Overview of Chapters 1, 2, and 5

Chapter 1. This course deals with corporate financial management. Most large businesses are operated as corporations. So, what is a corporation? A corporation is an artificial person created under the authority of a state or country.

Stockholders own corporations and use their votes to elect a board of directors. The board of directors are in charge of the major decisions of the corporation. One of these major decisions involves the hiring of management. Management is in charge of the day-to-day operations of the corporation.

Corporations (at the direction of the board of directors and management) can buy assets, borrow money, and issue stock.

<table>
<thead>
<tr>
<th>Financial assets (claims on future cash flows)</th>
<th>Debt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency</td>
<td>Bank loan</td>
</tr>
<tr>
<td>Real assets (tangible assets)</td>
<td>Equity</td>
</tr>
<tr>
<td>Land</td>
<td>Common stock</td>
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</tbody>
</table>

Potential agency problems

- Managers versus stockholders
- Owners of debt versus owners of common stock

Income taxation (double taxation)

<table>
<thead>
<tr>
<th>Corporation</th>
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<tbody>
<tr>
<td>Cash revenue</td>
<td>$100</td>
<td></td>
</tr>
<tr>
<td>Cash expenses</td>
<td>-80</td>
<td></td>
</tr>
<tr>
<td>Taxable income</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Corporate tax (34%)</td>
<td>After-tax cash flow</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Individual</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Dividend income</td>
<td></td>
</tr>
<tr>
<td>Individual income tax (28%)</td>
<td>After-tax cash flow</td>
</tr>
</tbody>
</table>

Limited liability to the owners (owners of stock and owners of debt)

Unlimited life

Ability to raise new capital

- Borrowed money (debt)
- Addition equity funds from the existing stockholders, or new stockholders
Chapter 2. Investment (capital budgeting) decisions - Deciding whether to invest in a project depends on three factors: (1) the cash flows the project is expected to generate, (2) the riskiness of those cash flows, (3) and the opportunity cost of capital (which depends on the riskiness of the project’s cash flows).

1. **Cash flows**

   Initial investment
   Expected future cash inflows and outflows (including expected terminal cash flows)

   **Example (Kentucky River Dam Project)**

   A. Initial investment = $100,000,000
   B. Perpetual revenues = $4,500,000 per year if a dry year (20% probability)
      $10,000,000 per year if a normal year (50% probability)
      $17,000,000 per year if a wet year (30% probability)
   C. Perpetual expenses = 1 / 11 of revenues

   What are the expected yearly cash flows?

2. **Riskiness of expected cash flows**

   How much can actual cash flows differ from expected cash flows?

   What are the general market conditions that would trigger lower than expected (or higher than expected) cash flows? Consider two possibilities:

   A. Lower than expected cash flows occur during recessionary economies, higher than expected cash flows occur during boom economies.
   B. Lower than expected cash flows occur during boom economies, higher than expected cash flows occur during recessionary economies.

3. **Opportunity cost of capital**

   The opportunity cost of capital is the expected return from an investment in the financial markets with the exact same risk as the proposed project’s cash flows.

   We use the expected cash flows of the project and these cash flows’ opportunity cost of capital to determine the project’s value.

   A. Assume you find a financial asset (e.g., stock, bond, mutual fund, etc.) for sale in the financial markets (e.g., NYSE, Nasdaq, etc.) that has the exact same amount of risk as the project’s cash flows. A $100,000,000 investment in this financial asset produces expected future cash flows of $8,000,000 per year in perpetuity. The expected return for this financial asset is the opportunity cost of capital for the project’s cash flows. What is the expected return?

   B. Note: According to the law of one price, all financial assets trading in an active and competitive market place that have the same amount of risk should have the same expected return.

   C. Does the project create value for the owner? Is the value of the project greater than the $100,000,000 cost? What is the value of the project?

