- Two types of mortgages are common: fixed-rate mortgages and variable-rate mortgages. Fixed-rate mortgages offer loans whose interest rates are fixed over the period of the contract, whereas variable-rate mortgages offer interest rates that fluctuate with market conditions. In general, the initial interest rate is lower for variable-rate mortgages, as the lenders have the flexibility to adjust the cost of the loans over the period of the contract.
- Allocating one's assets is simply a matter of answering the following question: "Given my personal tolerance for risk and my investment objectives, what percentage of my assets should be allocated for **growth**, what percentage for **income**, and what percentage for **liquidity**?"
- You can determine the **expected rate of return** on a portfolio by computing the weighted average of the returns on each investment.
- You can determine the **expected risk** of a portfolio by computing the weighted average of the volatility of each investment.
- All other things being equal, if the expected returns are approximately the same, choose the portfolio with the lowest expected risk.
- All other things being equal, if the expected risk is about the same, choose the portfolio with the highest expected return.
- **Asset-backed bonds:** If a company backs its bonds with specific pieces of property, such as buildings, we call these types of bonds **mortgage bonds**. These indicate the terms of repayment and the particular assets pledged to the bondholders in case of default. It is much more common, however, for a corporation simply to pledge its overall assets. A **debenture bond** represents such a promise.
- **Par value:** Individual bonds are normally issued in even denominations of $1,000 or multiples of $1,000. The stated face value of an individual bond is termed the **par value**.
- **Maturity date:** Bonds generally have a specified **maturity** date on which the par value is to be repaid.
- **Coupon rate:** We call the interest paid on the par value of a bond the **annual coupon rate**. The time interval between interest payments could be of any duration, but a semiannual period is the most common.
- **Discount or premium bond:** A bond that sells below its par value is called a **discount bond**. When a bond sells above its par value, it is called a **premium bond**.

PROBLEMS

Nominal and Effective Interest Rates

4.1. A department store has offered you a credit card that charges interest at 1.15% per month, compounded monthly. What is the nominal interest (annual percentage) rate for this credit card? What is the effective annual interest rate?

4.2. If your credit card calculates interest based on 13.90% APR, compounded monthly,

(a) What are your monthly interest rate and annual effective interest rate?

(b) If your current outstanding balance is $3,000 and you skip payments for two months, what would be the total balance two months from now?

***4.3.** A local bank advertised the following information: Interest 6.89%—effective annual yield 7.128%. No mention was made of the interest period in the advertisement. Can you figure out the compounding scheme used by the bank?

4.4. College Financial Sources, which makes small loans to college students, offers to lend $500. The borrower is required to pay $40 at the end of each week for 16 weeks. Find the interest rate per week. What is the nominal interest rate per year? What is the effective interest rate per year?

***4.5.** What is the effective annual yield of 8% compounded continuously?

4.6. A financial institution is willing to lend you $400. However, $450 is repaid at the end of one week.

(a) What is the nominal interest rate?

(b) What is the effective annual interest rate?

4.7. If a bank advertises a savings account that pays a 6% nominal interest rate compounded continuously, what is the effective annual percentage rate?

4.8. The Cadillac Motor Car Company is advertising a 24-month lease of a Cadillac Deville for $520 payable at the beginning of each month. The lease requires a $2,500 down payment plus a $500 refundable security deposit. As an alternative, the company offers a 24-month lease with a single up-front payment of $12,780 plus a $500 refundable security deposit. The security deposit will be refunded at the end of the 24-month lease. Assuming an interest rate of 6% compounded monthly, which lease is the preferred one?

4.9. You have three choices in placing your money in a bank account.

- **Bank A** pays 9.25% compounded annually.
- **Bank B** pays 9.00% compounded quarterly.
- **Bank C** pays 8.90% compounded continuously.

Which bank would you open an account with?

4.10. As a typical middle-class consumer, you are making monthly payments on your home mortgage (10% annual interest rate), car loan (12%), home improvement loan (14%), and past-due charge accounts (18%). Immediately after getting a $100 monthly raise, your friendly mutual fund broker tries to sell you some investment funds with a guaranteed return of 10% per year. Assuming that your only other investment alternative is a savings account, should you buy?

