Study Problems I

Problem 2.1. A zero coupon bond of Impervious Industries provides a single future payment of $10,200 at year 1.
   a. If the current market price is $10,050, what is the return at year 1?
   b. If investors demand an expected return of 1.3% per year on this bond, what is its current price?
   c. A zero coupon bond of Susceptible Services provides a single future payment of $10,400 at year 1. Investors demand an expected return of 5.2% per year on this bond. Calculate the current price of the Susceptible bond.
   d. Calculate the expected return on a portfolio consisting of the Impervious and Susceptible bonds.

Problem 2.2. Shares of Clean Corp. common stock currently trade at $79.43 per share. Clean will pay a dividend of $2.76 per share at year 1.
   a. If the share price at year 1 is $85.56, what is the return at year 1?
   b. Suppose investors expect the share price to rise by 4.5% per year. What is the OCC at year 0?
   c. Suppose instead that investors expect the share price to rise by 4% per year, while the dividend and OCC remain unchanged. Calculate the current share price in this case.

Problem 2.3. Calculate the current market values of the following cash flows at the given OCCs.
   a. $80,000 received at year 6, OCC is 11%.
   b. $120,000 received at year 15, OCC is 4%.
   c. $40,000 received at year 2, OCC is 6%.
   d. Calculate the current market value and OCC of the portfolio consisting of the assets in parts a, b and c.

Problem 2.4. Calculate the current market values of the following cash flow streams at the given OCCs.
   a. $20,000 received at years 1 through 15, OCC is 5%.
   b. $100,000 received at years 1 through 4, OCC is 15%.
   c. $65,000 received now and at years 1 through 20, OCC is 6%.
   d. Calculate the current market value and OCC of the portfolio consisting of the assets in parts a, b and c.

Problem 2.5. Calculate the current market values of the following cash flow streams at the given OCCs:
   a. $14,000 per year starting at year 1, continuing in perpetuity, OCC is 12%.
b. $60,000 at year 1, followed by cash flows at every future year that rise by 2% per year; OCC is 7%.
c. $750,000 received at year 1, growing at an annual rate of 4% for years 2 through 12; OCC is 18%.

Problem 2.6. A factory will generate an expected cash flow of $650,000 one year from now. After that, yearly expected cash flows from the factory will grow by 4% per year in perpetuity. The OCC for these cash flows is 11%.
   a. Calculate the current market value of the factory.
   b. Calculate the expected market value of the factory six years from now.
   c. Calculate the annual growth rate of the expected market value.

Problem 2.7. Suppose you expect to receive $35,000 in one year, $30,000 in two years and $25,000 in three years, but you must pay $40,000 in four years. The OCC for this cash flow stream is 9%.
   a. Calculate the current market value of the cash flow stream.
   b. Forecast the market value of this cash flow stream at year 2.

Problem 2.8. Suppose you expect to receive $150,000 in one year and $200,000 in two years. The OCC for this cash flow stream is 17%.
   a. Calculate the current market value of the cash flow stream.
   b. Suppose the cash flow stream is delayed by three years. Calculate the value of the delayed stream.
   c. Suppose instead that the cash flow stream is delayed by 10 years. Calculate the value of the delayed stream in this case.

Problem 2.9. You are considering an asset that generates $300,000 one year from now, followed by cash flows in each succeeding year that decline at an annual rate of 5% for 13 more years. Cash flows then level out and continue in perpetuity. The OCC of this asset is 9%. What is the current market value of this asset?

Problem 2.10. Calculate the current market values of the following cash flow streams at the given OCCs:
   a. $60,000 received one quarter from now, followed by quarterly cash flows at the same level until year 5; OCC is 14% per year.
   b. $1,500 received one month from now, followed by monthly cash flows that decline at a rate of 1% per month, with the final cash flow received at year 4; OCC is 17% per year.

Problem 2.11. You will receive cash payments totaling $500,000, to be spread over the next two years. Your OCC is 13% per year. Calculate the current market values of the following payment plans:
   a. Equal quarterly payments for two years, starting one quarter from now.
   b. Equal weekly payments for two years, starting one week from now.
**Problem 2.12.** A new retail outlet can be opened for an initial investment of $350,000. The store will generate new cash flows of $60,000 per year for 10 years, after which time it will be closed. There is no scrap value. The OCC is 9%. Calculate the NPV of this project.

