

Homework 5 – Solutions

Chapter 4C

Investment Plans. Use the savings plan formula to answer the following questions.

30. You put \$200 per month in an investment plan that pays an APR of 4.5%. How much money will you have after 18 years? Compare that amount to the total deposits made over the time period.

After 18 years you will have

$$A = \$200 \times \frac{\left[1 + \left(\frac{0.045}{12}\right)\right]^{(12 \times 18)} - 1}{\left(\frac{0.045}{12}\right)} = \$66,373.60.$$

Since you deposit \$200 each month for the 18 years, your will have deposited a total of $\$200 \times 12 \times 18 = \$43,200$, which is about two-thirds the value of the account.

Total and Annual Returns. Compute the total and annual returns on the following investments.

37. Five years after buying 100 shares of XYZ stock for \$60 per share, you sell the for \$9400.

The total return is the relative change in the investment,

$$\frac{\$9400 - (100 \times \$60)}{(100 \times \$60)} = \frac{\$9400 - \$6000}{\$6000} = 0.567 \text{ or } 56.7\%,$$

and the annual return is the APY that would give the same growth,

$$\left(\frac{\$9400}{\$6000}\right)^{(1/5)} - 1 = 0.094 \text{ or } 9.4\%.$$

43. Ten years after purchasing shares in a mutual fund for \$7500, you sell them for \$12,600.

The total return is:

$$\frac{\$12600 - \$7500}{\$7500} = 0.68 \text{ or } 68.0\%,$$

and the annual return is:

$$\left(\frac{\$12600}{\$7500}\right)^{(1/10)} - 1 = 0.053 \text{ or } 5.3\%.$$

44. Ten years after purchasing shares in a mutual fund for \$10,000, you sell them for \$2200 (at a loss).

The total return is:

$$= \frac{\$2200 - \$10000}{\$10000} = -0.78 \text{ or } -78.0\%,$$

and the annual return is:

$$\left(\frac{\$2200}{\$10000}\right)^{(1/10)} - 1 = -0.141 \text{ or } -14.1\%.$$

46. **Historical Returns.** Which investment in 1900 would have been worth more at the end of 2008: \$10 invested in stocks, \$75 invested in bonds, or \$500 invested in cash?

The \$10 investment in stocks would be worth $\$10(1 + 0.06)^{108} = \5407.96 , which is more than the investments in bonds, $\$75(1.021)^{108} = \707.69 , or the cash, $\$500(1.01)^{108} = \$1,464.46$.

Reading Stock Tables.

47. Answer the following questions, assuming the data for Intel stock come from an online quote you looked at last night.

Intel Corporation (INTC)				Market Cap (\$ millions)	\$86,460
Last	Change	% Change	Volume	P/E Ratio	19.77
15.48	+0.43	+2.86%	64,000,000	Dividend (latest quarter)	\$0.14
Open	High	Low		Dividend Yield	3.62%
15.00	15.51	15.00		Shares Outstanding	5580
52-Week-High	52-Week-Low			(millions)	
24.75	12.05				

- a. What is the symbol for Intel stock? INTC
- b. What was the price per share at the end of the day yesterday? \$15.48
- c. Based on the current price, what is the total value shares that have been traded so far today? $\$15.48/\text{share} \times 64 \text{ million shares} = \$990,720,000$
- d. What percentage of all Intel shares have been traded so far today? $64 \text{ million shares}/5580 \text{ million shares} \approx 1.1\%$
- e. Suppose you own 100 shares of Intel. Based on the current price and dividend yield, what total dividend should you expect to receive this year? $(100 \times \$15.48) \times 0.0362 = \56.04
- f. What were the earnings per share for Intel? $\$15.48/19.77 = \0.78 per share
- g. How much total profit did Intel earn in the past year? $(\$15.48/19.77) \text{ million shares} = \$4369 \text{ million, or } \4.37 billion.

Price-to-Earning Ratio. For the stocks described below, answer the following questions.

- a. How much were earnings per share?
- b. Does the stock seem overpriced, underpriced, of about right, given that the historical P/E ratio is 12-14?
51. IBM closed at \$101.89 per share with a P/E ratio of 11.30. (a) Earnings per share is $\$101.89/11.30 = \9.02 ; (b) the price seems “about right.”
52. Google closed at \$393.50 per share with a P/E ratio of 28.78. (a) Earnings per share is $\$393.50/28.78 = \13.67 ; (b) the stock seems overpriced.

Bond Yields. Compute the current yield on the following bonds.

56. A \$1000 Treasury bond with a coupon rate of 2.5% that has a market value of \$1050.

$$\text{current yield} = \frac{0.025 \times \$1000}{\$1050} = 0.0238 \text{ or } 2.38\%$$

57. A \$1000 Treasury bond with a coupon rate of 5.5% that has a market value of \$1100.

$$\text{current yield} = \frac{0.055 \times \$1000}{\$1100} = 0.05 \text{ or } 5\%$$

Who Comes Out Ahead? Consider the following pairs of savings plans. Compare the balances in each plan after 10 years. In each case, which person deposited more money in the plan? Which of the two investments strategies do you believe was better? Assume that the compounding and payment periods are the same.