   D. Should the project be accepted?

   E. Change annual expenses to 4 / 11 of revenues. Now does it create value for the owner?

<table>
<thead>
<tr>
<th>Value</th>
<th>Or</th>
<th>Expected return</th>
</tr>
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<tbody>
<tr>
<td>Cost</td>
<td></td>
<td>Opp. cost of cap.</td>
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</tbody>
</table>
**Objective of the firm** is to maximize the present (current) value of stockholder's stock.

- Why present value?
- Why value? Why not accounting profits?

  First, what are the expected accounting profits per year (with expenses at 4 / 11 of revenues)?

  - Revenue $11,000,000
  - Expenses ($4,000,000)
  - Depreciation
  - Net Income

Problems with trying to maximize accounting profits

1) Which accounting method? (For instance, what depreciation method and depreciation assumptions should the firm use?)
2) Which year’s profits are we trying to maximize?
3) If the project produces accounting profits, does it necessarily create value for the firm (and vice versa)?

- What about ethical issues?
- Why stockholder value? Shouldn’t we consider bondholder value?

**Project evaluation methods** (Chapter 5)

Assume a new corporation is formed – The Kentucky River Dam Corporation with a $10 million investment from the company’s founders (the Smith family). The company makes an initial public offering of two million shares of common stock that raises a total of $20 million. The remaining $70 million is borrowed from the bank (5%, perpetual). Use the original assumptions (expenses = 1 / 11 of revenues).

1) **The net present value (NPV) rule** – Accept positive NPV projects. Reject negative NPV projects.

- What is the NPV of the Kentucky River Dam project?
- How is the NPV of the project related to firm value?

  - Firm value without project =
  - Firm value with project =

    Book (Accounting) Value at Time 0
    Assets (Dam, turbines, power lines, equip.) | Bank Loan
    | Com. Stock (Smith)
    | Com. Stock (Public’s)

    Market Value at Time 0
    Assets (Dam, turbines, power lines, equip.) | Bank Loan
    | Com. Stock (Smith)
    | Com. Stock (Public’s)

- The main distinction between the book-value presentation and the market-value presentation is _____________.
- For financial decisions, we are primarily concerned with the affects of business decisions on market value – as determined by expected cash flows and risk.

2) **The internal rate of return (IRR) rule** – Accept projects if the IRR > the opportunity cost of capital

- What is the IRR of the Kentucky River Dam project?
- Should the project be accepted according to the IRR rule?
Using the IRR to select (or reject) a project can lead to some mistakes. The NPV method will always give the correct project selection / rejection recommendation. The Modified Internal Rate of Return (MIRR) can also be used in certain circumstances.

1) Potential problems with the IRR method for all projects

**Lending versus borrowing**

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<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Project A</td>
<td>-$100</td>
<td>$140</td>
</tr>
<tr>
<td>Project B</td>
<td>$100</td>
<td>-$140</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Project A</th>
<th>Project B</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV (at 5%)</td>
<td>$33.33</td>
</tr>
<tr>
<td>IRR</td>
<td>-$33.33</td>
</tr>
<tr>
<td>MIRR (at 5%)</td>
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</table>

To calculate the MIRR,
A) Calculate the PV of all negative cash flows using the opportunity cost of capital
B) Calculate the FV (as of the end of the project) for all positive cash flows using the opportunity cost of capital
C) Calculate a regular IRR for the two cash flows calculated in the previous steps

<table>
<thead>
<tr>
<th>Cash flow</th>
<th>PV (time 0)</th>
<th>FV (time 1)</th>
<th>IRR</th>
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</table>

**Multiple IRRs**

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<tr>
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<tbody>
<tr>
<td>Project C</td>
<td>$1000</td>
<td>$0</td>
<td>$0</td>
<td>-$2000</td>
<td>$0</td>
<td>$600</td>
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<table>
<thead>
<tr>
<th>Project C</th>
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</thead>
<tbody>
<tr>
<td>NPV (at 5%)</td>
<td>-$257.56</td>
</tr>
<tr>
<td>IRR #1</td>
<td>15.79%</td>
</tr>
<tr>
<td>IRR #2</td>
<td>-42.41%</td>
</tr>
<tr>
<td>MIRR (at 5%)</td>
<td></td>
</tr>
</tbody>
</table>

