Answers to Retirement Benefits Exercises

A spreadsheet is available with solutions to some of the Chapter 23 exercises.

Chapter 21

Section 21.1.6 Exercises

1. Why is retirement income system needed?

   - Economic shift to the physical demands of an industrial society made it harder for older workers to remain in the workforce
   - Societies are aging, resulting in a greater proportion of adults living in retirement
   - Retirement of older workers provide advancement opportunities for younger workers
   - Reduce the burden on public welfare triggered by impoverished elderly
   - Individuals want a period of leisure after their working careers

2. What is the impact of mortality and fertility on the aging of a population?

   - When mortality decreases, individuals live longer
   - When fertility decreases, there are fewer young people in the society
   - These two factors create a larger proportion of older individuals

3. What societal trends impact the current need for a retirement income system?

   - Families are geographically dispersed
   - It is less common for multiple generations of a family to live together

Section 21.2.5 Exercises

4. What was the objective of the earliest retirement plans?

   - Provide coverage for military veterans

5. What types of workers were covered by early private pensions?

   - Railroad workers
   - Banking and insurance
   - Teachers in higher education

6. What led to the advance funding of early pensions for educational workers?

   - A grant by Andrew Carnegie and the formation of the Teachers Insurance Annuity Association (TIAA)

7. What led to the expansion of U.S. private pensions after World War II?

    - Wage controls made it hard to reward workers with increased compensation, but pension benefits were not subject to the restrictions
    - Taft-Hartley Act created duty for management to bargain with unions over pension benefits

8. Are private pensions compensation for human depreciation, deferred wages, or both?

    - Both

Chapter 22
<u>Section 22.1.4 Exercises</u>

1. How is a defined benefit plan different from a defined contribution plan?

    - Defined benefit plans promise a certain level of benefit at retirement and defined contribution plans promise a certain contribution

2. Do social security systems usually provide benefits in the form of a defined benefit plan or a defined contribution plan?

    - Defined benefit

3. Who is typically covered by an employer-sponsored retirement plan?

    - Individuals employed by the employer who sponsors the plan

4. Do employer-sponsored retirement plans provide benefits in the form of a defined benefit plan or a defined contribution plan?

    - An employer can provide either a defined benefit or defined contribution plan, or both types of plan

5. What are the characteristics of an individual retirement plan?

    - Sponsored by the individual covered by the plan
    - Always fully funded
    - Benefit guarantee depends on type of plan funding

6. What is the most common funding for each of the following?

    a. Social security systems

        - Pay-as-you-go

b. Employer-sponsored plans?

- Advance funding with contributions from the employer. Sometimes employees also make contributions to the plan

c. Individual retirement plans?

- Advance funding with contributions from the individual covered by the plan

<u>Section 22.2.10 Exercises</u>

7. Who is covered by a social security system?

- Citizens or residents; may also be required to have contributed to the system or resided in the country a minimum length of time

8. What are the three primary objectives of a social security system? Give an example of how each is achieved.

- Savings - earn benefits during working years to provide income in retirement
- Income redistribution - replace higher portion of income for lower-paid individuals than for higher-paid individuals
- Insurance - benefit guarantees so a person does not outlive his social security retirement income as well as cost of living increases to protect against loss of purchasing power

9. Using the formula for U.S. social security given in Section 22.2.2, calculate the social security benefit and the income replacement percentage for each of the following average monthly wages used in the benefit formula:

a. $1,000

- $791 x 0.9 + $209 x 0.32 + $0 x 0.15 = $778.78; 778.78/1,000 = 77.9%

b. $2,500

- $791 x 0.9 + $1,709 x 0.32 + $0 x 0.15 = $1,258.78; 1,258.78/2,500 = 50.4%

c. $8,000

- $600 x 0.9 + $3,795 x 0.32 + $3,414 x 0.15 = $2,438.40; 2,438.40/8,000 = 30.5%

10. Which of the following are characteristics of a pay-as-you-go funding arrangement?

    a. Intergenerational transfers

    b. Declining tax rates as the population ages

    c. Trust fund assets

    d. Correlation between taxes paid and benefits received by an individual

    - Only (a) is a characteristic of a pay-as-you go funding arrangement.