66. Polly deposits \$50 month in an account with an APR of 6%, while Quint deposits \$40 per month in an account with an APR of 6.5%.

After ten years, the balance in Polly's account is

$$A = \$50 \times \frac{\left[1 + \left(\frac{0.06}{12}\right)\right]^{(12 \times 10)} - 1}{\left(\frac{0.06}{12}\right)} = \$8193.97.$$

She deposits \$50 each month, so her total deposits are $\$50 \times 12 \times 10 = \6000 . Quint's account is worth

$$A = \$40 \times \frac{\left[1 + \left(\frac{0.065}{12}\right)\right]^{(12 \times 10)} - 1}{\left(\frac{0.065}{12}\right)} = \$6736.13.$$

He deposits \$40 each year, so his total deposits are $\$40 \times 12 \times 10 = \4800 . Polly comes out ahead despite her lower APR, because she deposits more each month.

73. **Total Return on Stock.** Suppose you bought XYZ stock 1 year ago for \$5.80 per share and sell it at \$8.25. You also pay a commission of \$0.25 per share on your sale. What is the total return on your investment?

$$\text{total return} = \frac{(\$8.25 - \$0.25) - \$5.80}{\$5.80} = 0.379 \text{ or } 37.9\%$$

(Wrong) answer from Solutions Manual:

$$\text{total return} = \frac{\$8.25 - (\$0.25 + \$5.80)}{(\$0.25 + \$5.80)} = 0.364 \text{ or } 36.4\%$$

Chapter 4D

Loan Payments. Consider the following loans.

- Calculate the monthly payment.
- Determine the total amount paid over the term of the loan.
- Of the total amount paid, what percentage is paid toward the principal and what percentage is paid for interest?

16. A student loan of \$12,000 at a fixed APR of 8% for 10 years.

a. The monthly payment is

$$\text{PMT} = \frac{\$12,000 \left(\frac{0.08}{12}\right)}{1 - \left(1 + \frac{0.08}{12}\right)^{-12 \times 10}} = \$145.59.$$

b. The total payment is $\$145.59 \times 12 \times 10 = \$17,470.80$.

c. Of the total amount paid, $\$12,000/\$17,470.80 = 68.7\%$ is paid toward the principal, and $(\$17,470.80 - \$12,000)/\$17,470.80 = 31.3\%$ is paid for interest.

19. A home mortgage of \$200,000 with a fixed APR of 9% for 15 years.

a. The monthly payment is

$$\text{PMT} = \frac{\$200,000 \left(\frac{0.09}{12}\right)}{1 - \left(1 + \frac{0.09}{12}\right)^{-12 \times 15}} = \$2028.53.$$

b. The total payment is $\$2028.53 \times 12 \times 15 = \$365,135.40$.

c. Of the total amount paid, $\$200,000/\$365,135.40 = 54.8\%$ is paid toward the principal, and $(\$365,135.40 - \$200,000)/\$365,135.40 = 45.2\%$ is paid for interest.

Credit Card Debt. Suppose that on January 1 you have a balance of \$5000 on the following credit cards, which you want to pay off in the given amount of time. Assume that you make no additional charges to the card after January 1.

- Calculate your monthly payments.
- When the card is paid off, how much will you have paid since January 1?
- What percentage of your total payment (part b) is interest?

30. The credit card APR is 20% and you want to pay off the balance in in 2 years.

a. The monthly payment is

$$\text{PMT} = \frac{\$5,000 \left(\frac{0.20}{12}\right)}{1 - \left(1 + \frac{0.20}{12}\right)^{-12 \times 2}} = \$254.48.$$

b. When the card is paid off, you will have paid $\$254.48 \times 12 \times 2 = \6107.52 .

c. Of that $\$6107.52$, $(\$6107.52 - \$5,000)/\$6107.52 = 18.1\%$ is interest.

Comparing Loan Options. Compare the monthly payments and total loan costs for the following pairs of loan options. Assume that both loans are fixed rate and have the same closing costs. Discuss the pros and cons of each loan.

38. You need a \$75,000 loan.

Option 1: a 30-year loan at an APR of 8%.

Option 2: a 15-year loan at 7%.

Under option 1, the monthly payment is

$$\text{PMT} = \frac{\$75,000 \left(\frac{0.08}{12}\right)}{1 - \left(1 + \frac{0.08}{12}\right)^{-12 \times 30}} = \$550.32,$$

and the total cost of the loan is $\$550.32 \times 12 \times 30 = \$198,115.20$. Under option 2, the monthly payment is

$$\text{PMT} = \frac{\$75,000 \left(\frac{0.07}{12}\right)}{1 - \left(1 + \frac{0.07}{12}\right)^{-12 \times 15}} = \$674.12,$$

and the total cost of the loan is $\$674.12 \times 12 \times 15 = \$121,341.60$. Although, the payments in option 1 are significantly less, you'll end up paying considerably more interest over the term of the loan.

Closing Costs. Consider the following pairs of loan options for a \$120,000 mortgage. Calculate the monthly payment and total closing costs for each option. Explain which option you would choose and why.