4.11. Bank A offers a nominal annual interest rate of 7% compounded daily, while Bank B offers continuous compounding at a 6.9% nominal annual rate. If you deposit $3,000 with each bank, what will be the difference in the two bank account balances after two years?

Compounding More Frequent than Annually

4.12. How much will $5,000 be worth in 10 years with 6% interest compounded continuously?

4.13. How much money must you deposit now to have $5,000 in five years at 6% compounded continuously?

***4.14.** How much money will you have in five years if you deposit $3,000 in the bank at 8% interest compounded continuously?

4.15. How long will it take money to double with continuous compounding at 6% interest?

4.16. A loan company offers money at 1.95% per month compounded monthly.

(a) What is the nominal interest rate?

(b) What is the effective annual interest rate?

(c) How many years will it take an investment to triple if interest is compounded monthly?

(d) How many years will it take an investment to triple if the nominal rate is compounded continuously?

4.17. Suppose your savings account pays 8% interest compounded quarterly. If you deposit $15,000 for two years, how much will you have?

***4.18.** If you invest $15,000 today at a 6% interest compounded daily, what will be your ending value after 12 years?

4.19. What will be the amount accumulated by each of these present investments?

(a) $7,890 in 10 years at 9% compounded semiannually.

(b) $4,500 in 15 years at 8% compounded quarterly.

(c) $29,800 in 7 years at 12% compounded monthly.

4.20. How many years will it take an investment to triple if the interest rate is 6% compounded at the given intervals?

(a) Quarterly

(b) Monthly

(c) Continuously

4.21. A series of equal quarterly payments of $8,000 for 15 years is equivalent to what present amount at an interest rate of 9% compounded at the given intervals?

(a) Quarterly

(b) Monthly

(c) Continuously

***4.22.** What is the future worth of an equal payment series of $5,000 at the end of each quarter for five years if the interest rate is 8% compounded continuously?

4.23. Suppose that $4,000 is placed in a bank account at the end of each quarter over the next 10 years. What is the future worth at the end of 10 years when the interest rate is 9% compounded at the given intervals?

(a) Quarterly
(b) Monthly
(c) Continuously

4.24. A series of equal end-of-quarter deposits of $1,000 extends over a period of three years. It is desired to compute the future worth of this quarterly deposit series at 12% compounded monthly. Which of the following equations is correct?

(a) $F = 4(\$1{,}000)(F/A, 12\%, 3)$
(b) $F = \$1{,}000(F/A, 3\%, 12)$
(c) $F = \$1{,}000(F/A, 1\%, 12)$
(d) $F = \$1{,}000(F/A, 3.03\%, 12)$

4.25. If the interest rate is 7.9% compounded continuously, what is the required quarterly payment to repay a loan of $10,000 in five years?

***4.26.** What is the future worth of a series of equal end-of-month payments of $1,500 if the series extends over a period of eight years at 9% interest compounded at the given intervals?

(a) Quarterly
(b) Monthly
(c) Continuously

For (a), assume that deposits made in mid-quarter earn interest for the fraction of the quarter during which they are on deposit.

4.27. Suppose you deposit $500 at the end of each quarter for five years at an interest rate of 8% compounded monthly. What equal end-of-year deposit over the five years would accumulate the same amount at the end of the five years under the same interest compounding? To answer the question, which of the following is correct?

(a) $A = [\$500(F/A, 2\%, 20)] \times (A/F, 8\%, 5)$
(b) $A = \$500(F/A, 2.013\%, 4)$
(c) $A = \$500\left(F/A, \frac{8\%}{12}, 20\right) \times (A/F, 8\%, 5)$
(d) None of the above.

4.28. A series of equal quarterly payments of $6,000 for 15 years is equivalent to what future lump-sum amount at the end of 10 years at an interest rate of 9% compounded continuously?

4.29. What will be the required quarterly payment to repay a loan of $56,000 in five years if the interest rate is 8.75% compounded continuously?

***4.30.** A series of equal quarterly payments of $3,500 extends over a period of three years. What is the present worth of this quarterly payment series at 6.88% interest compounded continuously?

