# CHAPTER 11
# CASH FLOW ESTIMATION AND RISK ANALYSIS

**(Difficulty:  E = Easy, M = Medium, and T = Tough)**

## Multiple Choice:  Conceptual

### *Easy:*

**Relevant cash flows**                                        **Answer: d  Diff: E**

1.    Which of the following statements is most correct?

    a. The rate of depreciation will often affect operating cash flows, even though depreciation is not a cash expense.
    b. Corporations should fully account for sunk costs when making investment decisions.
    c. Corporations should fully account for opportunity costs when making investment decisions.
    d. Statements a and c are correct.
    e. All of the statements above are correct.

**Relevant cash flows**                                        **Answer: c  Diff: E**

2.    A company is considering a new project. The company's CFO plans to calculate the project's NPV by discounting the relevant cash flows (which include the initial up-front costs, the operating cash flows, and the terminal cash flows) at the company's cost of capital (WACC).  Which of the following factors should the CFO include when estimating the relevant cash flows?

    a. Any sunk costs associated with the project.
    b. Any interest expenses associated with the project.
    c. Any opportunity costs associated with the project.
    d. Statements b and c are correct.
    e. All of the statements above are correct.

**Relevant cash flows**                                        **Answer: d  Diff: E**

3.    When evaluating potential projects, which of the following factors should be incorporated as part of a project's estimated cash flows?

    a. Any sunk costs that were incurred in the past prior to considering the proposed project.
    b. Any opportunity costs that are incurred if the project is undertaken.
    c. Any externalities (both positive and negative) that are incurred if the project is undertaken.
    d. Statements b and c are correct.
    e. All of the statements above are correct.

**Relevant cash flows**                                    **Answer: b  Diff: E**

4.    Which of the following statements is most correct?

      a. When evaluating corporate projects it is important to include all
         sunk costs in the estimated cash flows.
      b. When evaluating corporate projects it is important to include all
         relevant externalities in the estimated cash flows.
      c. Interest expenses should be included in project cash flows.
      d. Statements a and b are correct.
      e. All of the statements above are correct.

**Relevant cash flows**                                    **Answer: c  Diff: E**

5.    Which of the following is not a cash flow that results from the decision
      to accept a project?

      a. Changes in net operating working capital.
      b. Shipping and installation costs.
      c. Sunk costs.
      d. Opportunity costs.
      e. Externalities.

**Relevant cash flows**                                  **Answer: b  Diff: E  N**

6.    When evaluating a new project, the firm should consider all of the
      following factors except:

      a. Changes in net operating working capital attributable to the project.
      b. Previous expenditures associated with a market test to determine the
         feasibility of the project, if the expenditures have been expensed
         for tax purposes.
      c. Current rental income of a building owned by the firm if it is not
         used for this project.
      d. The decline in sales of an existing product directly attributable to
         this project.
      e. All of the statements above should be considered.

**Relevant cash flows**                                  **Answer: d  Diff: E  N**

7.    Which of the following items should Bev's Beverage Inc. take into account
      when evaluating a proposed prune juice project?

      a. The company spent $300,000 two years ago to renovate its Cincinnati
         plant.  These renovations were made in anticipation of another project
         that the company ultimately did not undertake.
      b. If the company did not proceed with the prune juice project, the
         Cincinnati plant could generate leasing income of  $75,000 a year.
      c. If the company proceeds with the prune juice project, it is estimated
         that sales of the company's apple juice will fall by 3 percent a year.
      d. Statements b and c are correct.
      e. All of the statements above are correct.

**Relevant cash flows**                                    **Answer: d  Diff: E  N**

8.    Which of the following should a company consider in an analysis when
      evaluating a proposed project?

      a. The new project is expected to reduce sales of the company's existing
         products by 5 percent a year.
      b. Vacant facilities not currently leased out could instead be leased
         out for $10 million a year.
      c. The company spent $30 million last year to improve the vacant
         facilities in which the new project will be housed.
      d. Statements a and b are correct.
      e. All of the statements above are correct.

**Relevant cash flows**                                    **Answer: d  Diff: E  N**

9.    Hancock Furniture Inc. is considering new expansion plans for building a
      new store.  In reviewing the proposed new store, several members of the
      firm's financial staff have made a number of points regarding the
      proposed project.  Which of the following items should the CFO include
      in the analysis when estimating the project's net present value (NPV)?

      a. The new store is expected to take away sales from two of the firm's
         existing stores located in the same town.
      b. The company owns the land that is being considered for use in the
         proposed project.  This land could instead be leased to a local
         developer.
      c. The company spent $2 million two years ago to put together a national
         advertising campaign.  This campaign helped generate the demand for
         some of its past products, which have helped make it possible for the
         firm to consider opening a new store.
      d. Statements a and b are correct.
      e. All of the statements above are correct.

**Relevant and incremental cash flows**                    **Answer: a  Diff: E  N**

10.   Twin Hills Inc. is considering a proposed project.  Given available
      information, it is currently estimated that the proposed project is
      risky but has a positive net present value. Which of the following
      factors would make the company less likely to adopt the current project?

      a. It is revealed that if the company proceeds with the proposed
         project, the company will lose two other accounts, both of which have
         positive NPVs.
      b. It is revealed that the company has an option to back out of the
         project 2 years from now, if it is discovered to be unprofitable.
      c. It is revealed that if the company proceeds with the project, it will
         have an option to repeat the project 4 years from now.
      d. Statements a and b are correct.
      e. Statements b and c are correct.

**New project cash flows**                                     **Answer: a   Diff: E   N**

11. A company is considering a proposed expansion to its facilities. Which of the following statements is most correct?

    a. In calculating the project's operating cash flows, the firm should not subtract out financing costs such as interest expense, since these costs are already included in the WACC, which is used to discount the project's net cash flows.
    b. Since depreciation is a non-cash expense, the firm does not need to know the depreciation rate when calculating the operating cash flows.
    c. When estimating the project's operating cash flows, it is important to include any opportunity costs and sunk costs, but the firm should ignore cash flows from externalities since they are accounted for elsewhere.
    d. Statements a and c are correct.
    e. None of the statements above is correct.

**Corporate risk**                                         **Answer: b   Diff: E**

12. Which of the following statements is correct?

    a. Well-diversified stockholders do not consider corporate risk when determining required rates of return.
    b. Undiversified stockholders, including the owners of small businesses, are more concerned about corporate risk than market risk.
    c. Empirical studies of the determinants of required rates of return (k) have found that only market risk affects stock prices.
    d. Market risk is important but does not have a direct effect on stock price because it only affects beta.
    e. All of the statements above are correct.

**Risk analysis**                                           **Answer: e   Diff: E**

13. Which of the following is not discussed in the text as a method for analyzing risk in capital budgeting?

    a. Sensitivity analysis.
    b. Beta, or CAPM, analysis.
    c. Monte Carlo simulation.
    d. Scenario analysis.
    e. All of the statements above are discussed in the text as methods for analyzing risk in capital budgeting.

14.   Lieber Technologies is considering two potential projects, X and Y.   In
      assessing the projects' risk, the company has estimated the beta of each
      project and has also conducted a simulation analysis.   Their efforts
      have produced the following numbers:

|                           | Project X                | Project Y              |
|---------------------------|--------------------------|------------------------|
| Expected NPV              | $350,000                 | $350,000               |
| Standard deviation ($\sigma_{NPV}$) | $100,000       | $150,000               |
| Estimated project beta    | 1.4                      | 0.8                    |
| Estimated correlation of project's cash flows with the cash flows of the company's existing projects. | Cash flows are <u>not</u> highly correlated with the cash flows of the existing projects. | Cash flows are highly correlated with the cash flows of the existing projects. |

      Which of the following statements is most correct?

      a. Project X has a higher level of stand-alone risk relative to Project Y.
      b. Project X has a higher level of corporate risk relative to Project Y.
      c. Project X has a higher level of market risk relative to Project Y.
      d. Statements b and c are correct.
      e. All of the statements above are correct.

15.   Currently, Purcell Products Inc. has a beta of 1.0, and the sales of all of
      its products tend to be positively correlated with the overall economy and
      the overall market.   The company estimates that a proposed new project has
      a higher standard deviation than the typical project undertaken by the
      firm.   The company also estimates that the new project's sales will do
      better when the overall economy is down and do poorly when the overall
      economy is strong.   On the basis of this information, which of the
      following statements is most correct?

      a. The proposed new project has more stand-alone risk than the firm's
         typical project.
      b. If undertaken, the proposed new project will increase the firm's
         corporate risk.
      c. If undertaken, the proposed new project will increase the firm's
         market risk.
      d. Statements a and b are correct.
      e. All of the statements above are correct.

**Risk analysis**                                    Answer: e  Diff: E  N

16. In conducting its risk analysis, Hanratty Inc. estimates that on a
    stand-alone basis, a proposed project's estimated returns has more risk
    than its existing projects.  The project is also expected to be more
    sensitive to movements in the overall economy and market than are its
    existing projects.  However, Hanratty estimates that the overall
    standard deviation of the company's total returns would fall if the
    company were to go ahead with this project.  On the basis of this
    information, which of the following statements is most correct?

    a. The proposed project's estimated returns have a higher standard
       deviation compared to the average existing project.
    b. The proposed project will reduce the company's corporate risk.
    c. The proposed project will increase the company's market risk.
    d. The proposed project's returns are not perfectly correlated with the
       returns of its existing projects.
    e. All of the statements above are correct.


**Accepting risky projects**                              Answer: e  Diff: E

17. A firm is considering the purchase of an asset whose risk is greater
    than the current risk of the firm, based on any method for assessing
    risk. In evaluating this asset, the decision maker should

    a. Increase the IRR of the asset to reflect the greater risk.
    b. Increase the NPV of the asset to reflect the greater risk.
    c. Reject the asset, since its acceptance would increase the firm's risk.
    d. Ignore the risk differential, if the asset to be accepted would
       comprise only a small fraction of the firm's total assets.
    e. Increase the cost of capital used to evaluate the project to reflect
       the project's higher risk.