**Problem 2.13.** A new oil well can be drilled for $800,000. The well will generate net cash flows of $140,000 per year for the first six years. At year 6, an added $90,000 must be invested for secondary recovery, and net cash flows will be $60,000 per year for years 7 through 10. At year 10, the well must be closed down, at a cost of $25,000. The OCC is 15%. Calculate the NPV of this project.

**Problem 2.14.** A soap company is considering an investment of $5 million to introduce a new brand. The project will generate a cash flow of $1.2 million at year 1. The OCC is 12%.

- **a.** Positive cash flows are expected to continue in perpetuity, but they will decline at a rate of 8% per year. Calculate the NPV of this project.
- **b.** Suppose instead that cash flows will continue for 10 years only, still declining at 8% per year. Recalculate the NPV.

**Problem 2.15.** Compute the NPV and set of possible values of the IRR for the following investment projects:

- **a.** Invest $50,000 now to obtain $35,000 one year from now and $40,000 two years from now, OCC is 12%.
- **b.** Invest $80,000 now to obtain $240,000 one year from now and $40,000 three years from now, but $200,000 must be paid two years from now, OCC is 14%.

**Problem 2.16.** Confused Corp. can invest $10,000 to create an asset that generates the following cash flow stream:

\[
C_{B1} \quad C_{B2} \quad C_{B3} \quad C_{B4} \quad C_{B5}, C_{B6}, ...
\]

- $66,000  
- $160,500  
- $170,000  
- $66,000  
- 0

- **a.** Show that 10% and 50% are both IRRs for this project.
- **b.** Show that the project does not satisfy the IRR Regularity Conditions.
- **c.** Calculate the NPV of this project for the OCCs \( r_B = .07 \) and \( r_B = .13 \).

**Problem 2.17.** You can invest $26,000 now to obtain an asset that generates cash flows of $10,000 per year at years 1, 2 and 3. The OCC of these cash flows is 10%.

- **a.** Calculate the NPV of this project.
- **b.** Verify that the project satisfies the IRR Regularity Conditions.
- **c.** Show that the IRR lies between 7.5% and 7.6%.

**Problem 3.1.** Calculate the net cost in PV terms of the following equipment purchases. In each case assume the tax rate is 35%.
a. Original cost of $125,000, depreciated straight-line to an ending book value of $25,000 at year 5, scrapped at year 5, zero scrap value. Projected inflation is zero, OCC is 12%.

b. Original cost of $2 million, depreciated using the five-year depreciation schedule (p. 272 of textbook) to an ending book value of zero, scrapped for $250,000 at year 8. Projected inflation is zero, OCC is 7%.

c. Original cost of $750,000, depreciated straight-line to an ending book value of $150,000 at year 3, scrapped for $60,000 at year 5, scrap value expressed in today’s dollars. Projected inflation is 4% per year, OCC is 13%.

Problem 3.2. Snootjoy Wines is considering the purchase of an automatic winepress for $160,000. The press will be operated for six years, after which it will be scrapped. At year 6 a scrap value of $20,000 will be received. Further, a major overhaul of the winepress will be required at year 3, at a cost of $10,000.

For tax purposes, 20% of the initial investment may be depreciated in each year for years 1 through 4, and 10% in years 5 and 6. The overhaul cost will be treated as SG&A. The tax rate is 35%, projected inflation is zero, and the OCC is 9%. Calculate the net cost in PV terms of this equipment purchase.

Problem 3.3. Sunset Properties, Inc., is considering investing $250 million in land that it will hold for 25 years and then resell. The investment generates pretax net cash flows of $40 million per year, expressed in today’s prices. Land values are expected to rise at the rate of 7% per year, while other prices are expected to rise at 2% per year. The tax rate is 45% and the OCC is 13%. Calculate the NPV of this project.

Problem 3.4. Hightower Equipment Co. is considering the purchase of a new heavy duty crane for $320,000. Rental of the crane will generate cash revenue of $150,000 per year, while cash operating expenses will be $30,000 per year, for the lifetime of the crane. In four years the crane must be overhauled at a cost of $80,000, and in eight years the crane will be scrapped at a cost of $25,000. All of these figures are in today’s prices.