4.31. What is the future worth of the following series of payments?

(a) $22,000 at the end of each six-month period for five years at 8% compounded semiannually.
(b) $80,000 at the end of each quarter for 10 years at 6% compounded quarterly.
(c) $33,000 at the end of each month for six years at 9% compounded monthly.

4.32. You have $15,345.36 in your savings account that has been paying at 7% compounded continuously. If you opened the account 10 years ago and made no deposits during any other years, how much was your original deposit?

4.33. What equal series of payments must be paid into a sinking fund to accumulate the following amount?

(a) $45,000 in 10 years at 7.45% compounded semiannually when payments are semiannual.
(b) $25,000 in 15 years at 6.35% compounded quarterly when payments are quarterly.
(c) $12,000 in five years at 9.25% compounded monthly when payments are monthly.

4.34. You have a habit of drinking a cup of Starbucks coffee ($3.50 a cup) on the way to work every morning. If instead you put the money in the bank for 30 years, how much would you have at the end of that time, assuming that your account earns 5% interest compounded *daily*? Assume also that you drink a cup of coffee every day, including weekends.

***4.35.** Michelle Passmore is purchasing a $25,000 automobile, which is to be paid for in 60 monthly installments of $489.15. What effective annual interest is she paying for this financing arrangement?

4.36. You are planning to purchase your first home five years from today. The required down payment

will be $50,000. You currently have $20,000, but you plan to contribute $500 each quarter to a special savings account until you purchase the home. To achieve your goal, what nominal interest rate, compounded continuously, must you earn on your account?

*4.37. A loan of $15,000 is to be financed to assist in buying an automobile. On the basis of monthly compounding for 42 months, the end-of-the-month equal payment is quoted as $409.61. What nominal interest rate in percentage is being charged?

4.38. Suppose a young newlywed couple is planning to buy a home three years from now. To save the down payment required at the time of purchasing a home worth $350,000 (let's assume that the down payment is 20% of the sale price, which is $70,000), the couple decides to set aside some money from each of their salaries at the end of every month. If each of them can earn 6% interest (compounded monthly) on his or her savings, determine the equal amount this couple must deposit each month until the point is reached where the couple can buy the home.

4.39. What is the present worth of the following series of payments?

(a) $3,000 at the end of each six-month period for 10 years at 6% compounded semiannually.

(b) $4,000 at the end of each quarter for 12 years at 8% compounded quarterly.

(c) $2,200 at the end of each month for four years at 9% compounded monthly.

4.40. What is the amount of the quarterly deposits A such that you will be able to withdraw the amounts shown in the cash flow diagram if the interest rate is 8% compounded quarterly?

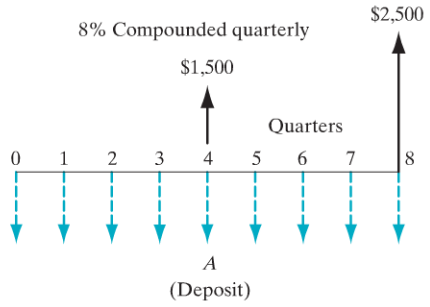

Figure P4.40

4.41. Joe Franklin deposits $22,000 in a savings account that pays 6% interest compounded monthly. Three years later, he deposits $16,000. Two years after the $16,000 deposit, he makes another deposit in the amount of $13,500. Four years after the $13,500 deposit, half of the accumulated funds is transferred to a fund that pays 8% interest compounded quarterly. How much money will be in each account six years after the transfer?

*4.42. A man is planning to retire in 25 years. He wishes to deposit a regular amount every three months until he retires, so that, beginning one year following his retirement, he will receive annual payments of $80,000 for the next 15 years. How much must he deposit if the interest rate is 6% compounded quarterly?

4.43. You borrowed $12,000 to buy a new car from a bank at an interest rate of 9% compounded monthly. This loan will be repaid in 48 equal monthly installments over four years. Immediately after the 20th payment, you desire to pay the remainder of the loan in a single payment. Compute this lump-sum amount.

4.44. A building is priced at $125,000. If a down payment of $25,000 is made and a payment of $1,200 every month thereafter is required, how many months will it take to pay for the building? Interest is charged at a rate of 9% compounded monthly.

*4.45. You obtained a loan of $20,000 to finance an automobile. Based on monthly compounding over 36 months, the end-of-the-month equal payment was figured to be $650.52. What APR was used for this loan?