**Risk adjustment**                                       Answer: b  Diff: E

18. Risk in a revenue-producing project can best be adjusted for by

    a. Ignoring it.
    b. Adjusting the discount rate upward for increasing risk.
    c. Adjusting the discount rate downward for increasing risk.
    d. Picking a risk factor equal to the average discount rate.
    e. Reducing the NPV by 10 percent for risky projects.


**Risk and project selection**                            Answer:  b  Diff: E

19. A company estimates that an average-risk project has a WACC of 10
    percent, a below-average risk project has a WACC of 8 percent, and an
    above-average risk project has a WACC of 12 percent.  Which of the
    following independent projects should the company accept?

    a. Project A has average risk and an IRR = 9 percent.
    b. Project B has below-average risk and an IRR = 8.5 percent.
    c. Project C has above-average risk and an IRR = 11 percent.
    d. All of the projects above should be accepted.
    e. None of the projects above should be accepted.

**Risk and project selection**                                     **Answer: c   Diff: E**

20. Downingtown Industries has an overall (composite) WACC of 10 percent. This cost of capital reflects the cost of capital for a Downingtown project with average risk; however, there are large risk differences among its projects. The company estimates that low-risk projects have a cost of capital of 8 percent and high-risk projects have a cost of capital of 12 percent. The company is considering the following projects:

| Project | Expected Return | Risk |
|---------|-----------------|---------|
| A | 15% | High |
| B | 12 | Average |
| C | 11 | High |
| D | 9 | Low |
| E | 6 | Low |

Which of the projects should the company select to maximize shareholder wealth?

a. A and B.
b. A, B, and C.
c. A, B, and D.
d. A, B, C, and D.
e. A, B, C, D, and E.

**Sensitivity, scenario, and simulation analyses**          **Answer: c   Diff: E**

21. Which of the following statements is most correct?

a. Sensitivity analysis is a good way to measure market risk because it explicitly takes into account diversification effects.
b. One advantage of sensitivity analysis relative to scenario analysis is that it explicitly takes into account the probability of certain effects occurring, whereas scenario analysis does not consider probabilities.
c. Simulation analysis is a computerized version of scenario analysis that uses continuous probability distributions of the input variables.
d. Statements a and b are correct.
e. All of the statements above are correct.

*Medium:*

**Cash flows and accounting measures**                    **Answer: d  Diff: M**

22.   Which of the following statements is correct?

      a. An asset that is sold for less than book value at the end of a
         project's life will generate a loss for the firm and will cause an
         actual cash outflow attributable to the project.
      b. Only incremental cash flows are relevant in project analysis and the
         proper incremental cash flows are the reported accounting profits
         because they form the true basis for investor and managerial
         decisions.
      c. It is unrealistic to expect that increases in net operating working
         capital required at the start of an expansion project are simply
         recovered at the project's completion.  Thus, these cash flows are
         included only at the start of a project.
      d. Equipment sold for more than its book value at the end of a project's
         life will increase income and, despite increasing taxes, will
         generate a greater cash flow than if the same asset is sold at book
         value.
      e. None of the statements above is correct.

**Relevant cash flows**                                   **Answer: d  Diff: M**

23.   Adams Audio is considering whether to make an investment in a new type
      of technology.  Which of the following factors should the company
      consider when it decides whether to undertake the investment?

      a. The company has already spent $3 million researching the technology.
      b. The new technology will affect the cash flows produced by its other
         operations.
      c. If the investment is not made, then the company will be able to sell
         one of its laboratories for $2 million.
      d. Statements b and c should be considered.
      e. All of the statements above should be considered.

**Relevant cash flows**                                   **Answer: d  Diff: M**

24.   Laurier Inc. is a household products firm that is considering developing a
      new detergent. In evaluating whether to go ahead with the new detergent
      project, which of the following items should Laurier explicitly include in
      its cash flow analysis?

      a. The company will produce the detergent in a vacant facility that they
         renovated five years ago at a cost of $700,000.
      b. The company will need to use some equipment that it could have leased
         to another company. This equipment lease could have generated
         $200,000 per year in after-tax income.
      c. The new detergent is likely to significantly reduce the sales of the
         other detergent products the company currently sells.
      d. Statements b and c are correct.
      e. All of the statements above are correct.

**Relevant cash flows**                                             **Answer: d  Diff: M**

25. Sanford & Son Inc. is thinking about expanding their business by opening another shop on property they purchased 10 years ago. Which of the following items should be included in the analysis of this endeavor?

    a. The property was cleared of trees and brush five years ago at a cost of $5,000.
    b. The new shop is expected to affect the profitability of the existing shop since some current customers will transfer their business to the new shop. The firm estimates that profits at the existing shop will decrease by 10 percent.
    c. Sanford & Son can lease the entire property to another company (that wants to grow flowers on the lot) for $5,000 per year.
    d. Both statements b and c should be included in the analysis.
    e. All of the statements above should be included in the analysis.

**Relevant cash flows**                                             **Answer: d  Diff: M**

26. Pickles Corp. is a company that sells bottled iced tea. The company is thinking about expanding its operations into the bottled lemonade business. Which of the following factors should the company incorporate into its capital budgeting decision as it decides whether or not to enter the lemonade business?

    a. If the company enters the lemonade business, its iced tea sales are expected to fall 5 percent as some consumers switch from iced tea to lemonade.
    b. Two years ago the company spent $3 million to renovate a building for a proposed project that was never undertaken. If the project is adopted, the plan is to have the lemonade produced in this building.
    c. If the company doesn't produce lemonade, it can lease the building to another company and receive after-tax cash flows of $500,000 a year.
    d. Statements a and c are correct.
    e. All of the statements above are correct.

**Incremental cash flows**                                      **Answer: d  Diff: M**

27. Which of the following constitutes an example of a cost that is not incremental, and therefore, not relevant in a capital budgeting decision?

    a. A firm has a parcel of land that can be used for a new plant site, or alternatively, can be used to grow watermelons.
    b. A firm can produce a new cleaning product that will generate new sales, but some of the new sales will be from customers who switch from another product the company currently produces.
    c. A firm orders and receives a piece of new equipment that is shipped across the country and requires $25,000 in installation and set-up costs.
    d. Statements a, b, and c are examples of incremental cash flows, and therefore, relevant cash flows.
    e. None of the statements above is an example of an incremental cash flow.

**Incremental cash flows**                                         **Answer: d  Diff: M**

28. Which of the following is not considered a relevant concern in determining incremental cash flows for a new product?

    a. The use of factory floor space that is currently unused but available for production of any product.
    b. Revenues from the existing product that would be lost as a result of some customers switching to the new product.
    c. Shipping and installation costs associated with preparing the machine to be used to produce the new product.
    d. The cost of a product analysis completed in the previous tax year and specific to the new product.
    e. None of the statements above.  (All of the statements above are relevant concerns in estimating relevant cash flows attributable to a new product.)

**Cash flow estimation**                                            **Answer: b  Diff: M**

29. Which of the following rules are essential to successful cash flow estimates, and ultimately, to successful capital budgeting analysis?

    a. The return on invested capital is the only relevant cash flow.
    b. Only incremental cash flows are relevant to the accept/reject decision.
    c. Total cash flows are relevant to capital budgeting analysis and the accept/reject decision.
    d. Statements a and b are correct.
    e. All of the statements above are correct.

**Cash flow estimation**                                            **Answer: d  Diff: M**

30. Which of the following statements is correct?

    a. In a capital budgeting analysis where part of the funds used to finance the project are raised as debt, failure to include interest expense as a cost in the cash flow statement when determining the project's cash flows will lead to an upward bias in the NPV.
    b. The preceding statement would be true if "upward" were replaced with "downward."
    c. The existence of "externalities" reduces the NPV to a level below the value that would exist in the absence of externalities.
    d. If one of the assets to be used by a potential project is already owned by the firm, and if that asset could be leased to another firm if the new project were not undertaken, then the net rent that could be obtained should be charged as a cost to the project under consideration.
    e. The rent referred to in statement d is a sunk cost, and as such it should be ignored.

**Corporate risk**                                              **Answer: e  Diff: M**

31.  In theory, the decision maker should view market risk as being of primary importance.  However, within-firm, or corporate, risk is relevant to a firm's

     a. Well-diversified stockholders, because it may affect debt capacity and operating income.
     b. Management, because it affects job stability.
     c. Creditors, because it affects the firm's credit worthiness.
     d. Statements a and c are correct.
     e. All of the statements above are correct.

**Sensitivity, scenario, and simulation analyses**             **Answer: a  Diff: M**

32.  Which of the following statements is correct?

     a. Sensitivity analysis is incomplete because it fails to consider the range of likely values of key variables as reflected in their probability distributions.
     b. In comparing two projects using sensitivity analysis, the one with the steeper lines would be considered less risky, because a small error in estimating a variable, such as unit sales, would produce only a small error in the project's NPV.
     c. The primary advantage of simulation analysis over scenario analysis is that scenario analysis requires a relatively powerful computer, coupled with an efficient financial planning software package, whereas simulation analysis can be done using a PC with a spreadsheet program or even a calculator.
     d. Sensitivity analysis is a risk analysis technique that considers both the sensitivity of NPV to changes in key variables and the likely range of variable values.
     e. Statements c and d are correct.