11. Describe the two components of the Canadian social security system.

    - Old Age Security (OAS): provides a fully indexed monthly benefit. A person must have been a resident of Canada for at least 10 years to receive a benefit and at least 40 years to receive the full benefit. In late 2010, the benefit full benefit amount was $512.62. OAS is funded through general revenues.

    - Canada/Quebec Pension Plan (C/QPP): provides an income-based benefit that is designed to replace about 25% of income. The 2010 tax rate was 4.95% for both the employee and employer.

12. How has China's one-child policy affected its public pension system?

    - Low birth rates cause a rapidly aging society which crippled the social security system

13. Compare the benefits provided by the U.K. social security system to the U.S. and Canadian systems.

    - The U.K. system contains 4 parts: a basic pension, an earnings-related benefit, a flat-rate non-contributory benefit, and a means-tested benefit
    - Canada's system includes an earnings-related benefit, a flat-rate non-contributory benefit
    - The U.S. system is an earnings-related benefit with a benefit formula that replaces a larger portion of income for lower wage earners

<u>Section 22.3.4 Exercises</u>

14. Why would an employer provide a retirement plan for its employees?

    - The employer is competing with other employers to hire qualified workers
    - Workforce management options, including encouraging retirement to provide opportunities for younger workers

15. What factors would an employer consider to determine whether the expected cost of a retirement plan is acceptable?

    - Available financial resources for plan funding
    - Long-term projections of company financial resources and expected plan funding requirements
    - Whether expected fluctuation in funding requirements are acceptable

16. What public policy considerations favor encouraging an employer-sponsored retirement system?

    - Employer-sponsored plans reduce the need for
        - Government-provided retirement income
        - Public welfare benefits for retired citizens
    - Dignified transition from work to retirement for a worker no longer to meet the job demands
    - Promotional opportunities for younger workers

<u>Section 22.4.3 Exercises</u>

17. How can the income tax system encourage an employer to establish a retirement plan for its employees?

    - Tax deduction for employer contributions when they are made
    - Delayed tax to employees until benefit distributions are received from the plan

18. List the primary objectives of the U.S. Congress when they passed the Employee Retirement Income Security Act of 1974.

    - Improve plan funding, vesting requirements, reporting to government agencies, disclosure to participants, security of benefits, and fiduciary standards.

19. What is the primary responsibility of the IRS under ERISA? The Department of Labor's EBSA?

    - IRS: tax aspects including plan document, nondiscrimination, and funding requirements
    - EBSA: reporting, disclosure, and fiduciary compliance

20. How do pension requirements protect the participant's spouse?

    - Plans are required to provide a death benefit to the surviving spouse in the worker dies after satisfying the plan's requirements for early or normal retirement
    - In plans subject to minimum funding requirements, the spouse must consent to anyone else being named beneficiary or for the benefit being received in a form of distribution that does not provide a survivor benefit to the spouse

21. Describe how the Tax Reform Act of 1986 accomplished the following objectives:

    a. Preventing wealthy plan participants from leaving assets in the plan indefinitely where they are not taxed.

        - Distributions must begin at age 70½ if the participant is no longer working for the plan sponsor

    b. Ensuring that lower-paid participants receive a meaningful benefit compared to higher-paid participants.

        - Numerical test to be sure the plan does not disproportionately benefit highly compensated employees

22. How did the Pension Protection Act of 2006 change the funding of defined benefit plans?

    - Focuses on funding currently accrued benefits using a mark-to-market concept

<u>Section 22.5.1 Exercises</u>

23. How do courts become involved in retirement plan issues?

    - When someone brings legal action against the plan or the plan sponsor with respect to the plan

24. What is most apt to lead to criminal action against a retirement plan official?

    - Illegal handling of plan assets

<u>Section 22.6.3 Exercises</u>

25. Are Canadian employers required to offer retirement benefits to their employees?

    - No

26. Are pensions regulated at the provincial or national level?

    - Most are regulated at the provincial level, but the banking and telecommunications industry are federally regulated

27. What changes to the Canadian pension system have been instituted in recent years?

    - Temporary solvency funding relief for federally-regulated plans

Section 22.7.1 Exercises

28. What components of the U.K. pension system are similar to the U.S. and Canadian systems?

    - Social security benefits
    - Employer-sponsored pensions
    - Individual-funded pensions
    - Investment income
    - Income from employment