4.46. A professional journal offers three types of subscriptions, payable in advance: one year at $66, two years at $120, and three years at $160. If money can earn 6% interest compounded monthly, which subscription should you take? (Assume that you plan to subscribe to the journal over the next three years.)

4.47. A married couple are trying to finance their three-year-old son's college education. Money can be deposited at 6% compounded quarterly. What end-of-quarter deposit must be made from the son's 3rd birthday to his 18th birthday to provide $60,000 on each birthday from the 18th to the 21st? (Note that the first deposit comes three months after his 3rd birthday and the last deposit is made on the date of the first withdrawal.)

*4.48. Cory Manciagli is planning to retire in 20 years. Money can be deposited at 6% compounded quarterly. What quarterly deposit must be made at the end of each quarter until Corey retires so that he can make a withdrawal of $40,000 semiannually over the first 10 years of his retirement? Assume that his first withdrawal occurs at the end of six months after his retirement.

4.49. Patricia French received $500,000 from an insurance company after her husband's death. Patricia wants to deposit this amount in a savings account that earns interest at a rate of 5% compounded monthly. Then she would like to make 120 equal monthly withdrawals over the 10-year period such that, when she makes the last withdrawal, the savings account will have a balance of zero. How much can she withdraw each month?

4.50. Debbie Weissinger, who owns a travel agency, bought an old house to use as her business office. She found that the ceiling was poorly insulated and that the heat loss could be cut significantly if 6 inches of foam insulation were installed. She estimated that with the insulation, she could cut the heating bill by $50 per month and the air-conditioning cost by $35 per month. Assuming that the summer season is three months (June, July, and August) of the year and that the winter season is another three months (December, January, and February) of the year, how much can Anita spend on insulation if she expects to keep the property for five years? Assume that neither heating nor air-conditioning would be required during the fall and spring seasons. If she decides to install the insulation, it will be done at the beginning of May. Debbie's interest rate is 6% compounded monthly.

Continuous Payments with Continuous Compounding

4.51. A new chemical production facility that is under construction is expected to be in full commercial operation one year from now. Once in full operation, the facility will generate $95,000 cash profit daily over the plant's service life of 10 years. Determine the equivalent present worth of the future cash flows generated by the facility at the beginning of commercial operation, assuming

(a) 10% interest compounded daily, with the daily flows.

(b) 10% interest compounded continuously, with the daily flow series approximated by a uniform continuous cash flow function.

Also, compare the difference between part (a) discrete (daily) and part (b) continuous compounding.

4.52. Income from a project is expected to decline at a constant rate from an initial value of $500,000 at time 0 to a final value of $40,000 at the end of year 3. If interest is compounded continuously at a nominal annual rate of 11%, determine the present value of this continuous cash flow.

4.53. A sum of $16,000 per year will be received uniformly over a five-year period beginning two years from today. What is the present value of this deferred-funds flow if interest is compounded continuously at a nominal rate of 9%?

4.54. A small chemical company that produces an epoxy resin expects its production volume to decline exponentially according to the relationship

$$y_t = 5e^{-0.25t}$$

where y_t is the production rate at time t. Simultaneously, the unit price is expected to increase linearly over time at the rate

$$u_t = 55(1 + 0.09t)$$

What is the expression for the present worth of sales revenues from $t = 0$ to $t = 20$ at 12% interest compounded continuously?

Changing Interest Rates

4.55. How much money would be accumulated in 10 years for a deposit of $10,000 made at the end of year 0 if the account earned interest at 8% per year for the first three years, 10% per year for the next four years, and 11% per year for the last three years?

4.56. Consider the accompanying cash flow diagram, which represents three different interest rates applicable over the five-year time span shown.

(a) Calculate the equivalent amount P at the present time.

(b) Calculate the single-payment equivalent to F at $n = 5$.

(c) Calculate the equivalent equal-payment series cash flow A that runs from $n = 1$ to $n = 5$.