**Monte Carlo simulation**                                      **Answer: e  Diff: M**

33.  Monte Carlo simulation

     a. Can be useful for estimating a project's stand-alone risk.
     b. Is capable of using probability distributions for variables as input data instead of a single numerical estimate for each variable.
     c. Produces both an expected NPV (or IRR) and a measure of the riskiness of the NPV or IRR.
     d. Statements a and b are correct.
     e. All of the statements above are correct.

34. The Oneonta Chemical Company is evaluating two mutually exclusive pollution control systems. Since the company's revenue stream will not be affected by the choice of control systems, the projects are being evaluated by finding the PV of each set of costs. The firm's required rate of return is 13 percent, and it adds or subtracts 3 percentage points to adjust for project risk differences. System A is judged to be a high-risk project because it might cost much more to operate than is expected. System A's risk-adjusted cost of capital is

    a. 10 percent; this might seem illogical at first but it correctly adjusts for risk, when outflows rather than inflows are being discounted.
    b. 13 percent; the firm's cost of capital should not be adjusted when evaluating outflow-only projects.
    c. 16 percent; since A is more risky, its cash flows should be discounted at a higher rate because this correctly penalizes the project for its high risk.
    d. Somewhere between 10 percent and 16 percent, with the answer depending on the riskiness of the relevant inflows.
    e. Indeterminate, or, more accurately, irrelevant, because for such projects we would simply select the process that meets the requirements with the lowest required investment.


## Multiple Choice: Problems

### *Easy:*

35. St. John's Paper is considering purchasing equipment today that has a depreciable cost of $1 million. The equipment will be depreciated on a MACRS 5-year basis, which implies the following depreciation schedule:

    | Year | MACRS Depreciation Rates |
    |------|--------------------------|
    | 1 | 0.20 |
    | 2 | 0.32 |
    | 3 | 0.19 |
    | 4 | 0.12 |
    | 5 | 0.11 |
    | 6 | 0.06 |

    Assume that the company sells the equipment after three years for $400,000 and the company's tax rate is 40 percent. What would be the tax consequences resulting from the sale of the equipment?

    a. There are no tax consequences.
    b. The company would have to pay $44,000 in taxes.
    c. The company would have to pay $160,000 in taxes.
    d. The company would receive a tax credit of $124,000.
    e. The company would receive a tax credit of $48,000.

**Inventory and NPV**                                        **Answer: d  Diff: E  N**

36. Rojas Computing is developing a new software system for one of its clients. The system has an up-front cost of $75 million (at t = 0). The client has forecasted its inventory levels for the next five years as shown below:

| Year | Inventory |
|------|-----------|
| 1 | $1.0 billion |
| 2 | 1.2 billion |
| 3 | 1.6 billion |
| 4 | 2.0 billion |
| 5 | 2.2 billion |

Rojas forecasts that its new software will enable its client to reduce inventory to the following levels:

| Year | Inventory |
|------|-----------|
| 1 | $0.8 billion |
| 2 | 1.0 billion |
| 3 | 1.4 billion |
| 4 | 1.7 billion |
| 5 | 1.9 billion |

After Year 5, the software will become obsolete, so it will have no further impact on the client's inventory levels. Rojas' client is evaluating this software project as it would any other capital budgeting project. The client estimates that the weighted average cost of capital for the software system is 10 percent. What is the estimated NPV (in millions of dollars) of the new software system?

a. $233.56
b. $489.98
c. $625.12
d. $813.55
e. $956.43

**NPV with externalities**                                        **Answer: c  Diff: E**

37. Ellison Products is considering a new project that develops a new laundry detergent, WOW. The company has estimated that the project's NPV is $3 million, but this does not consider that the new laundry detergent will reduce the revenues received on its existing laundry detergent products. Specifically, the company estimates that if it develops WOW the company will lose $500,000 in after-tax cash flows during each of the next 10 years because of the cannibalization of its existing products. Ellison's WACC is 10 percent. What is the net present value (NPV) of undertaking WOW after considering externalities?

a.  $2,927,716.00
b.  $3,000,000.00
c. -$   72,283.55
d.  $2,807,228.00
e. -$3,072,283.55

*Medium:*

**After-tax salvage value**                                      **Answer: c  Diff: M  N**

38.   For a new project, Armstead Inc. had planned on depreciating new
      machinery that costs $300 million on a 4-year, straight-line basis.
      Suppose now, that Armstead decides to depreciate the new machinery on an
      accelerated basis according to the following depreciation schedule:

|      | MACRS Depreciation |
| Year | Rates |
|------|-------|
| 1    | 20%   |
| 2    | 32    |
| 3    | 19    |
| 4    | 12    |
| 5    | 11    |
| 6    | 6     |

      The project for which the machinery has been purchased ends in four
      years, and as a result the machinery is going to be sold at its salvage
      value of $50,000,000.  Under this accelerated depreciation method, what
      is the after-tax cash flow expected to be generated by the sale of the
      equipment in Year 4?  Assume the firm's tax rate is 40 percent.

      a. $31,800,000
      b. $41,600,000
      c. $50,400,000
      d. $51,600,000
      e. $72,200,000

**New project NPV**                                              **Answer: e  Diff: M**

39.   Given the following information, calculate the NPV of a proposed
      project:  Cost = $4,000; estimated life = 3 years; initial decrease in
      accounts receivable = $1,000, which must be restored at the end of the
      project's life; estimated salvage value = $1,000; earnings before taxes
      and depreciation = $2,000 per year; tax rate = 40 percent; and cost of
      capital = 18 percent.  The applicable depreciation rates are 33 percent,
      45 percent, 15 percent, and 7 percent.

      a.  $1,137
      b. -$  151
      c.  $  137
      d.  $  804
      e.  $  544

40. Mars Inc. is considering the purchase of a new machine that will reduce manufacturing costs by $5,000 annually. Mars will use the MACRS accelerated method to depreciate the machine, and it expects to sell the machine at the end of its 5-year operating life for $10,000. The firm expects to be able to reduce net operating working capital by $15,000 when the machine is installed, but required net operating working capital will return to its original level when the machine is sold after 5 years. Mars' marginal tax rate is 40 percent, and it uses a 12 percent cost of capital to evaluate projects of this nature. The applicable depreciation rates are 20 percent, 32 percent, 19 percent, 12 percent, 11 percent, and 6 percent. If the machine costs $60,000, what is the project's NPV?

    a. -$15,394
    b. -$14,093
    c. -$58,512
    d. -$21,493
    e. -$46,901

41. Stanton Inc. is considering the purchase of a new machine that will reduce manufacturing costs by $5,000 annually and increase earnings before depreciation and taxes by $6,000 annually. Stanton will use the MACRS method to depreciate the machine, and it expects to sell the machine at the end of its 5-year operating life for $10,000 before taxes. Stanton's marginal tax rate is 40 percent, and it uses a 9 percent cost of capital to evaluate projects of this type. The applicable depreciation rates are 20 percent, 32 percent, 19 percent, 12 percent, 11 percent, and 6 percent. If the machine's cost is $40,000, what is the project's NPV?

    a. $1,014
    b. $2,292
    c. $7,550
    d. $  817
    e. $5,040

42.  Maple Media is considering a proposal to enter a new line of business.
     In reviewing the proposal, the company's CFO is considering the
     following facts:

     •  The new business will require the company to purchase additional
        fixed assets that will cost $600,000 at t = 0. For tax and accounting
        purposes, these costs will be depreciated on a straight-line basis
        over three years. (Annual depreciation will be $200,000 per year at
        t = 1, 2, and 3.)
     •  At the end of three years, the company will get out of the business
        and will sell the fixed assets at a salvage value of $100,000.
     •  The project will require a $50,000 increase in net operating working
        capital at t = 0, which will be recovered at t = 3.
     •  The company's marginal tax rate is 35 percent.
     •  The new business is expected to generate $2 million in sales each
        year (at t = 1, 2, and 3). The operating costs excluding deprecia-
        tion are expected to be $1.4 million per year.
     •  The project's cost of capital is 12 percent.

        What is the project's net present value (NPV)?

        a. $536,697
        b. $ 86,885
        c. $ 81,243
        d. $ 56,331
        e. $561,609

43. MacDonald Publishing is considering entering a new line of business. In analyzing the potential business, their financial staff has accumulated the following information:

- The new business will require a capital expenditure of $5 million at t = 0. This expenditure will be used to purchase new equipment.
- This equipment will be depreciated according to the following depreciation schedule:

| Year | MACRS Depreciation Rates |
|:----:|:----:|
| 1 | 0.33 |
| 2 | 0.45 |
| 3 | 0.15 |
| 4 | 0.07 |

- The equipment will have no salvage value after four years.
- If MacDonald goes ahead with the new business, inventories will rise by $500,000 at t = 0, and its accounts payable will rise by $200,000 at t = 0. This increase in net operating working capital will be recovered at t = 4.
- The new business is expected to have an economic life of four years. The business is expected to generate sales of $3 million at t = 1, $4 million at t = 2, $5 million at t = 3, and $2 million at t = 4. Each year, operating costs excluding depreciation are expected to be 75 percent of sales.
- The company's tax rate is 40 percent.
- The company's weighted average cost of capital is 10 percent.
- The company is very profitable, so any accounting losses on this project can be used to reduce the company's overall tax burden.