29. What components are different?

    - In-kind benefits provided by the state including television licenses, winter fuel payments, and transportation concessions

Section 22.8.1 Exercises

30. What changes did Mexico make to its retirement system in 1997?

    - Creation of a three-pillar pension system based on World Bank recommendations

31. What termination benefit is mandatory in Mexico? How much income can that benefit replace for a 30-year employee?

    - Lump sum termination benefit of close to two years of full pay if the worker has 30 years of service
    - It can replace 10% to 20% of pay on a lifetime basis

32. Are Mexican employer-sponsored pensions primarily defined benefit or defined contribution plans?

    - 70% are defined benefit

Section 22.9.1 Exercises

33. Why does an employer-sponsored retirement plan need an actuary's expertise?

    - Funding for a defined benefit plan requires an actuary to value projected distributions involving multiple decrements

34. What is an enrolled actuary in the U.S.?

- An enrolled actuary is a person who can sign actuarial statements and certifications required by the U.S. government
- A person must complete both an educational and experience requirement to become an enrolled actuary

Section 22.10.1 Exercises

35. What is the advantage of receiving retirement income from more than one source?

- Different sources of retirement income provide different types of protection
- Having multiple sources provide broader protection than a single source

36. What are the possible sources of retirement income?

- Social security
- Employer-sponsored plan
- Personal savings
- Income from other family members

Chapter 23

Section 23.1.5 Exercises

Data to use for the following exercises:

Date of hire:	January 1st
Age at hire:	50th birthday
Normal retirement age:	65th birthday
Service earned each year:	1 year
Annual investment return:	5%

Salary History	
Age on January 1	**Salary Earned During FollowingYear**
50	$50,000
51	$52,500
52	$55,000
53	$55,500
54	$58,000
55	$57,000
56	$60,000
57	$62,500
58	$65,000
59	$68,000
60	$69,000
61	$70,000
62	$71,500
63	$68,000
64	$66,000

1. The employer sponsors a defined contribution plan. The employer contributes 3% per year to all participants and matches 50% of the first 4% contributed to the plan by participants. Assume the participant contributes 4% each year and all contributions are made at the end of the year.

   a. What is the participant's account balance at age 55?

      - $26,861.68

   b. At age 60?

      - $65,233.85

   c. At normal retirement age?

      - $117,558.70

2. The employer sponsors a defined benefit plan with the following benefit formula: 50% of career average compensation.

   a. What is the career average compensation at normal retirement age?

      - $61,866.67

   b. What annual benefit has the participant earned at normal retirement age?

      - 0.5 x $61,866.67 = $30,933.33

   c. What is the career average compensation at age 60?

      - $58,350.00

   d. What annual benefit has the participant earned at age 60?

      - 0.5 x $58,350.00 = $29,175.00

   e. If the benefit begins prior to normal retirement, it is reduced 4% for each year it begins prior to normal retirement. How much can the participant receive each year beginning at age 60?

      - $29,175 x (1 - 0.04 x 5) = $29,175 x 0.80 = $23,340.00

3. The employer sponsors a defined benefit plan with the following benefit formula:

   1.5% of average compensation multiplied by years of service at the date the benefit is calculated. Average compensation is the highest average using five consecutive salaries.

   a. What is average compensation at normal retirement age?

      - $69,300.00 (note that the highest average was for ages 59-63, not 60-64)

   b. What annual benefit has the participant earned at normal retirement age?

      - 0.015 x $69,300.00 x 15 = $15,592.50

   c. What is average compensation at age 60?

      - $62,500.00

   d. What annual benefit has the participant earned at age 60?

      - 0.015 x $62,500.00 x 10 = $9,375.00

e. If the benefit begins prior to normal retirement, it is reduced 4% for each year it begins prior to normal retirement. How much can the participant receive each year beginning at age 60?

- $9,375.00 x (1 - 0.04 x 5) = $9,375.00 x 0.8 = $7,500.00

4. The employer sponsors a defined benefit plan with the following benefit formula that is coordinated with social security:

   1.5% of average compensation up to $25,000 multiplied by years of service at the date the benefit is calculated plus 2% of average compensation in excess of $25,000 multiplied by years of service at the date the benefit is calculated. Average compensation is the average five consecutive salaries prior to the date the benefit is calculated.

   a. What is the average compensation at normal retirement age?