43. Choice 1: 30-year fixed rate at 7.25% with closing costs of \$1200 and 1 point

Choice 2: 30-year fixed rate at 6.75% with closing costs of \$1200 and 3 points

Under choice 1, the monthly payment is

$$\text{PMT} = \frac{\$120,000 \left(\frac{0.0725}{12}\right)}{1 - \left(1 + \frac{0.0725}{12}\right)^{-12 \times 30}} = \$818.61,$$

and the closing costs are $\$1200 + \$120,000(0.01) = \$2400$. For choice 2, the monthly payment is

$$\text{PMT} = \frac{\$120,000 \left(\frac{0.0675}{12}\right)}{1 - \left(1 + \frac{0.0675}{12}\right)^{-12 \times 30}} = \$778.32,$$

and the closing costs are $\$1200 + \$120,000(0.03) = \$4800$. You'll save $\$818.61 - \$778.32 = \$40.29$ each month with choice 2, but it will take you $\$2400/\$40.29 \approx 60$ months (5 years) to recoup the additional closing costs.

46. **Accelerated Loan Payment.** Suppose you have a student loan of \$60,000 with an APR of 8% for 25 years.

a. What are your required monthly payments?

$$\text{PMT} = \frac{\$60,000 \left(\frac{0.08}{12}\right)}{1 - \left(1 + \frac{0.08}{12}\right)^{-12 \times 25}} = \$463.09.$$

b. Suppose you would like to pay the loan off in 15 years instead of 25. What monthly payments will you need to make?

$$\text{PMT} = \frac{\$60,000 \left(\frac{0.08}{12}\right)}{1 - \left(1 + \frac{0.08}{12}\right)^{-12 \times 15}} = \$573.39.$$

- c. Compare the total amounts you'll pay over the loan term if you pay the loan off in 25 years versus 15 years.

If you pay the loan off in 25 years, the total payments will be $\$463.09 \times 12 \times 25 = \$138,927$, while, if you pay the loan off in 15 years the total payments will be $\$573.39 \times 12 \times 15 = \$103,210.20$.

- 47. ARM Rate Approximations.** You have a choice between a 30-year fixed rate loan at 7% and an adjustable rate mortgage (ARM) with a first-year rate of 5%. Neglecting compounding and changes in principal, estimate your monthly savings with the ARM during the first year on an \$150,000 loan. Suppose that the ARM rate rises to 8.5% at the start of the third year. Approximately how much extra will you then be paying over what you would have paid if you had taken the fixed rate loan?

Following example 10 in the text, the interest on the \$150,000 loan in the first year will be approximately $7\% \times \$150,000 = \$10,500$ which means the monthly payment will be about $\$10,500/12 = \875 . With the 5% ARM the interest will be approximately $5\% \times \$150,000 = \7500 , so the monthly payment will be about $\$7500/12 = \625 . You'll save $\$875 - \$625 = \$250$ each month with the ARM. In the third year, the rate on the ARM will be 1.5% higher than the fixed rate loan, so the yearly interest payments will be about $\$150,000 \times 0.015 = \2200 (or \$187.50 per month) higher.

- 51. Student Loan Consolidation.** Suppose you have the following three student loans: \$10,000 with an APR of 8% for 15 years, \$15,000 with an APR of 8.5% for 20 years, and \$12,500 with an APR of 9% for 10 years.

- a. Calculate the monthly payment for each loan individually.

$$\text{PMT}_1 = \frac{\$10,000 \left(\frac{0.08}{12}\right)}{1 - \left(1 + \frac{0.08}{12}\right)^{-12 \times 15}} = \$95.57; \quad \text{PMT}_2 = \frac{\$15,000 \left(\frac{0.085}{12}\right)}{1 - \left(1 + \frac{0.085}{12}\right)^{-12 \times 20}} = \$130.17;$$

$$\text{PMT}_3 = \frac{\$12,500 \left(\frac{0.09}{12}\right)}{1 - \left(1 + \frac{0.09}{12}\right)^{-12 \times 10}} = \$158.34.$$

- b. Calculate the total you'll pay in payments during the life of all three loans.

The total payments are $\$95.57 \times 12 \times 15 = \$17,202.60$, $\$130.17 \times 12 \times 20 = \$31,240.80$, and $\$158.34 \times 12 \times 10 = \$19,000.80$, respectively. The overall total is then \$67,444.20.

- c. A bank offers to consolidate your three loans into a single loan with an APR of 8.5% and a loan term of 20 years. What will your monthly payments be in that case? What will your total payments be over the 20 years? Discuss the pros and cons of accepting this loan consolidation.

The monthly payment for the consolidated loan is

$$\text{PMT} = \frac{\$37,500 \left(\frac{0.085}{12}\right)}{1 - \left(1 + \frac{0.085}{12}\right)^{-12 \times 20}} = \$325.43,$$

so your total payments will be $\$325.43 \times 12 \times 20 = \$78,103.20$, which is \$10,659 more for the consolidated loan (though your monthly payments will be less for the first ten years).