What is the expected net present value (NPV) of the new business?

a. $ 740,298
b. -$1,756,929
c. -$1,833,724
d. -$1,961,833
e. -$5,919,974

44.   Rio Grande Bookstores is considering a major expansion of its business.
      The details of the proposed expansion project are summarized below:

   •  The company will have to purchase $500,000 in equipment at t = 0.
      This is the depreciable cost.
   •  The project has an economic life of four years.
   •  The cost can be depreciated on a MACRS 3-year basis, which implies
      the following depreciation schedule:

|        | MACRS Depreciation |
| Year   | Rates  |
|--------|--------|
| 1      | 0.33   |
| 2      | 0.45   |
| 3      | 0.15   |
| 4      | 0.07   |

   •  At t = 0, the project requires that inventories increase by $50,000
      and accounts payable increase by $10,000.   The change in net
      operating working capital is expected to be fully recovered at t = 4.
   •  The project's salvage value at the end of four years is expected to
      be $0.
   •  The company forecasts that the project will generate $800,000 in
      sales the first two years (t = 1 and 2) and $500,000 in sales during
      the last two years (t = 3 and 4).
   •  Each year the project's operating costs excluding depreciation are
      expected to be 60 percent of sales revenue.
   •  The company's tax rate is 40 percent.
   •  The project's cost of capital is 10 percent.

   What is the net present value (NPV) of the proposed project?

   a.  $159,145
   b.  $134,288
   c.  $162,817
   d.  $150,776
   e. -$257,060

45.   Your company is considering a machine that will cost $1,000 at Time 0 and
      can be sold after 3 years for $100.  To operate the machine, $200 must be
      invested at Time 0 in inventories; these funds will be recovered when the
      machine is retired at the end of Year 3.  The machine will produce sales
      revenues of $900 per year for 3 years and variable operating costs
      (excluding depreciation) will be 50 percent of sales. Operating cash
      inflows will begin 1 year from today (at Time 1).  The machine will have
      depreciation expenses of $500, $300, and $200 in Years 1, 2, and 3,
      respectively.  The company has a 40 percent tax rate, enough taxable income
      from other assets to enable it to get a tax refund from this project if the
      project's income is negative, and a 10 percent cost of capital.  Inflation
      is zero.  What is the project's NPV?

      a. $ 6.24
      b. $ 7.89
      c. $ 8.87
      d. $ 9.15
      e. $10.41

46.   Your company is considering a machine that will cost $50,000 at Time 0
      and that can be sold after 3 years for $10,000.  $12,000 must be invested
      at Time 0 in inventories and receivables; these funds will be recovered
      when the operation is closed at the end of Year 3.  The facility will
      produce sales revenues of $50,000 per year for 3 years and variable
      operating costs (excluding depreciation) will be 40 percent of sales.  No
      fixed costs will be incurred.  Operating cash inflows will begin 1 year
      from today (at t = 1).  By an act of Congress, the machine will have
      depreciation expenses of $40,000, $5,000, and $5,000 in Years 1, 2, and
      3, respectively.  The company has a 40 percent tax rate, enough taxable
      income from other assets to enable it to get a tax refund on this project
      if the project's income is negative, and a 15 percent cost of capital.
      Inflation is zero.  What is the project's NPV?

      a. $ 7,673.71
      b. $12,851.75
      c. $17,436.84
      d. $24,989.67
      e. $32,784.25

47.   Buckeye Books is considering opening a new production facility in Toledo, Ohio.  In deciding whether to proceed with the project, the company has accumulated the following information:

 • The estimated up-front cost of constructing the facility at t = 0 is $10 million.  For tax purposes the facility will be depreciated on a straight-line basis over 5 years.
 • The company plans to operate the facility for 4 years.  It estimates today that the facility's salvage value at t = 4 will be $3 million.
 • If the facility is opened, Buckeye will have to increase its inventory by $2 million at t = 0.  In addition, its accounts payable will increase by $1 million at t = 0.  The company's net operating working capital will be recovered at t = 4.
 • If the facility is opened, it will increase the company's sales by $7 million each year for the 4 years that it will be operated (t = 1, 2, 3, and 4).
 • The operating costs (excluding depreciation) are expected to equal $3 million a year.
 • The company's tax rate is 40 percent.
 • The project's cost of capital is 12 percent.

What is the project's net present value (NPV)?

a. $0.28 million
b. $0.50 million
c. $0.63 million
d. $1.01 million
e. $1.26 million

48.  Burress Beverages is considering a project where they would open a new facility in Seattle, Washington.  The company's CFO has assembled the following information regarding the proposed project:

*   It would cost $500,000 today (at t = 0) to construct the new facility. The cost of the facility will be depreciated on a straight-line basis over five years.
*   If the company opens the facility, it will need to increase its inventory by $100,000 at t = 0.  $70,000 of this inventory will be financed with accounts payable.
*   The CFO has estimated that the project will generate the following amount of revenue over the next three years:

                        Year 1    Revenue = $1.0 million
                        Year 2    Revenue = $1.2 million
                        Year 3    Revenue = $1.5 million

*   Operating costs excluding depreciation equal 70 percent of revenue.
*   The company plans to abandon the facility after three years.  At t = 3, the project's estimated salvage value will be $200,000.  At t = 3, the company will also recover the net operating working capital investment that it made at t = 0.
*   The project's cost of capital is 14 percent.
*   The company's tax rate is 40 percent.

What is the project's net present value (NPV)?

a. $ 69,207
b. $178,946
c. $286,361
d. $170,453
e. $224,451

49.  Mills Mining is considering an expansion project.  The proposed project has the following features:

•  The project has an initial cost of $500,000.  This is also the amount that can be depreciated using the following depreciation schedule:

|       | MACRS Depreciation |
| Year  | Rates              |
|-------|--------------------|
| 1     | 0.33               |
| 2     | 0.45               |
| 3     | 0.15               |
| 4     | 0.07               |

•  If the project is undertaken, at $t = 0$ the company will need to increase its inventories by $50,000, and its accounts payable will rise by $10,000.  This net operating working capital will be recovered at the end of the project's life ($t = 4$).
•  If the project is undertaken, the company will realize an additional $600,000 in sales over each of the next four years ($t = 1, 2, 3,$ and $4$).  The company's operating costs (not including depreciation) will equal $400,000 a year.
•  The company's tax rate is 40 percent.
•  At $t = 4$, the project's economic life is complete, but it will have a salvage value (before-tax) of $50,000.
•  The project's WACC is 10 percent.
•  The company is very profitable, so any accounting losses on this project can be used to reduce the company's overall tax burden.

What is the project's net present value (NPV)?

a.  $11,122.87
b.  $50,330.14
c.  $54,676.59
d.  $68,336.86
e.  $80,035.52

50.    As one of its major projects for the year, Steinbeck Depot is considering opening up a new store.  The company's CFO has collected the following information, and is proceeding to evaluate the project.

*   The building would have an up-front cost (at t = 0) of $14 million. For tax purposes, this cost will be depreciated over seven years using straight-line depreciation.
*   The store is expected to remain open for five years.  At t = 5, the company plans to sell the store for an estimated pre-tax salvage value of $8 million.
*   The project also requires the company to spend $5 million in cash at t = 0 to purchase additional inventory for the store.  After purchasing the inventory, the company's net operating working capital will remain unchanged until t = 5.  At t = 5, the company will be able to fully recover this $5 million.
*   The store is expected to generate sales revenues of $15 million per year at the end of each of the next five years.  Operating costs (excluding depreciation) are expected to be $10 million per year.
*   The company's tax rate is 40 percent.

What is the project's internal rate of return (IRR)?

a. 15.35%
b. 13.94%
c. 10.64%
d. 12.45%
e.  3.60%

51.   Parker Products manufactures a variety of household products.  The company
      is considering introducing a new detergent.  The company's CFO has
      collected the following information about the proposed product.  (Note:
      You may or may not need to use all of this information, use only relevant
      information.)

      - The project has an anticipated economic life of 4 years.
      - The company will have to purchase a new machine to produce the
        detergent.  The machine has an up-front cost (t = 0) of $2 million.
        The machine will be depreciated on a straight-line basis over 4 years
        (that is, the company's depreciation expense will be $500,000 in each
        of the first four years (t = 1, 2, 3, and 4).  The company
        anticipates that the machine will last for four years, and that after
        four years, its salvage value will equal zero.
      - If the company goes ahead with the proposed product, it will have an
        effect on the company's net operating working capital.  At the
        outset, t = 0, inventory will increase by $140,000 and accounts
        payable will increase by $40,000.  At t = 4, the net operating
        working capital will be recovered after the project is completed.
      - The detergent is expected to generate sales revenue of $1 million the
        first year (t = 1), $2 million the second year (t = 2), $2 million
        the third year (t = 3), and $1 million the final year (t = 4).  Each
        year the operating costs (not including depreciation) are expected to
        equal 50 percent of sales revenue.
      - The company's interest expense each year will be $100,000.
      - The new detergent is expected to reduce the after-tax cash flows of the
        company's existing products by $250,000 a year (t = 1, 2, 3, and 4).
      - The company's overall WACC is 10 percent.  However, the proposed
        project is riskier than the average project for Parker; the project's
        WACC is estimated to be 12 percent.
      - The company's tax rate is 40 percent.

      What is the net present value of the proposed project?

      a. -$  765,903.97
      b. -$1,006,659.58
      c. -$  824,418.62
      d. -$  838,997.89
      e. -$  778,583.43

**Risk-adjusted NPV**                                    **Answer: a   Diff: M**

52. Virus Stopper Inc., a supplier of computer safeguard systems, uses a cost of capital of 12 percent to evaluate average-risk projects, and it adds or subtracts 2 percentage points to evaluate projects of more or less risk. Currently, two mutually exclusive projects are under consideration. Both have a cost of $200,000 and will last 4 years. Project A, a riskier-than-average project, will produce annual end-of-year cash flows of $71,104. Project B, a less-than-average-risk project, will produce cash flows of $146,411 at the end of Years 3 and 4 only. Virus Stopper should accept

    a. B with a NPV of $10,001.
    b. Both A and B because both have NPVs greater than zero.
    c. B with a NPV of $8,042.
    d. A with a NPV of $7,177.
    e. A with a NPV of $15,968.