   - $68,900

   b. What annual benefit has the participant earned at normal retirement age?

   - 0.015 x $25,000 x 15 +0 .02 x ($68,900 - $25,000) x 15 = $18,795

   c. What is the average compensation at age 60?

   - $62,500

   d. What annual benefit has the participant earned at age 60?

   - 0.015 x $25,000 x 10 + 0.02 x ($62,500 - $25,000) x 10 = $11,250

   e. If the benefit begins prior to normal retirement, it is reduced 4% for each year it begins prior to normal retirement. How much can the participant receive each year beginning at age 60?

   - $11,250 x (1 - 0.04 x 5) = $11,250 x 0.8 = $9,000

Section 23.2.1 Exercise

Use the participant data from Section 23.1 exercises for the following exercises. Use the following interest credits:

Year	Interest Credit
1 – 5	4%
6 – 10	3%
11 - 15	5%

5. The employer sponsors a cash balance plan that credits 10% of compensation each year as the hypothetical allocation with contributions and annual interest credited on the account balance at the end of the year.

   a. What is the participant's account balance at the end of year five?

      - $29,275.63

   b. At the end of year ten?

      - $67,035.86

   c. At normal retirement age?

      - $123,669.88

Section 23.3.1 Exercises

6. How are the following risks allocated in a defined contribution arrangement?

   a. Pre-retirement inflation risk

      - Employee

   b. Longevity risk

      - Employee

   c. Investment risk

      - Employee

7. How are the following risks allocated in a defined benefit arrangement?

    a. Pre-retirement inflation risk?

        - If the benefit formula is pay-related, pre-retirement inflation will at least partly be reflected in salary increases. If the benefit formula is not pay-related, the employee bears the risk.

    b. Longevity risk?

        - Employer

    c. Investment risk?

        - Employer

    d. Post-retirement inflation risk?

        - Employee

8. How does mobility affect a participant covered whose employers sponsor a final-average-pay defined benefit plan?

    - Benefits earned prior to the final employer will not be based on earnings at retirement because the employee left the employer prior to retirement

9. How can a participant in a defined contribution plan insure against the risk of outliving the benefit received from the plan?

    - Use the account balance to purchase a lifetime annuity

Section 23.4.3 Exercises

10. Are defined benefit or defined contribution plans more prevalent in the U.S. today?

    - Defined contribution

11. What is a reason for the increase in defined benefit plan terminations in the mid-1980s?

    - Plan sponsors wanted access to surplus assets

12. What steps did the U.S. government take to slow these plan terminations?

    - Add an additional income tax on surplus assets returned to the plan sponsor

13. List reasons plan sponsors terminate defined benefit plans.

    - Lack of control over plan funding as a result of increased regulation
    - High administrative expenses
    - Worker dissatisfaction with the benefits provided by the plan
    - Ability to shift investment risk to employees by switching to a defined contribution plan

<u>Section 23.5.1 Exercises</u>

14. Are plans requiring employee contributions more common in the U.S. or Canada?

    - Canada

15. What type of death benefit must be provided in a Canadian retirement plan?

    - Between 60% and 100% of the actuarial value of the applicable portion of the accrued benefit paid as a spousal death benefit

16. What types of plan is the most common in Canada - defined contribution or defined benefit?

    - Defined benefit plans for large employers and defined contribution plans for small employers

<u>Section 23.6.1 Exercises</u>

17. Do defined benefit or defined contribution plans offer the plan sponsor more opportunities for workforce management?

    - Defined benefit plans

18. How can a retirement plan be used to attract workers?

    - Competitive advantage compared to other employers seeking to attract the same workers
    - Defined benefit plan attractive to older workers
    - Defined contribution plan attractive to younger workers

19. How can a retirement plan be used to discourage workers from terminating their employment with the plan sponsor?

    - Vesting schedule
    - Eligibility for unreduced retirement benefits

20. How is an early retirement window used to manage the workforce?

    - Enhanced benefits can be offered to employees who retire during a limited timeframe.