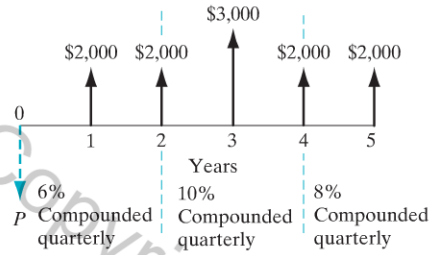

Figure P4.56

4.57. Consider the cash flow transactions depicted in the accompanying cash flow diagram with the changing interest rates specified.

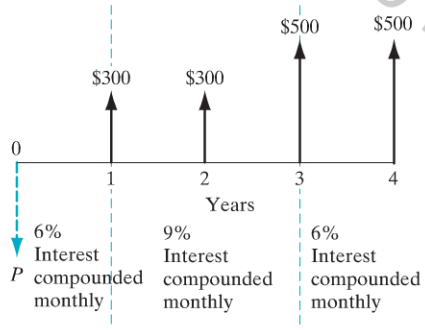

Figure P4.57

(a) What is the equivalent present worth? (In other words, how much do you have to deposit now so that you can withdraw $300 at the end of year 1, $300 at the end of year 2, $500 at the end of year 3, and $500 at the end of year 4?)

(b) What is the single, effective annual interest rate over four years?

4.58. Compute the future worth of the cash flows with the different interest rates specified. The cash flows occur at the end of each year over four years.

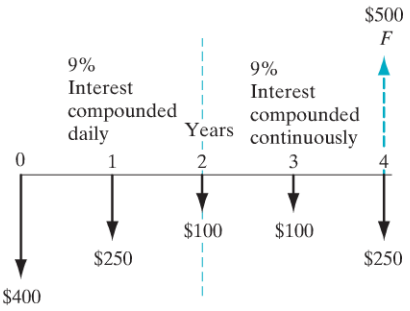

Figure P4.58

4.59. Suppose the continuously compounded interest rate this year is 6%, and next year it will be 8%. What is the balance after two years of $1,000 invested today?

Amortized Loans

***4.60.** An automobile loan of $25,000 at a nominal rate of 6% compounded monthly for 60 months requires equal end-of-month payments of $483.32. Complete Table P4.60 for the first six payments, as you would expect a bank to calculate the values.

TABLE P4.60

End of Month (n)	Interest Payment	Repayment of Principal	Remaining Loan Balance
1			$24,641.68
2			
3		$361.91	
4	$119.60		
5	$117.78		
6			$22,823.03

4.61. Mr. Smith wants to buy a new car that will cost $18,000. He will make a down payment in the amount of $8,000. He would like to borrow the remainder from a bank at an interest rate of 9% compounded monthly. He agrees to pay off the loan monthly for a period of two years. Select the correct answer for the following questions:

(a) What is the amount of the monthly payment A?

i. $A = \$10{,}000(A/P, 0.75\%, 24)$

ii. $A = \$10{,}000(A/P, 9\%, 2)/12$

iii. $A = \$10{,}000(A/F, 0.75\%, 24)$

iv. $A = \$12{,}500(A/F, 9\%, 2)/12$

(b) Mr. Smith has made 12 payments and wants to figure out the balance remaining immediately after 12th payment. What is that balance?

i. $B_{12} = 12A$
ii. $B_{12} = A(P/A, 9\%, 1)/12$
iii. $B_{12} = A(P/A, 0.75\%, 12)$
iv. $B_{12} = 10{,}000 - 12A$

4.62. Kelly Robins is considering purchasing a used automobile. The price including the title and taxes is $15,455. Kelly is able to make a $2,455 down payment. The balance of $13,000 will be borrowed from his credit union at an interest rate of 9.45% compounded daily. The loan should be paid in 36 equal monthly payments. Compute the monthly payment. What is the total amount of interest Kelly has to pay over the life of the loan?

4.63. Suppose you are in the market for a new car worth $22,000. You are offered a deal to make a $2,000 down payment now and to pay the balance in equal end-of-month payments of $505.33 over a 48-month period. Consider the following situations.

(a) Instead of going through the dealer's financing, you want to make a down payment of $1,800 and take out an auto loan from a bank at 9.2% compounded monthly. What would be your monthly payment to pay off the loan in four years?

(b) If you were to accept the dealer's offer, what would be the effective rate of interest per month the dealer charges on your financing?