**Risk-adjusted NPV**                                      **Answer: e   Diff: M**

53. An all-equity firm is analyzing a potential project that will require an initial, after-tax cash outlay of $50,000 and after-tax cash inflows of $6,000 per year for 10 years. In addition, this project will have an after-tax salvage value of $10,000 at the end of Year 10. If the risk-free rate is 6 percent, the return on an average stock is 10 percent, and the beta of this project is 1.50, what is the project's NPV?

    a.  $13,210
    b.  $ 4,905
    c.  $ 7,121
    d. -$ 6,158
    e. -$12,879

**Risk-adjusted NPV**                                      **Answer: c   Diff: M**

54. Real Time Systems Inc. is considering the development of one of two mutually exclusive new computer models. Each will require a net investment of $5,000. The cash flows for each project are shown below:

| Year | Project A | Project B |
|------|-----------|-----------|
| 1 | $2,000 | $3,000 |
| 2 | 2,500 | 2,600 |
| 3 | 2,250 | 2,900 |

Model B, which will use a new type of laser disk drive, is considered a high-risk project, while Model A is an average-risk project. Real Time adds 2 percentage points to arrive at a risk-adjusted cost of capital when evaluating high-risk projects. The cost of capital used for average-risk projects is 12 percent. Which of the following statements regarding the NPVs for Models A and B is most correct?

    a. $NPV_A = \$ \ 380$; $NPV_B = \$1,815$
    b. $NPV_A = \$ \ 197$; $NPV_B = \$1,590$
    c. $NPV_A = \$ \ 380$; $NPV_B = \$1,590$
    d. $NPV_A = \$5,380$; $NPV_B = \$6,590$
    e. $NPV_A = \$ \ 197$; $NPV_B = \$1,815$

**Risk-adjusted discount rate**                                   **Answer: b  Diff: M**

55. The Unlimited, a national retailing chain, is considering an investment in one of two mutually exclusive projects. The discount rate used for Project A is 12 percent. Further, Project A costs $15,000, and it would be depreciated using MACRS. It is expected to have an after-tax salvage value of $5,000 at the end of 6 years and to produce after-tax cash flows (including depreciation) of $4,000 for each of the 6 years. Project B costs $14,815 and would also be depreciated using MACRS. B is expected to have a zero salvage value at the end of its 6-year life and to produce after-tax cash flows (including depreciation) of $5,100 each year for 6 years. The Unlimited's marginal tax rate is 40 percent. What risk-adjusted discount rate will equate the NPV of Project B to that of Project A?

    a. 15%
    b. 16%
    c. 18%
    d. 20%
    e. 12%

**Risk-adjusted discount rate**                                   **Answer: e  Diff: M**

56. California Mining is evaluating the introduction of a new ore production process. Two alternatives are available. Production Process A has an initial cost of $25,000, a 4-year life, and a $5,000 net salvage value, and the use of Process A will increase net cash flow by $13,000 per year for each of the 4 years that the equipment is in use. Production Process B also requires an initial investment of $25,000, will also last 4 years, and its expected net salvage value is zero, but Process B will increase net cash flow by $15,247 per year. Management believes that a risk-adjusted discount rate of 12 percent should be used for Process A. If California Mining is to be indifferent between the two processes, what risk-adjusted discount rate must be used to evaluate B?

    a.  8%
    b. 10%
    c. 12%
    d. 14%
    e. 16%

57. Alabama Pulp Company (APC) can control its environmental pollution using either "Project Old Tech" or "Project New Tech." Both will do the job, but the actual costs involved with Project New Tech, which uses unproved, new state-of-the-art technology, could be much higher than the expected cost levels. The cash outflows associated with Project Old Tech, which uses standard proven technology, are less risky. (They are about as uncertain as the cash flows associated with an average project.) APC's cost of capital for average-risk projects is normally set at 12 percent, and the company adds 3 percent for high-risk projects but subtracts 3 percent for low-risk projects. The two projects in question meet the criteria for high and average risk, but the financial manager is concerned about applying the normal rule to such cost-only projects. You must decide which project to recommend, and you should recommend the one with the lower PV of costs. What is the PV of costs of the better project?

| | | Cash Outflows | | | | |
|---|---|---|---|---|---|---|
| Years: | 0 | 1 | 2 | 3 | 4 |
| Project New Tech | 1,500 | 315 | 315 | 315 | 315 |
| Project Old Tech | 600 | 600 | 600 | 600 | 600 |

    a. -$2,521
    b. -$2,399
    c. -$2,457
    d. -$2,543
    e. -$2,422

58. Mid-State Electric Company must clean up the water released from its generating plant. The company's cost of capital is 10 percent for average-risk projects, and that rate is normally adjusted up or down by 2 percentage points for high- and low-risk projects. Clean-up Plan A, which is of average risk, has an initial cost of -$1,000 at Time 0, and its operating cost will be -$100 per year for its 10-year life. Plan B, which is a high-risk project, has an initial cost of -$300, and its annual operating cost over Years 1 to 10 will be -$200. What is the proper PV of costs for the better project?

    a. -$1,430.04
    b. -$1,525.88
    c. -$1,614.46
    d. -$1,642.02
    e. -$1,728.19

**Discounting risky outflows**                               **Answer: c  Diff: M**

59.  Your company must ensure the safety of its work force.  Two plans are being
     considered for the next 10 years:   (1) Install a high electrified fence
     around the property at a cost of $100,000.  Maintenance and electricity
     would then cost $5,000 per year over the 10-year life of the fence.
     (2) Hire security guards at a cost of $25,000 paid at the end of each year.
     Because the company plans to build new headquarters with a "state of the
     art" security system in 10 years, the plan will be in effect only until
     that time.  Your company's cost of capital is 15 percent for average-risk
     projects, and that rate is normally adjusted up or down by 2 percentage
     points for high- and low-risk projects.  Plan 1 is considered to be of low
     risk because its costs can be predicted quite accurately.  Plan B, on the
     other hand, is a high-risk project because of the difficulty of predicting
     wage rates.  What is the proper PV of costs for the better project?

     a. -$104,266.20
     b. -$116,465.09
     c. -$123,293.02
     d. -$127,131.22
     e. -$135,656.09

**Risky projects**                                           **Answer: d  Diff: M**

60.  Cochran Corporation has a weighted average cost of capital of 11 percent
     for projects of average risk.  Projects of below-average risk have a cost
     of capital of 9 percent, while projects of above-average risk have a cost
     of capital equal to 13 percent.  Projects A and B are mutually exclusive,
     whereas all other projects are independent.  None of the projects will be
     repeated.  The following table summarizes the cash flows, internal rate of
     return (IRR), and risk of each of the projects.

| Year | Project A | Project B | Project C | Project D | Project E |
|------|-----------|-----------|-----------|-----------|-----------|
| 0 | -$200,000 | -$100,000 | -$100,000 | -$100,000 | -$100,000 |
| 1 | 66,000 | 30,000 | 30,000 | 30,000 | 40,000 |
| 2 | 66,000 | 30,000 | 30,000 | 30,000 | 25,000 |
| 3 | 66,000 | 40,000 | 30,000 | 40,000 | 30,000 |
| 4 | 66,000 | 40,000 | 40,000 | 50,000 | 35,000 |
| | | | | | |
| IRR | 12.110% | 14.038% | 10.848% | 16.636% | 11.630% |
| Project | Below | Below | Average | Above | Above |
| Risk | Average | Average | | Average | Average |

     Which projects will the firm select for investment?

     a. Projects:  A, B, C, D, E
     b. Projects:  B, C, D, E
     c. Projects:  B, D
     d. Projects:  A, D
     e. Projects:  B, C, D

61.  Klott Company encounters significant uncertainty with its sales volume and price in its primary product.  The firm uses scenario analysis in order to determine an expected NPV, which it then uses in its budget.  The base-case, best-case, and worst-case scenarios and probabilities are provided in the table below.  What is Klott's expected NPV (in thousands of dollars), standard deviation of NPV (in thousands of dollars), and coefficient of variation of NPV?

|  | Probability of Outcome | Unit Sales Volume | Sales Price | NPV (In Thousands) |
|---|---|---|---|---|
| Worst case | 0.30 | 6,000 | $3,600 | −$6,000 |
| Base case | 0.50 | 10,000 | 4,200 | +13,000 |
| Best case | 0.20 | 13,000 | 4,400 | +28,000 |

a. Expected NPV = $35,000; $\sigma_{NPV}$ = 17,500; $CV_{NPV}$ = 2.00
b. Expected NPV = $35,000; $\sigma_{NPV}$ = 11,667; $CV_{NPV}$ = 0.33
c. Expected NPV = $10,300; $\sigma_{NPV}$ = 12,083; $CV_{NPV}$ = 1.17
d. Expected NPV = $13,900; $\sigma_{NPV}$ =  8,476; $CV_{NPV}$ = 0.61
e. Expected NPV = $10,300; $\sigma_{NPV}$ = 13,900; $CV_{NPV}$ = 1.35

62.  Jackson Corporation is evaluating the following four independent, investment opportunities:

| Project | Cost | Rate of Return |
|---|---|---|
| A | $300,000 | 14% |
| B | 150,000 | 10 |
| C | 200,000 | 13 |
| D | 400,000 | 11 |

Jackson's target capital structure is 60 percent debt and 40 percent equity. The yield to maturity on the company's debt is 10 percent. Jackson will incur flotation costs for a new equity issuance of 12 percent.  The growth rate is a constant 6 percent.  The stock price is currently $35 per share for each of the 10,000 shares outstanding. Jackson expects to earn net income of $100,000 this coming year and the dividend payout ratio will be 50 percent.  If the company's tax rate is 30 percent, which of the projects will be accepted?

a. Project A
b. Projects A and C
c. Projects A, C, and D
d. All of the investment projects will be taken.
e. None of the investment projects will be taken.

