19,000
 - d. She would have gained $26 - 0.35 = 25.65$ per share, or \$25,650 total.