**MIRR Calculation**

<table>
<thead>
<tr>
<th>Cash flow</th>
<th>PV (time 0)</th>
<th>FV (time 5)</th>
<th>IRR</th>
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</table>

2) Potential problems with the IRR method when evaluating mutually exclusive projects

**Scale Differences**

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<tbody>
<tr>
<td>Project D</td>
<td>-$100</td>
<td>$140</td>
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<tr>
<td>Project E</td>
<td>-$1000</td>
<td>$1100</td>
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</table>

<table>
<thead>
<tr>
<th>Project D</th>
<th>Project E</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV (at 5%)</td>
<td>$33.33</td>
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<tr>
<td>IRR</td>
<td>40%</td>
</tr>
<tr>
<td>MIRR (at 5%)</td>
<td>40%</td>
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</table>
Timing differences

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<tbody>
<tr>
<td>Project F</td>
<td>-$20,000</td>
<td>$8619.99</td>
<td>$8619.99</td>
<td>$8619.99</td>
<td>$8619.99</td>
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<tr>
<td>Project G</td>
<td>-$20,000</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$42,871.78</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Project F</th>
<th>Project G</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPV (at 5%)</td>
<td>$10,566.05</td>
<td>$15,270.72</td>
</tr>
<tr>
<td>IRR</td>
<td>26%</td>
<td>21%</td>
</tr>
<tr>
<td>MIRR (at 5%)</td>
<td>16.75%</td>
<td>21%</td>
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</table>

Capital Rationing

Traditional assumption in finance – firms have access to unlimited funds in the capital markets. Therefore: accept all positive-NPV projects.

In cases of limited resources: accept combinations of projects that produce the highest NPV subject to the budget constraint. (For instance, a firm may only budget $20 million for capital expenditures this year.)

**Reasons** for limited resources:

- **Cash flow estimation bias** – Managers might overestimate project cash flows in order make a project that really has a negative NPV appear to have a positive NPV. Why would they want to do this?
- Rapid growth might produce managerial problems that are hard to quantify.
- A majority stockholder might refuse to sell additional stock to the public to raise funds for the new projects.
- Capital markets might not be available to small firms. (Discounting at the ‘market’ opportunity cost of capital may not be appropriate in this case.)

***************

Chapters 1, 2, and 5 Review Questions

1. What is a corporation? Understand the benefits and problems of operating a business using the corporate form of business.
   - What agency problems are presented with the corporate form of business?
   - What is double taxation?
   - What is the potential liability to owners of a corporation (owners of common stock and owners of debt)?
   - Comment on the life of a corporation.
   - Comment on the ability of the corporation to raise capital.

2. Understand the basics of the capital budgeting decision.
   - Remember that the three major cash flows for a project are the initial investment, the future expected cash flows (from operations), and the expected terminal value (from abandonment).
   - Remember that the PV of a project is determined by discounting expected future cash flows to time zero using the opportunity cost of capital as the discount rate.
   - How is risk measured?
   - What is the definition of the opportunity cost of capital? Be able to (intuitively) determine the opportunity cost of capital for a project based on the project's riskiness.

3. Be able to provide a book value (accounting) and a market value presentation of a balance sheet assuming that firm issues new common stock and borrows money to fund a project.
4. How is the project NPV related to the difference in value of the corporation if (A) it accepts the project versus (B) it rejects the project?

5. Know how to calculate the NPV, IRR, and MIRR (modified internal rate of return) of a project. How should these methods be used to determine if the firm should select or reject potential projects?

6. Understand why using the IRR method to evaluate projects gives the wrong recommendation in certain circumstances, such as: lending versus borrowing, multiple internal rates of return, scale differences, and timing differences. How does the modified internal rate of return method “fix” some of these problems?