*Tough:*

63.   Blair Bookstores is thinking about expanding its facilities.  In considering
      the expansion, Blair's finance staff has obtained the following information:

   • The expansion will require the company to purchase today (t = 0)
     $5 million of equipment.  The equipment will be depreciated over the
     following four years at the following rate:

                         Year 1:        33%
                         Year 2:        45
                         Year 3:        15
                         Year 4:         7

   • The expansion will require the company to increase its net operating
     working capital by $500,000 today (t = 0).  This net operating working
     capital will be recovered at the end of four years (t = 4).
   • The equipment is not expected to have any salvage value at the end of
     four years.
   • The company's operating costs, excluding depreciation, are expected to
     be 60 percent of the company's annual sales.
   • The expansion will increase the company's dollar sales.  The projected
     increases, all relative to current sales are:

                         Year 1:     $3.0 million
                         Year 2:      3.5 million
                         Year 3:      4.5 million
                         Year 4:      4.0 million

     (For example, in Year 4 sales will be $4 million more than they would
     have been had the project not been undertaken.)  After the fourth year,
     the equipment will be obsolete, and will no longer provide any
     additional incremental sales.
   • The company's tax rate is 40 percent and the company's other divisions
     are expected to have positive tax liabilities throughout the project's
     life.
   • If the company proceeds with the expansion, it will need to use a
     building that the company already owns.  The building is fully
     depreciated; however, the building is currently leased out.  The company
     receives $300,000 before-tax rental income each year (payable at year
     end).  If the company proceeds with the expansion, the company will no
     longer receive this rental income.
   • The project's WACC is 10 percent.

     What is the proposed project's NPV?

     a. -$1,034,876
     b. -$1,248,378
     c. -$1,589,885
     d. -$5,410,523
     e. -$  748,378

64.   Foxglove  Corp.  is  faced  with  an  investment  project.   The  following
      information is associated with this project:

|        |              | MACRS<br>Depreciation |
| Year   | Net Income*  | Rates                 |
|--------|--------------|-----------------------|
| 1      | $50,000      | 0.33                  |
| 2      | 60,000       | 0.45                  |
| 3      | 70,000       | 0.15                  |
| 4      | 60,000       | 0.07                  |

      *Assume no interest expenses and a zero tax rate.

      The project involves an initial investment of $100,000 in equipment that
      falls  in  the  3-year  MACRS  class  and  has  an  estimated  salvage  value  of
      $15,000.    In  addition,  the  company  expects  an  initial  increase  in  net
      operating working capital of $5,000 that will be recovered in Year 4.   The
      cost  of  capital  for  the  project  is  12  percent.   What  is  the  project's  net
      present value?  (Round your final answer to the nearest whole dollar.)

      a. $153,840
      b. $159,071
      c. $162,409
      d. $168,604
      e. $182,344

65.   Pierce  Products  is  deciding  whether  it  makes  sense  to  purchase  a  new  piece
      of  equipment.   The  equipment  costs  $100,000  (payable  at  t  =  0).    The
      equipment  will  provide  cash  inflows  before  taxes  and  depreciation  of
      $45,000  at  the  end  of  each  of  the  next  four  years  (t  =  1,  2,  3,  and  4).
      The equipment can be depreciated according to the following schedule:

|      | MACRS<br>Depreciation |
| Year | Rates                 |
|------|-----------------------|
| 1    | 0.33                  |
| 2    | 0.45                  |
| 3    | 0.15                  |
| 4    | 0.07                  |

      At  the  end  of  four  years  the  company  expects  to  be  able  to  sell  the
      equipment  for  an  after-tax  salvage  value  of  $10,000.   The  company  is  in  the
      40 percent tax bracket.   The company has a weighted average cost of capital
      of  11  percent.   Because  there  is  more  uncertainty  about  the  salvage  value,
      the  company  has  chosen  to  discount  the  salvage  value  at  12  percent.   What
      is the net present value (NPV) of purchasing the equipment?

      a. $ 9,140.78
      b. $16,498.72
      c. $20,564.23
      d. $22,853.90
      e. $28.982.64

66.     Lugar Industries is considering an investment in a proposed project that requires an initial expenditure of $100,000 at t = 0.  This expenditure can be depreciated at the following annual rates:

|        | MACRS Depreciation |
| Year   | Rates |
| --- | --- |
| 1      | 0.20 |
| 2      | 0.32 |
| 3      | 0.19 |
| 4      | 0.12 |
| 5      | 0.11 |
| 6      | 0.06 |

The project has an economic life of six years.  The project's revenues are forecasted to be $90,000 a year.  The project's operating costs (not including depreciation) are forecasted to be $50,000 a year.  After six years, the project's estimated salvage value is $10,000.  The company's WACC is 10 percent, and its corporate tax rate is 40 percent.  What is the project's net present value (NPV)?

a. $31,684
b. $33,843
c. $34,667
d. $38,840
e. $45,453

67.     After a long drought, the manager of Long Branch Farms is considering the installation of an irrigation system that will cost $100,000.  It is estimated that the irrigation system will increase revenues by $20,500 annually, although operating expenses other than depreciation will also increase by $5,000.  The system will be depreciated using MACRS over its depreciable life (5 years) to a zero salvage value.  The applicable depreciation rates are 20 percent, 32 percent, 19 percent, 12 percent, 11 percent, and 6 percent.  If the tax rate is 40 percent, what is the project's IRR?

a. 12.6%
b. -1.3%
c. 13.0%
d. 10.2%
e. -4.8%

**NPV and risk-adjusted discount rate**                              **Answer: e  Diff: T**

68.  Garcia Paper is deciding whether to build a new plant.  The proposed project would have an up-front cost (at t = 0) of $30 million.  The project's cost can be depreciated on a straight-line basis over three years.  Consequently, the depreciation expense will be $10 million in each of the first three years, t = 1, 2, and 3.  Even though the project is depreciated over three years, the project has an economic life of five years.

The project is expected to increase the company's sales by $20 million.  Sales will remain at this higher level for each year of the project (t = 1, 2, 3, 4, and 5).  The operating costs, not including depreciation, equal 60 percent of the increase in annual sales.  The project's interest expense is $5 million per year and the company's tax rate is 40 percent.  The company is very profitable, so any accounting losses on this project can be used to reduce the company's overall tax burden.  The project does not require any additions to net operating working capital.  The company estimates that the project's after-tax salvage value at t = 5 will be $1.2 million.  The project is of average risk, and, therefore, the CFO has decided to discount the operating cash flows at the company's overall WACC of 10 percent.  However, the salvage value is more uncertain, so the CFO has decided to discount it at 12 percent. What is the net present value (NPV) of the proposed project?

a.  $11.86 million
b.  $14.39 million
c. -$26.04 million
d. -$12.55 million
e. -$ 1.18 million

## *Multiple Part:*

*(The following information applies to the next four problems.)*

The president of Real Time Inc. has asked you to evaluate the proposed acquisition of a new computer.  The computer's price is $40,000, and it falls in the MACRS 3-year class.  The applicable depreciation rates are 33 percent, 45 percent, 15 percent, and 7 percent.  Purchase of the computer would require an increase in net operating working capital of $2,000.  The computer would increase the firm's before-tax revenues by $20,000 per year but would also increase operating costs by $5,000 per year.  The computer is expected to be used for three years and then sold for $25,000.  The firm's marginal tax rate is 40 percent, and the project's cost of capital is 14 percent.

**New project investment**                                          **Answer: a  Diff: E**

69.  What is the net investment required at t = 0?

a. -$42,000
b. -$40,000
c. -$38,600
d. -$37,600
e. -$36,600

70. What is the operating cash flow in Year 2?

    a. $ 9,000
    b. $10,240
    c. $11,687
    d. $13,453
    e. $16,200

71. What is the total value of the terminal year non-operating cash flows at the end of Year 3?

    a. $18,120
    b. $19,000
    c. $21,000
    d. $25,000
    e. $27,000

72. What is the project's NPV?

    a. $2,622
    b. $2,803
    c. $2,917
    d. $5,712
    e. $6,438

*(The following information applies to the next four problems.)*

You have been asked by the president of your company to evaluate the proposed acquisition of a new special-purpose truck. The truck's basic price is $50,000, and it will cost another $10,000 to modify it for special use by your firm. The truck falls in the MACRS 3-year class, and it will be sold after three years for $20,000. The applicable depreciation rates are 33 percent, 45 percent, 15 percent, and 7 percent. Use of the truck will require an increase in net operating working capital (spare parts inventory) of $2,000. The truck will have no effect on revenues, but it is expected to save the firm $20,000 per year in before-tax operating costs, mainly labor. The firm's marginal tax rate is 40 percent.