Chapter 24
Section 24.1.4 Exercises

1. What role does the actuary plan in defined benefit plan funding?

    - Assemble necessary inputs, reviewing the information for reasonableness
    - Review plan document to see if changes have been made since prior valuation
    - Set assumptions
    - Calculate liabilities and funding range
    - Communicate results to plan sponsor

2. What determines the ultimate cost of a defined benefit plan? A defined contribution plan?

    Defined benefit plan
    - Benefit payments plus plan expenses minus investment earnings over the life of the plan

    Defined contribution plan
    - Contributions over the life of the plan

3. Why is the plan document important to the actuary in preparing a defined benefit plan valuation?

    - Provides details about the promised benefits that will be valued

4. What is the primary purpose of an annual actuarial valuation?

    - Determine annual funding requirements

5. Compare open and closed group valuations and describe common uses of each.

    Open group
    - Anticipates new entrants into the plan beyond the current year
    - Can't be used for the minimum required or maximum deductible contributions in the United States
    - Helps plan sponsor make business decisions or decide on plan changes

    Closed group
    - Use current plan participants
    - Sometimes anticipates new entrants during the current year
    - Used for the minimum required or maximum deductible contributions in the United States

Section 24.2.1 Exercises

6. Describe how the inflation rate assumption is used in a defined benefit valuation.

   - Component of salary increase and investment return assumption

7. How is the interest rate assumption different from the expected return on plan assets?

   - Interest rate is used to discount future benefit payments and it reflects expectations about annuity purchase rates
   - Expected return on plan assets reflects expectations about investment markets.

8. What decrement rates may be used in a valuation?

   - Retirement
   - Mortality
   - Disability
   - Turnover

Section 24.3.1 Exercises

9. What creates actuarial gains?

   - Actual experience more favorable (less costly) than expected experience based on actuarial assumptions

10. How is the actuarial accrued liability different from the normal cost?

    - Normal cost is the liability allocated to the current year by the funding method
    - Actuarial accrued liability is the liability allocated to prior years by the funding method

Section 24.4.4 Exercises

The following information will be used for the following exercises:

Age at entry into plan	25
Normal retirement age	65
Current age	30
Projected annual benefit at normal retirement	$116,928
Annual accrued benefit at age 30 • with salary increase to normal retirement • with no salary increase after current year	 $14,616 $3,704

Benefit accrual allocated to age 30 • with salary increase to normal retirement • with no salary increase after current year	 $2,923 $741
Temporary annuity factor • at age 25 • at age 30	 16.224543 15.736780
$\ddot{a}_{65}$	12
Interest discount rate	6%
${}_{35}p_{30}$	100%

11. Calculate the traditional unit credit normal cost at age 30.

    $\$741 \text{ x } 12 \text{ x } 1 \text{ x } 1.06^{-35} = \$1{,}157$

12. Calculate the projected unit credit normal cost at age 30.

    $\$2{,}923 \text{ x } 12 \text{ x } 1 \text{ x } 1.06^{-35} = \$4{,}564$

13. Calculate the projected unit credit actuarial accrued liability at age 30.

    $\$14{,}616 \text{ x } 12 \text{ x } 1 \text{ x } 1.06^{-35} = \$22{,}819$

14. Calculate normal cost at age 30 using the entry age normal cost method.

$$\frac{\$116,928 \times 12 \times 1 \times 1.06^{-40}}{\$16.224543} = \$8,408$$

<u>Section 24.5.3 Exercises</u>

15. What participant census data is needed?

    Information needed for all participants
    - Service earned during the prior year
    - If the benefit is pay-related, compensation earned during the prior plan year.

    Additional information needed for new participants
    - Date of birth
    - Gender
    - Date of hire

    Additional information needed for participants leaving the plan during the prior year
    - Date of decrement
    - Type of decrement
    - Beneficiary information, including date of birth, if applicable

16. Who provides asset information?

    - The plan's trustee or custodian of the assets

17. What asset information is needed?

    - Year-end value of assets by type of asset
    - Dates and amounts of contributions made during the prior year
    - Investment income
    - Realized and unrealized investment gains
    - Benefits paid
    - Expenses paid
    - Realized and unrealized investment losses