7. How should the NPV method be adapted to handle capital rationing? Why would a corporation ration capital?

Chapter 1, 2, and 5 Practice Problems

1. A corporation has $500 of taxable income and is taxed at the 34% tax rate. The corporation pays a dividend to its stockholders equal to its taxable income ($500) less the amount of corporate income taxes paid to the government. If the corporation's stockholders are taxed at the 25% rate, how much income tax will be paid?

   $170 by the corporation and $82.50 by the stockholders = $252.50 total income taxes paid.

2. Similar to the ‘double taxation’ example given in class, assume that AAA Corporation has $90,000 of taxable income and is taxed at the 34% tax rate. AAA Corporation will pay a dividend to its stockholders equal to its taxable income ($90,000) less the amount of corporate income taxes paid to the government. If the corporation's stockholders are taxed at the 24% rate, how much total income tax will be paid?

   $30,600 by the corporation and $14,256 by the stockholders = $44,856 total income taxes paid.

3. Assume that the initial investment for a project is $8,000,000 and the project will produce one of two possible cash flows each year (starting in one year) in perpetuity: $600,000 if the economy is good for the year and $500,000 if the economy is bad for the year. For any given year, the probability of a good economy is 60% and the probability of a bad economy is 40%.

   A. What is the expected yearly cash flow? $560,000.
   B. What is the PV of the project if the opportunity cost of capital is 6%? $9,333,333.
   C. What is the NPV of the project? $1,333,333.
   D. What is the expected return (and IRR) for the project? 7%
   E. Should the project be accepted? Yes, the NPV > 0.

4. A firm has existing assets with a book value and market value of $50 million. The firm has perpetual risk-free debt with a face amount of $10 million and an annual coupon rate of 5%. The annual payments on the debt are $500,000 per year. Using a risk-free opportunity cost of capital of 5%, the current market value of the debt is $10 million. The book value of the debt is also $10 million and the book value of the firm’s common stock is $40 million. The firm has access to a project that requires an initial investment of $20 million. Since the firm has no cash, it will raise the required cash with a new common stock issue. The project has an expected cash flow of $1.8 million in perpetuity. Use an opportunity cost of capital of 8% to discount the project’s cash flows. The acceptance of the project will not change the riskiness or value of the firm's existing assets or debt.

   A. What is the NPV of the project? $2.5 million
   B. If the project is funded through a $20 million equity issue, what will the book value and market value balance sheet look like immediately after the stock issue and investment in the project?

   **Book Value**
   - Existing assets = $50 million
   - New project = $20 million
   - Debt = $10 million
   - Stock = $60 million

   **Market Value**
   - Existing assets = $50 million
   - New project = $22.5 million
   - Debt = $10 million
   - Stock = $62.5 million
C. Assuming that the new stock is purchased by the new investors at a fair price (i.e., the market value of their stock ownership is equal to $20 million), what percentage ownership will the new stockholders have of the firm’s stock? 32%

5. Using a 5% opportunity cost of capital, what is the MIRR and NPV for the following project? 6.26%, $10.15

<table>
<thead>
<tr>
<th>Time</th>
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<tbody>
<tr>
<td>CF</td>
<td>-$100</td>
<td>$50</td>
<td>$50</td>
<td>-$30</td>
<td>$100</td>
<td>-$50</td>
</tr>
</tbody>
</table>

6. Using a 6% opportunity cost of capital, what is the MIRR and NPV for the above project? 7.06%, $8.33

7. Using an opportunity cost of capital of 8%, what is the modified internal rate of return of the following project? 15.13%

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<tr>
<th>Time</th>
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</tr>
</thead>
<tbody>
<tr>
<td>CF</td>
<td>$300</td>
<td>$0</td>
<td>$0</td>
<td>-$200</td>
<td>-$100</td>
</tr>
</tbody>
</table>