73. What is the net investment in the truck? (That is, what is the Year 0 net cash flow?)

    a. -$50,000
    b. -$52,600
    c. -$55,800
    d. -$62,000
    e. -$65,000

**Operating cash flow**                                            **Answer: c   Diff: M**

74.  What is the operating cash flow in Year 1?

     a. $17,820
     b. $18,254
     c. $19,920
     d. $20,121
     e. $21,737

**Non-operating cash flows**                                       **Answer: c   Diff: M**

75.  What is the total value of the terminal year non-operating cash flows at
     the end of Year 3?

     a. $10,000
     b. $12,000
     c. $15,680
     d. $16,000
     e. $18,000

**New project NPV**                                                **Answer: a   Diff: M**

76.  The truck's cost of capital is 10 percent.  What is its NPV?

     a. -$1,547
     b. -$  562
     c. $    0
     d. $  562
     e. $1,034

          *(The following information applies to the next four problems.)*

Bruener Retail is considering opening a new store.  In evaluating the proposed
project the company's CFO has collected the following information:

- It will cost $10 million to construct the new store.  These costs will be
  incurred at t = 0.  These costs will be depreciated on a straight-line basis
  over the next 10 years.
- The company will need an additional $5 million of inventory to stock the new
  store.  $2 million of this inventory will be financed with accounts payable,
  the other $3 million will be paid for in cash.  The cost of this net increase
  in operating working capital will be incurred at t = 0.  Assume that this net
  operating working capital is fully recovered at t = 4.
- The new store will be open for four years.  During each of the four years  (t
  = 1, 2, 3, and 4) the store will produce the following financial projections
  (in millions of dollars):

|              | t = 1 | t = 2 | t = 3 | t = 4 |
|--------------|-------|-------|-------|-------|
| EBITDA       | $8.0  | $8.0  | $8.0  | $8.0  |
| Depreciation | 1.0   | 1.0   | 1.0   | 1.0   |
| EBIT         | 7.0   | 7.0   | 7.0   | 7.0   |
| Taxes        | 2.8   | 2.8   | 2.8   | 2.8   |
| Net income   | 4.2   | 4.2   | 4.2   | 4.2   |

Bruener finances its projects with 100 percent equity; thus, there is no interest expense. The company has a 10 percent weighted average cost of capital. The company assigns a 7 percent cost of capital for its low-risk projects, a 10 percent cost of capital for its average-risk projects, and a 13 percent cost for its above-average risk projects. Bruener estimates that this new store has average risk, so therefore the proposed project's cost of capital is 10 percent.

**Operating cash flows**                              **Answer: e  Diff: E  N**

77.  What are the project's after-tax operating cash flows for each of the four years?

  a. $2.8 million
  b. $3.6 million
  c. $4.2 million
  d. $4.8 million
  e. $5.2 million

**After-tax salvage value**                           **Answer: d  Diff: M  N**

78.  The CFO estimates that the store can be sold after four years for $7.5 million. Bruener's tax rate is 40 percent. What is the store's after-tax salvage value at t = 4?

  a. $4.5 million
  b. $6.0 million
  c. $6.6 million
  d. $6.9 million
  e. $7.5 million

**New project NPV**                                   **Answer: d  Diff: M  N**

79.  Assuming the store is sold after four years for $7.5 million, what is the project's net present value (NPV)?

  a. $ 6.87 million
  b. $ 7.49 million
  c. $ 7.99 million
  d. $10.25 million
  e. $10.65 million

80.  After taking into account all of the relevant cash flows from the
     previous question, the company's CFO has estimated the project's NPV and
     has also put together the following scenario analysis:

| Scenario | Prob. of Scenario Occurring | Expected NPV |
|---|---|---|
| County taxes increased | 25% | $ 5 million |
| County taxes unchanged | 50 | 8 million |
| County taxes decreased | 25 | 10 million |

On the basis of the numbers calculated above, the CFO estimates that the
standard deviation of the project's NPV is 2.06.  The company typically
calculates a project's coefficient of variation (CV) and uses this
information to assess the project's risk.  Here is the scale that
Bruener uses to evaluate project risk:

| Range for Coefficient of Variation (CV) | Risk Assessment | Project's WACC |
|---|---|---|
| CV > 0.3 | High risk | 12% |
| 0.2 < CV < 0.3 | Average risk | 10 |
| CV < 0.2 | Low risk | 8 |

On the basis of this scenario analysis, which of the following
statements is most correct?

a. The project's expected NPV is $7.75 million.
b. The project would be classified as an average-risk project.
c. If the project were classified as a high-risk project, the company
   should go back and recalculate the project's NPV using the higher
   cost of capital estimate.
d. Statements a and b are correct.
e. All of the statements above are correct.

*(The following information applies to the next two problems.)*

Mitts Beverage Inc. manufactures and distributes fruit juice products. Mitts is considering the development of a new prune juice product. Mitts' CFO has collected the following information regarding the proposed project:

- The project can be operated at the company's Dayton plant, which is currently vacant.
- The project will require that the company spend $1 million today (t = 0) to purchase a new machine. For tax purposes, the equipment will be depreciated on a straight-line basis. The company plans to use the machine for all 3 years of the project. At t = 3, the equipment is expected to have no salvage value.
- The project will require a $200,000 increase in net operating working capital at t = 0. The cost of the net operating working capital will be fully recovered at t = 3.
- The project is expected to increase the company's sales $1 million a year for three years (t = 1, 2, and 3).
- The project's annual operating costs (excluding depreciation) are expected to be 60 percent of sales.
- The company's tax rate is 40 percent.
- The company is extremely profitable, so any losses incurred from the prune juice project can be used to partially offset taxes paid on the company's other projects.
- The project has a WACC equal to 10 percent.

**New project NPV**            **Answer: e   Diff: M   N**

81. What is the project's net present value?

    a. -$162,621
    b. -$159,464
    c. -$142,035
    d. -$135,201
    e. -$121,313

**After-tax salvage value**            **Answer: c   Diff: E   N**

82. There is a possibility that the company may be forced to end the project after only the second year. If forced to end the project, the company will have to sell its equipment. If it sells its equipment after the second year, Mitts expects to sell it for $400,000. What is the after-tax salvage value that would be incorporated into the project's cash flow analysis?

    a. $383,333.33
    b. $362,444.50
    c. $373,333.33
    d. $383,333.33
    e. $400,000.00

*(The following information applies to the next two problems.)*

Bucholz Brands is considering the development of a new ketchup product. The ketchup will be sold in a variety of different colors and will be marketed to young children. In evaluating the proposed project, the company has collected the following information:

- The company estimates that the project will last for four years.
- The company will need to purchase new machinery that has an up-front cost of $300 million (incurred at t = 0). At t = 4, the machinery has an estimated salvage value of $50 million.
- The machinery will be depreciated on a 4-year straight-line basis.
- Production on the new ketchup product will take place in a recently vacated facility that the company owns. The facility is empty and Bucholz does not intend to lease the facility.
- The project will require a $60 million increase in inventory at t = 0. The company expects that its accounts payable will rise by $10 million at t = 0. After t = 0, there will be no changes in net operating working capital, until t = 4 when the project is completed, and the net operating working capital is completely recovered.
- The company estimates that sales of the new ketchup will be $200 million each of the next four years.
- The operating costs, excluding depreciation, are expected to be $100 million each year.
- The company's tax rate is 40 percent.
- The project's WACC is 10 percent.

**Operating cash flows**                                            **Answer: e  Diff: M  N**

83.   What is the project's after-tax operating cash flow the first year (t = 1)?

    a. $22.5 million
    b. $45.0 million
    c. $60.0 million
    d. $72.5 million
    e. $90.0 million

**New project NPV**                                                 **Answer: a  Diff: M  N**

84.   What is the project's estimated net present value (NPV)?

    a. -$10.07 million
    b. -$25.92 million
    c. -$46.41 million
    d. -$60.07 million
    e. +$ 5.78 million

# Web Appendix 11A

## Multiple Choice:  Conceptual

### *Easy:*

**NPV and depreciation**                                    **Answer: c   Diff: E**

11A-1.  Other things held constant, which of the following would increase the
        NPV of a project being considered?

        a. A shift from MACRS to straight-line depreciation.
        b. Making the initial investment in the first year rather than
           spreading it over the first three years.
        c. A decrease in the discount rate associated with the project.
        d. An increase in required net operating working capital.
        e. All of the statements above will increase the project's NPV.

### *Medium:*

**Depreciation cash flows**                                 **Answer: c   Diff: M**

11A-2.  Which of the following statement completions is incorrect?  For a
        profitable firm, when MACRS accelerated depreciation is compared to
        straight-line depreciation, MACRS accelerated allowances produce

        a. Higher depreciation charges in the early years of an asset's life.
        b. Larger cash flows in the earlier years of an asset's life.
        c. Larger total undiscounted profits from the project over the
           project's life.
        d. Smaller accounting profits in the early years, assuming the company
           uses the same depreciation method for tax and book purposes.
        e. None of the statements above. (All of the statements above are
           correct.)

# Web Appendix 11B

## Multiple Choice: Conceptual

### Medium:

**Replacement cash outflows**                                  **Answer: d   Diff: M**

11B-1. Given the following information, what is the required cash outflow associated with the acquisition of a new machine; that is, in a project analysis, what is the cash outflow at t = 0?

| | |
|---|---|
| Purchase price of new machine | $8,000 |
| Installation charge | 2,000 |
| Market value of old machine | 2,000 |
| Book value of old machine | 1,000 |
| Inventory decrease if new machine is installed | 1,000 |
| Accounts payable increase if new machine is installed | 500 |
| Tax rate | 35% |
| Cost of capital | 15% |

    a. -$ 8,980
    b. -$ 6,460
    c. -$ 5,200
    d. -$ 6,850
    e. -$12,020

### Tough:

**Replacement decision**                                         **Answer: b   Diff: T**

11B-2. Topsider Inc. is considering the purchase of a new leather-cutting machine to replace an existing machine that has a book value of $3,000 and can be sold for $1,500. The old machine is being depreciated on a straight-line basis, and its estimated salvage value 3 years from now is zero. The new machine will reduce costs (before taxes) by $7,000 per year. The new machine has a 3-year life, it costs $14,000, and it can be sold for an expected $2,000 at the end of the third year. The new machine would be depreciated over its 3-year life using the MACRS method. The applicable depreciation rates are 0.33, 0.45, 0.15, and 0.07. Assuming a 40 percent tax rate and a cost of capital of 16 percent, find the new machine's NPV.