<u>Section 24.6.1 Exercise</u>

18. How does a plan sponsor decide how much to contribute to a defined benefit plan for a particular year?

    - The actuarial valuation report will provide the minimum required and maximum deductible contribution range; the amount contributed will be within this range
    - Consider cash flows and company financial obligations
    - Talk with the actuary to understand the implication of various contribution levels
    - Apply any funding philosophy to the permitted funding range to select the contribution amount

Chapter 25
<u>Section 25.1.1 Exercises</u>

1. What role does the U.S. SEC play?

    - Authority over financial reporting for publicly traded companies
    - Protect investors
    - Maintain efficient investment markets
    - Facilitate capital formation

2. What rules apply to a company's financial statements?

    - Audited financial statements must comply with rules published by the Financial Accounting Standards Board
    - Actuarial calculations for accounting purposes must comply with these rules

3. What is the role of the IASB?

    - They establish pension standards with the goal of consistent global financial reporting.

Section 25.2.1 Exercises

4. How is the cost of a retirement plan recognized for company accounting purposes?

   - The pension expense is reported in the income statement

5. Where does other pension information appear in a company's financial statements?

   - Financial statement footnotes

Section 25.3.1 Exercises

6. How are inputs used by the actuary for accounting calculations different from similar inputs used for retirement plan funding calculations?

   - Participant census data used for year-end accounting calculations is updated based on estimates; the funding valuation and the pension expense for accounting purposes will use actual participant census data
   - Actual asset information will be used for both types of calculations

7. How selects the assumptions used for pension accounting calculations? What role does the actuary play?

   - The plan sponsor selects the assumptions with the help of the actuary

Section 25.4.1 Exercises

8. Who has ultimate responsibility for information in a company's financial statements?

   - Company management

9. What is the actuary's responsibility with respect to a company's financial statements?

   - Compliance with the Actuarial Standards of Practice

Section 25.5.1 Exercises

10. What are the components of pension expense?

    - Service cost
    - Interest cost
    - Amortization of the unrecognized asset/obligation at initial application, prior service change related to plan amendments, effect of assumption changes, and actuarial gains/losses
    - Expected return on plan assets

11. Compare the ABO and PBO.

    - The PBO reflects future salary increases, but the ABO does not; the PBO also recognizes expected future benefit increases if the plan has a history of making these changes.

12. Does the ABO ever equal the PBO?

    - Yes, if the plan is not pay-related and does not have a history of regular benefit increases

<u>Section 25.6.1 Exercise</u>

13. What is the objective of financial statement footnote disclosures?

    - Provide investors with sufficient information to make an informed investment decision

Chapter 26
<u>Section 26.2.1 Exercises</u>

1. Why would a plan sponsor want to see the results from modeling actuarial costs?

    - Analyze the future cash and accounting requirements for the plan over several years.
    - Assist in business planning

2. How is dynamic modeling different from static modeling?

    - Dynamic modeling uses a Monte Carlo approach to vary actual experience in future years
    - Static modeling uses a single set of actual experience for each future year
    - Dynamic modeling produces the probability that future funding or accounting expense will be within a particular range

3. What assumptions are needed for modeling that are not needed to determine the funding range in the actuarial valuation?

    - New entrants
    - Actual future experience in addition to actuarial assumptions used to value each year’s cash and accounting requirements

Chapter 27
<u>Section 27.1.1 Exercises</u>

1. Is it important for a defined benefit plan to always have assets at least equal to the present value of accrued benefits?

   - If the plan sponsor intends to continue the plan, it is acceptable for assets to be less than the present value of accrued liabilities
   - If the sponsor plans to terminate the plan in the near future, it becomes important to have sufficient assets to provide promised benefits

2. What restrictions apply to a U.S. plan with assets less than 60% of the value for current accrued benefits?

   - No benefit accruals are permitted until the funded status improves

3. What restrictions apply to a U.S. plan with assets at least 60% but less than 80% of the value for current accrued benefits?

   - Payment of accelerated forms of distribution such as a lump sum is restricted until the funded status improves

4. Why would a plan sponsor not want to build up as much as it can afford in plan assets?

   - Avoid funding-based benefit accrual and distribution restrictions
   - Investment earnings on plan assets help offset future funding needs
   - Reduce plan termination insurance premiums
   - Be able to terminate the plan without being concerned about funding a shortfall
   - Contributions are a tax deductible business expense