8. Using an opportunity cost of capital of 8%, the modified internal rate of return for a project is 4%. The internal rate of return for the project is 10%. Based on this, the NPV for the project is:

A. Positive.
B. Negative. Correct Answer
C. Zero.

9. The opportunity cost of capital is 8%. Your firm is evaluating two mutually exclusive projects with scale differences. Each project requires an initial investment at time zero and produces one positive cash flow at the end of the tenth year. Project A (the smaller project, requiring an initial investment of $10,000) has an internal rate of return of 9%. Project B (the larger project, requiring an initial investment of $12,000) has an internal rate of return of 10%. Which of the two projects has the higher NPV?

A. Project A has the higher NPV.
B. Project B has the higher NPV. Correct Answer
C. Both projects have the same NPV.
D. It is impossible to determine the answer to this problem without more information.

10. What is the maximum number of NPVs, IRRs, and MIRRs possible with the following set of cash flows? 1 NPV, 2 IRRs, 1 MIRR

<table>
<thead>
<tr>
<th>Time</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Cash Flow</td>
<td>$500</td>
<td>$0</td>
<td>$1,000</td>
<td>-$2,000</td>
<td>-$3,000</td>
<td>$2,000</td>
</tr>
</tbody>
</table>

11. What is the maximum number of NPVs, IRRs, and MIRRs possible with the following set of cash flows? 1 NPV, 1 IRR, 1 MIRR

<table>
<thead>
<tr>
<th>Time</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Cash Flow</td>
<td>$500</td>
<td>$0</td>
<td>$1,000</td>
<td>-$2,000</td>
<td>-$3,000</td>
<td>-$1,000</td>
</tr>
</tbody>
</table>

12. Using an opportunity cost of 7%, what is the modified internal rate of return for the following project? 7.54%

<table>
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<tr>
<th>Time</th>
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<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project A Cash Flow</td>
<td>$100</td>
<td>$100</td>
<td>$100</td>
<td>$100</td>
<td>$100</td>
<td>-$600</td>
</tr>
</tbody>
</table>
13. Consider the following set of project cash flows.

<table>
<thead>
<tr>
<th>Time</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project B Cash Flow</td>
<td>$-1000</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$2000</td>
</tr>
</tbody>
</table>

Using an opportunity cost of capital of 7%, which of the following statements are true?

A. The IRR is **greater** than the MIRR.
B. The IRR is **less** than the MIRR.
C. The IRR is **equal** to the MIRR.  **Correct Answer**

14. Consider the two projects outlined in the previous two problems. Which of the following statements are true?

A. Neither Project A or Project B will have multiple IRRs.  **Correct Answer**
B. Both Project A and Project B could have multiple IRRs.
C. Project A could have two IRRs. Project B only has one IRR.
D. Project A has one IRR. Project B could have two IRRs.

15. The following are project cash flows for two projects.

<table>
<thead>
<tr>
<th></th>
<th>0</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Project A</td>
<td>-$1000</td>
<td>1300</td>
</tr>
<tr>
<td>Project B</td>
<td>+1000</td>
<td>-1300</td>
</tr>
</tbody>
</table>

What is the internal rate of return of each of these two projects? **Both projects have an IRR = 30%**

16. The opportunity cost of capital for Project B is 5%. The modified internal rate of return (MIRR) for Project B is **greater than 0%**, but less than 5%. Based on these two facts:

A. The NPV for Project B is negative.  **Correct Answer**
B. The NPV for Project B is positive.
C. The NPV for Project B is zero.
D. There is not enough information to determine if the NPV for Project B is positive, negative, or zero.