For tax purposes, the purchase price is depreciated straight-line for eight years to an ending book value of zero, while the overhaul cost is depreciated straight-line for four years to an ending book value of zero. The tax rate is 35% the projected inflation rate is 3% per year, and the OCC is 14%. Calculate the NPV of this project.

Problem 3.5. Rehash Records is considering a new album by their pop group, the Derivatives. Recording requires an immediate investment of $160,000. Rehash will receive $10 per CD for each CD sold. Sales of the album are projected at 100,000 CDs in the first year, declining by 50% per year for the next two years.

Production costs are $1 per CD. Initial inventory will consist of 65,000 CDs, and inventory holdings will be 55,000 and 25,000 CDs at years 1 and 2, respectively. Marketing costs of $500,000 will also be incurred at year 1.

For tax purposes the recording investment may be depreciated straight-line for two years to an ending book value of $40,000, while marketing costs are treated as SG&A. Disposal
value at year 2 is zero. Rehash has a tax rate of 35% and requires a return of 8%. Calculate the NPV of this project.

**Problem 3.6.** Profound Products, Inc., is planning to market a new banana peeler. Projected sales are $80,000 per year for the first two years, declining at a rate of 25% per year for the next four years. The peeler will be discontinued after year 6. COGS amounts to 85% of sales. Required inventories are $10,000 now, rising by 15% per year for the first two years, then falling by 40% per year for the next three years. Inventory is zero at year 6.

The tax rate is 35% and the OCC is 11%. Calculate the NPV of this project.

**Problem 3.7.** The Lucrative Liquidation Co. can purchase two warehouses now, and three more one year from now. Lucrative expects to sell one warehouse per year for the next five years. In terms of today’s dollars, each warehouse costs $500,000, and will sell for $650,000. The tax rate is 35%.

a. Suppose projected inflation is zero and the OCC is 9%. Calculate the NPV of this project.

b. Now suppose projected inflation is 4% per year and the OCC is 13%. The warehouses purchased now will be the first to be sold. Recalculate the NPV.

**Problem 3.8.** The Greenback Gallery can purchase a collection of paintings for $20 million, and resell them for $30 million in one year. Receivables will be $20 million in one year, $10 million in two years and zero in three years. Assume Bad Debt is zero. The tax rate is 35% and the OCC is 10%.

a. Suppose the Gallery charges no interest on credit sales. Calculate the NPV of this project.

b. Recalculate the NPV under the assumption that the Gallery charges 14% annual interest on outstanding Receivables, payable in cash at years 2 and 3.

**Problem 3.9.** The Chasm clothing store is considering expanding its selling area by converting existing storage space. The cost of the conversion is $100,000. The expansion is expected to generate new sales of $75,000 at year 1, and new sales are expected to grow at a rate of 3% per year. Added selling costs and working capital requirements are estimated at $50,000 and $80,000, respectively, at year 1, and these are expected to remain constant. Further, additional storage area will need to be rented at a cost of $10,000 per year. The store will be closed at year 6, with zero scrap value.

The conversion cost will be depreciated straight-line to an ending book value of $10,000 at year 6. The tax rate is 35% and the OCC is 14%. Calculate the NPV of this project.

**Problem 3.10.** Atomic Nutrition, Inc., has perfected a process for turning radioactive waste into a dietary supplement. Production and distribution require an up front investment of $6 million, of which $4 million is plant and equipment and $2 million is startup cost. Annual sales of the supplement and selling costs are projected to be $5.5 million and $2.5 million, respectively, starting at year 1. The product will be discontinued at year 4. Working capital
requirements are projected to be 7.5% of sales while the product is in production. Working capital is recovered at the end of year 4. The plant and equipment will be scrapped at year 5, generating projected scrap revenue of $1 million. All of these figures are expressed in today’s prices. 

For tax purposes, the plant and equipment can be depreciated using the three-year tax depreciation schedule (p.272 of textbook) to an ending book value of $500,000, while the startup cost can be treated as SG&A at year 0. The tax rate is 35%, projected inflation is 3% and the OCC is 10%. Calculate the NPV of this project.