***4.64.** Clay Harden borrowed $25,000 from a bank at an interest rate of 9% compounded monthly. The loan will be repaid in 36 equal monthly installments over three years. Immediately after his 20th payment, Bob desires to pay the remainder of the loan in a single payment. Compute the total amount he must pay.

4.65. You plan to buy a $250,000 home with a 20% down payment. The bank you want to finance the loan suggests two options: a 15-year mortgage at 4.25% APR and a 30-year mortgage at 5% APR. What is the difference in monthly payments between these two options?

4.66. Antonio Menifee borrowed money from a bank to finance a small fishing boat. The bank's terms allowed him to defer payments (including interest) on the loan for six months and to make 36 equal end-of-month payments thereafter. The original bank note was for $16,000 with an interest rate of 9% compounded monthly. After 16 monthly payments, Antonio found himself in a financial bind and went to a loan company for assistance in lowering his monthly payments. Fortunately, the loan company offered to pay his debts in one lump sum if he would pay the company $308.29 per month for the next 36 months. What monthly rate of interest is the loan company charging on this transaction?

4.67. Deborah Milstead is considering buying a home for $200,000.

(a) If she makes a down payment of $50,000 and takes out a mortgage on the rest of the money at 7.8% compounded monthly, what will be her monthly payment to retire the mortgage in 15 years?

(b) Consider the 24th payment. How much will the interest and principal payments be?

***4.68.** With a $400,000 home mortgage loan with a 15-year term at 9% APR compounded monthly, compute the total payments on principal and interest over the first five years of ownership.

4.69. A lender requires that monthly mortgage payments be no more than 25% of gross monthly income with a maximum term of 30 years. If you can make only a 15% down payment, what is the minimum monthly income needed to purchase a $300,000 house when the interest rate is 6% compounded monthly?

4.70. To buy a $150,000 house, you take out a 9% (APR) mortgage for $120,000. Five years later, you sell the house for $185,000 (after all other selling expenses). What equity (the amount that you can keep before tax) would you realize with a 30-year repayment term?

4.71. Consider the following three individuals. Just after their 14th payment:

- Robert Dixon had a balance of $80,000 on a 9%, 15-year mortgage;
- Wanda Harper had a balance of $80,000 on a 9%, 20-year mortgage; and
- Tony Zang had a balance of $80,000 on a 9%, 30-year mortgage.

How much interest did each individual pay on the 15th payment?

4.72. Home mortgage lenders usually charge points on a loan to avoid exceeding a legal limit on interest rates or to be competitive with other lenders. As an example, for a two-point loan, the lender would lend

only $98 for each $100 borrowed. The borrower would receive only $98, but would have to make payments just as if he or she had received $100. Suppose that you receive a loan of $130,000, payable at the end of each month for 30 years with an interest rate of 9% compounded monthly, but you have been charged three points. What is the effective borrowing rate on this home mortgage loan?

4.73. You are considering purchasing a lot adjacent to your laundry business to provide adequate parking space for your customers. You need to borrow $50,000 to secure the lot. You have made a deal with a local bank to pay the loan back over a five-year period with the following payment terms: 15%, 20%, 25%, 30%, and 35% of the initial loan at the end of first, second, third, fourth, and fifth years, respectively.

(a) What rate of interest is the bank earning from this loan?

(b) What would be the total interest paid over the five-year period?

4.74. Emily Dorsey's current salary is $75,000 per year, and she is planning to retire 25 years from now. She anticipates that her annual salary will increase by $3,000 each year (to $75,000 the first year, $78,000 the second year, $81,000 the third year, and so forth), and she plans to deposit 5% of her yearly salary into a retirement fund that earns 7% interest compounded daily. What will be the amount of interest accumulated at the time of Emily's retirement?

4.75. Consider the following two options for financing a car:

- **Option A.** Purchase the vehicle at the normal price of $26,200 and pay for the vehicle over three years with equal monthly payments at 1.9% APR financing.
- **Option B.** Purchase the vehicle for a discount price of $24,048 to be paid immediately. The funds that would be used to purchase the vehicle are presently earning 5% annual interest compounded monthly.

(a) What is the meaning of the APR of 1.9% quoted by the dealer?

(b) Under what circumstances would you prefer to go with the dealer's financing?