17. A firm has $100,000 of assets (all cash) and $60,000 of debt and $40,000 of equity. The firm is considering a project that will require an initial investment of $10,000. The project will produce a $14,000 risk-free cash flow in one year. Using a risk-free opportunity cost of capital of 5%:

- What is the NPV of the project? **$3333.33**
- What is the combined debt and equity (t = 0) market value if the firm decides to undertake the project? **$103,333.33**

18. Using a 5% opportunity cost of capital, what is the modified internal rate of return (MIRR) of the following project? 10.22%

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<tbody>
<tr>
<td></td>
<td>-$10,000</td>
<td>$0</td>
<td>$0</td>
<td>+$7200</td>
<td>+$7200</td>
</tr>
</tbody>
</table>

19. Similar to the Kentucky River Dam Project, and using an 8.5% opportunity cost of capital, what is the NPV of the following project? **$20,294,118**

Initial investment = $90,000,000 (a negative cash flow at time zero).

Depending on the type of weather for the year, the project will produce one of the following three cash flows. Cash flows will be received at the end of each year, and continue forever (i.e., in perpetuity).
<table>
<thead>
<tr>
<th>Type of weather</th>
<th>Project cash flow</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wet</td>
<td>$15,500,000</td>
<td>25%</td>
</tr>
<tr>
<td>Normal</td>
<td>$9,000,000</td>
<td>50%</td>
</tr>
<tr>
<td>Dry</td>
<td>$4,000,000</td>
<td>25%</td>
</tr>
</tbody>
</table>

20. Jones Inc. has just invested $50 million in a factory. Jones Inc. has no other assets besides this factory. Jones Inc. expects to generate a positive expected cash flow of $8,812,500 per year in perpetuity from operating this factory. The opportunity cost of capital for this $8,812,500 expected cash flow stream is 7.5%.

The market value of the debt of Jones Inc. is $10 million. What is the market value of the equity of Jones Inc.? (Hint: The first step in answering this problem is calculating the market value of the assets of Jones Inc.)

Answer = $107,500,000

21. A project is expected to have positive accounting profits (i.e., positive net income) for each year of its life. Based on this information, the project’s net present value is:

A. Positive.  
B. Either positive or negative - cannot determine from the information given.  
C. Negative.  

Correct Answer

22. A project requires a time 0 initial investment of $100,000. Assume that annual cash flows (starting at time 1 and continuing forever) are either $20,000 or $11,500. The following gives the probabilities of receiving one of these two cash flows for any given year: $20,000 (35% probability), $11,500 (65% probability)

Using a 12% opportunity cost of capital (i.e., discount rate), what is the net present value of the project?

$20,625

23. A project requires a time 0 initial investment of $60,000. Assume that annual cash flows (starting at time 1 and continuing forever) are either $10,000 or $8,100. The following gives the probabilities of receiving one of these two cash flows for any given year:

$10,000 (40% probability)  
$8,100 (60% probability)

Using a 12% opportunity cost of capital (i.e., discount rate), what is the net present value of the project?

$13,833

24. Brown Inc. is a new manufacturing corporation. Its only asset is a factory (cost $15 million). It borrowed $5 million from the bank and issued stock for $10 million. The following is the time zero book value (accounting value) balance sheet:

<table>
<thead>
<tr>
<th>Factory</th>
<th>$15 million</th>
<th>Bank Loan</th>
<th>Equity (Common Stock)</th>
<th>$5 million</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Assets</td>
<td>$15 million</td>
<td>Total Debt and Equity</td>
<td>$15 million</td>
<td></td>
</tr>
</tbody>
</table>

The factory project (which required an initial investment of $15 million), has a NPV = -$4 million. What is the market value (finance value) of the assets of Brown Inc.? $11 million

25. The Green family, founding stockholders of Green Inc., currently owns 100% of the stock of a corporation. (The Green family bought the stock for $18 million.) Green Inc. plans to raise $32 million in an initial public offering of stock. After the initial public offering, the corporation will have $50 million of cash. The $50 million will be invested in a project with a market value of $60 million (i.e., the project NPV is $10 million). The corporation has no other assets other than the project. It has no debt.

Assume the stock purchased by the investing public in the initial public offering has a market value of $32 million. Based on this, what percent of the stock of Green Inc. does the investing public own? 53.33%