(c) Which interest rate (the dealer's interest rate or the savings rate) would you use in comparing the two options?

Add-On Loans

4.76. If you borrowed $20,000 for 60 months at 18% with an add-on loan, what would be your monthly payment and the total amount you paid on interest?

4.77. Katerina Unger wants to purchase a set of furniture worth $3,000. She plans to finance the furniture for two years. The furniture store tells Katerina that the interest rate is only 1% per month, and her monthly payment is computed as follows.

- Installment period = 24 months.
- Interest = $24(0.01)(\$3{,}000) = \$720$.
- Loan processing fee = $25.
- Total amount owed = $3,000 + $720 + $25 = $3,745.
- Monthly payment = $3,745/24 = $156.04 per month.

(a) What is the annual effective interest rate that Katerina is paying for her loan transaction? What is the nominal interest (annual percentage rate) for the loan?

(b) Katerina bought the furniture and made 12 monthly payments. Now she wants to pay off the remaining installments in one lump sum (at the end of 12 months). How much does she owe the furniture store?

***4.78.** You purchase a piece of furniture worth $5,000 on credit through a local furniture store. You are told that your monthly payment will be $146.35, including an acquisition fee of $25, at a 10% add-on interest rate over 48 months. After making 15 payments, you decide to pay off the balance. Compute the remaining balance based on the conventional amortized loan.

Loans with Variable Payments

4.79. Kathy Stonewall bought a new car for $15,458. A dealer's financing was available through a local bank at an interest rate of 11.5% compounded monthly. Dealer financing required a 10% down payment and 60 equal monthly payments. Because the interest rate was rather high, Kathy checked her credit union for possible financing. The loan officer at the credit union quoted a 9.8% interest rate for a new-car loan and 10.5% for a used car. But to be eligible for the loan, Kathy has to be a member of the union for at least six months. Since she joined the

union two months ago, she has to wait four more months to apply for the loan. Consequently, she decided to go ahead with the dealer's financing, and four months later she refinanced the balance through the credit union at an interest rate of 10.5%.

(a) Compute the monthly payment to the dealer.
(b) Compute the monthly payment to the union.
(c) What is the total interest payment on each loan?

4.80. A house can be purchased for $155,000, and you have $25,000 cash for a down payment. You are considering the following two financing options:

- **Option 1.** Getting a new standard mortgage with a 7.5% (APR) interest and a 30-year term.
- **Option 2.** Assuming the seller's old mortgage, which has an interest rate of 5.5% (APR), a remaining term of 25 years (the original term was 30 years), a remaining balance of $97,218, and payments of $597 per month. You can obtain a second mortgage for the remaining balance ($32,782) from your credit union at 9% (APR) with a 10-year repayment period.

(a) What is the effective interest rate of the combined mortgage?
(b) Compute the monthly payments for each option over the life of the mortgage.
(c) Compute the total interest payment for each option.
(d) What homeowner's interest rate makes the two financing options equivalent?

Loans with Variable Interest Rates

4.81. A loan of $10,000 is to be financed over a period of 24 months. The agency quotes a nominal rate of 8% for the first 12 months and a nominal rate of 9% for any remaining unpaid balance after 12 months, which is compounded monthly. Based on these rates, what equal end-of-the-month payment for 24 months would be required to repay the loan with interest?

4.82. Emily Wang financed her office furniture from a furniture dealer. The dealer's terms allowed her to defer payments (including interest) for six months and to make 36 equal end-of-month payments thereafter. The original note was for $15,000, with interest at 9% compounded monthly. After 26 monthly payments, Emily found herself in a financial bind and went to a loan company for assistance. The loan company offered to pay her debts in one lump sum if she would pay the company $186 per month for the next 30 months.

(a) Determine the original monthly payment made to the furniture store.
(b) Determine the lump-sum payoff amount the loan company will make.
(c) What monthly rate of interest is the loan company charging on this loan?

4.83. You borrow $120,000 with a 30-year term at a 9% (APR) variable rate and the interest rate can be changed every five years.

(a) What is the initial monthly payment?
(b) If the lender's interest rate is 9.75% (APR) at the end of five years, what will the new monthly payments be?

4.84. Suppose you are going to buy a home worth $110,000 and you make a down payment in the amount of $50,000. The balance will be borrowed from the Capital Savings and Loan Bank. The loan officer offers the following two financing plans for the property.

- **Option 1.** A conventional fixed-rate loan at an interest rate of 13% over 30 years with 360 equal monthly payments.
- **Option 2.** A graduated payment schedule (FHA 235 plan) at 11.5% interest with the monthly payment schedule given in Table P4.84.

For the FHA 235 plan, mortgage insurance is a must.

(a) Compute the monthly payment under option 1.

TABLE P4.84

Year (n)	Monthly Payment	Monthly Mortgage Insurance
1	$497.76	$25.19
2	522.65	25.56
3	548.78	25.84
4	576.22	26.01
5	605.03	26.06
6–30	635.28	25.96

(b) What is the effective annual interest rate you are paying under option 2?

(c) Compute the outstanding balance at the end of five years under each option.

(d) Compute the total interest payment under each option.

(e) Assuming that your only investment alternative is a savings account that earns an interest rate of 6% compounded monthly, which option is a better deal?

Investment in Bonds

4.85. The Green Cable Corporation issued a new series of bonds on January 1, 2010. The bonds were sold at par ($1,000), have a 12% coupon rate, and mature in 30 years on December 31, 2039. Coupon interest payments are made semiannually (on June 30 and December 31).

(a) What was the yield to maturity (YTM) of the bond on January 1, 2010?

(b) Assuming that interest rates had fallen to 9%, what was the price of the bond on January 1, 2015 (five years later)?

(c) On July 1, 2015, the bonds sold for $922.38. What was the YTM at that date? What was the current yield at that date?

***4.86.** A $1,000, 9.50% semiannual bond is purchased for $1,010. If the bond is sold after three years and six interest payments, what should the selling price be to yield a 10% return on the investment?

4.87. Mr. Gonzalez wishes to sell a bond that has a face value of $1,000. The bond bears an interest rate of 8% with bond interest payable semiannually. Four years ago, $920 was paid for the bond. At least a 9% return (yield) on the investment is desired. What must be the minimum selling price?

4.88. Suppose you have the choice of investing in one of the following.

(a) A zero-coupon bond which costs $513.60 today, pays nothing during its life, and then pays $1,000 after five years.

(b) A bond that costs $1,000 today, pays $113 in interest semiannually, and matures at the end of five years with a par value of $1,000 to be repaid. Which bond would provide the higher yield?

***4.89.** Suppose you were offered a 12-year, 15% coupon, $1,000 par value bond at a price of $1,298.68. What rate of interest (yield to maturity) would you earn if you bought the bond and held it to maturity (at semiannual interest)?

4.90. The Lakeside Electronics Company has two bond issues outstanding. Both bonds pay $100 semiannual interest plus $1,000 at maturity. Bond A has a remaining maturity of 15 years; bond B has a maturity of one year. What is the value of each of these bonds now when the going rate of interest is 9%?

4.91. The Photo Film Company's bonds have four years remaining to maturity. Interest is paid annually, the bonds have a $1,000 par value, and the coupon interest rate is 8.75%.

(a) What is the yield to maturity at a current market price of $1,108?

(b) Would you pay $935 for one of these bonds if you thought that the market rate of interest was 9.5%?

4.92. Suppose Ford sold an issue of bonds with a 15-year maturity, a $1,000 par value, a 12% coupon rate, and semiannual interest payments.

(a) Two years after the bonds were issued, the going rate of interest on bonds such as these fell to 9%. At what price would the bonds sell?

(b) Suppose that, two years after the bonds' issue, the going interest rate had risen to 13%. At what price would the bonds sell?

(c) Today, the closing price of the bond is $783.58. What is the effective current yield?

4.93. Suppose you purchased a corporate bond with a 10-year maturity, a $1,000 par value, a 10% coupon rate, and semiannual interest payments. This means that you receive a $50 interest payment at the end of each six-month period for 10 years (20 times). Then, when the bond matures, you will receive the principal amount (the face value) in a lump sum. Three years after the bonds were purchased, the going rate of interest on new bonds fell to 6% (or 6% compounded semiannually). What is the current market value (P) of the bond (three years after its purchase)?