    a. -$ 2,822
    b.  $ 1,658
    c.  $ 4,560
    d.  $15,374
    e.  $ 9,821

11B-3. Meals on Wings Inc. supplies prepared meals for corporate aircraft (as opposed to public commercial airlines), and it needs to purchase new broilers. If the broilers are purchased, they will replace old broilers purchased 10 years ago for $105,000 and which are being depreciated on a straight-line basis to a zero salvage value (15-year depreciable life). The old broilers can be sold for $60,000. The new broilers will cost $200,000 installed and will be depreciated using MACRS over their 5-year class life; they will be sold at their book value at the end of the fifth year. The applicable depreciation rates are 0.20, 0.32, 0.19, 0.12, 0.11, and 0.06. The firm expects to increase its revenues by $18,000 per year if the new broilers are purchased, but cash expenses will also increase by $2,500 per year. If the firm's cost of capital is 10 percent and its tax rate is 35 percent, what is the NPV of the broilers?

    a. -$60,644
    b. $17,972
    c. $28,451
    d. -$44,553
    e. $ 5,021

11B-4. Mom's Cookies Inc. is considering the purchase of a new cookie oven. The original cost of the old oven was $30,000; it is now 5 years old, and it has a current market value of $13,333.33. The old oven is being depreciated over a 10-year life toward a zero estimated salvage value on a straight-line basis, resulting in a current book value of $15,000 and an annual depreciation expense of $3,000. The old oven can be used for 6 more years but has no market value after its depreciable life is over. Management is contemplating the purchase of a new oven whose cost is $25,000 and whose estimated salvage value is zero. Expected before-tax cash savings from the new oven are $4,000 a year over its full MACRS depreciable life. Depreciation is computed using MACRS over a 5-year life, and the cost of capital is 10 percent. The applicable depreciation rates are 0.20, 0.32, 0.19, 0.12, 0.11, and 0.06. Assume a 40 percent tax rate. What is the net present value of the new oven?

    a. -$2,418
    b. -$1,731
    c. $2,635
    d. $ 163
    e. $1,731

**Replacement project IRR**                             **Answer: c  Diff: T**

11B-5. Tech Engineering Company is considering the purchase of a new machine
to replace an existing one. The old machine was purchased 5 years ago
at a cost of $20,000, and it is being depreciated on a straight-line
basis to a zero salvage value over a 10-year life. The current market
value of the old machine is $14,000. The new machine, which falls
into the MACRS 5-year class, has an estimated life of 5 years, it
costs $30,000, and Tech plans to sell the machine at the end of the
fifth year for $1,000. The applicable depreciation rates are 0.20,
0.32, 0.19, 0.12, 0.11, and 0.06. The new machine is expected to
generate before-tax cash savings of $3,000 per year. The company's
tax rate is 40 percent. What is the IRR of the proposed project?

    a.   4.1%
    b.   2.2%
    c.   0.0%
    d.  -1.5%
    e.  -3.3%

**Replacement project**                                   **Answer: d  Diff: T**

11B-6. XYZ Manufacturing Corporation currently has production equipment that
has 4 years of remaining life. The equipment was purchased a year ago
at a cost of $10,000. The annual depreciation for this machine is
$1,800 and its expected salvage value is $1,000. The equipment can be
sold today for $8,000. The company has been considering the purchase
of a new machine that will replace the existing one. The new
equipment costs $15,000 and would increase sales (through increased
production) by $2,000 per year and decrease operating costs by $1,000
per year. The equipment falls into the 3-year MACRS class and will be
worthless after 4 years. The applicable depreciation rates are 0.33,
0.45, 0.15, and 0.07. The company's tax rate is 40 percent and its
cost of capital is 12 percent. By how much would the value of the
company change if it accepts the replacement project?

    a.   $2,112.05
    b.  $  318.27
    c.  -$5,887.95
    d.  $  552.62
    e.   $1,497.91

11B-7. Foxglove Corp. is faced with an investment project.  The following
       information is associated with this project:

|  |  | MACRS<br>Depreciation |
|---|---|---|
| Year | Net Income* | Rates |
| 1 | $50,000 | 0.33 |
| 2 | 60,000 | 0.45 |
| 3 | 70,000 | 0.15 |
| 4 | 60,000 | 0.07 |

*Assume no interest expenses and a zero tax rate.

The project involves an initial investment of $100,000 in equipment
that falls in the 3-year MACRS class and has an estimated salvage
value of $15,000.   In addition, the company expects an initial
increase in net working capital of $5,000 which will be recovered in
year 4. The cost of capital for the project is 12 percent.

What is the project's net present value?   (Round your final answer to
the nearest whole dollar.)

a. $153,840
b. $159,071
c. $162,409
d. $168,604
e. $182,344

# CHAPTER 11
# ANSWERS AND SOLUTIONS

**1.** **Relevant cash flows** **Answer: d Diff: E**

Statements a and c are true; therefore, statement d is the correct answer. Net cash flow = Net income + depreciation; therefore, depreciation affects operating cash flows. Sunk costs should be disregarded when making investment decisions, while opportunity costs should be considered when making investment decisions, as they represent the best alternative use of an asset.

**2.** **Relevant cash flows** **Answer: c Diff: E**

The correct answer is c. Sunk costs should be excluded from the analysis, and interest expense is incorporated in the WACC so it should not be incorporated in the project's cash flows.

**3.** **Relevant cash flows** **Answer: d Diff: E**

Sunk costs should be ignored, but externalities and opportunity costs should be included in the project evaluation. Therefore, the correct choice is statement d.

**4.** **Relevant cash flows** **Answer: b Diff: E**

Sunk costs are never included in project cash flows, so statement a is false. Externalities are always included, so statement b is true. Since the weighted average cost of capital includes the cost of debt, and this is the discount rate used to evaluate project cash flows, interest expense should not be included in project cash flows. Therefore, statement c is false.

**5.** **Relevant cash flows** **Answer: c Diff: E**

**6.** **Relevant cash flows** **Answer: b Diff: E N**

**7.** **Relevant cash flows** **Answer: d Diff: E N**

The correct answer is statement d. Statement a is a sunk cost and should not be included. Statement b is an opportunity cost and should be included. Statement c is an externality and should be included. Therefore, statement d is the correct choice.

**8.** **Relevant cash flows** **Answer: d Diff: E N**

The correct answer is statement d. Statement c is incorrect because it is a sunk cost. Both statements a and b are correct, since statement a impacts expected cash flows and statement b is a relevant opportunity cost.

9.    **Relevant cash flows**                                    **Answer: d  Diff: E  N**

The correct answer is statement d.  Statement a is correct.  This represents a future loss in revenue to the firm.  Statement b is also correct because the firm needs to consider the best alternative use of the land.  Statement c, on the other hand, is NOT correct since it represents a sunk cost.  So, Statement d is the correct choice.

10.   **Relevant and incremental cash flows**                    **Answer: a  Diff: E  N**

Statement a is true; the other statements are false.  If the company lost two other accounts with positive NPVs, this would obviously be a huge negative when considering the proposed project.  If the firm has an option to abandon a project if it is unprofitable, this would make the company more likely to accept the project.  An option to repeat a project is a plus not a negative.

11.   **New project cash flows**                                 **Answer: a  Diff: E  N**

Statement a is true; the others are false.  Depreciation cash flows must be considered when calculating operating cash flows.  In addition, externality cash flows should be considered; however, sunk costs are not included in the analysis.

12.   **Corporate risk**                                         **Answer: b  Diff: E**

13.   **Risk analysis**                                          **Answer: e  Diff: E**

14.   **Risk analysis**                                          **Answer: c  Diff: E**

Statement a is false.  Stand-alone risk is measured by standard deviation.  Therefore, since Y's standard deviation is higher than X's, Y has higher stand-alone risk than X.  Statement b is false.  Corporate risk is measured by the correlation of project cash flows with other company cash flows.  Therefore, since Y's cash flows are highly correlated with the cash flows of existing projects, while X's are not, Y has higher corporate risk than X.  Market risk is measured by beta.  Therefore, since X's beta is greater than Y's, statement c is true.

15.   **Risk analysis**                                          **Answer: a  Diff: E  N**

The correct answer is statement a.  Since the proposed new project has a higher standard deviation than the firm's typical project, it has more stand-alone risk than the firm's typical project.  Statement b is incorrect; it will actually lower corporate risk.  Statement c is incorrect; we do not know what effect the project will have on the firm's market risk.

16.   **Risk analysis**                                          **Answer: e  Diff: E  N**

The correct answer is statement e.  Statement a comes directly from the first sentence.  Statement c comes from the second sentence.  Statements b and d follow directly from the third sentence.

17.  **Accepting risky projects**                          **Answer: e   Diff: E**

18.  **Risk adjustment**                                   **Answer: b   Diff: E**

19.  **Risk and project selection**                        **Answer: b   Diff: E**

20.  **Risk and project selection**                        **Answer: c   Diff: E**

Determine the required rate of return on each project.  High-risk projects must have a higher required rate of return than low-risk projects.  The following table shows the required return for each project on the basis of its risk level.

| Project | Expected Return | Risk | Required return for the risk level |
|---------|-----------------|---------|------------------------------------|
| A | 15% | High | 12% |
| B | 12 | Average | 10 |
| C | 11 | High | 12 |
| D | 9 | Low | 8 |
| E | 6 | Low | 8 |

The company will accept all projects whose expected return exceeds its required return.  Therefore, it will accept Projects A, B, and D.

21.  **Sensitivity, scenario, and simulation analyses**    **Answer: c   Diff: E**

Statement a is false; sensitivity analysis measures a project's stand-alone risk.  Statement b is false; sensitivity analysis doesn't consider probabilities, while scenario analysis does.  Statement c is true.

22.  **Cash flows and accounting measures**                **Answer: d   Diff: M**

23.  **Relevant cash flows**                               **Answer: d   Diff: M**

Statements b and c are true; therefore, statement d is the correct choice.  The $3 million spent on researching the technology is a sunk cost and should not be considered in the investment decision.

24.  **Relevant cash flows**                               **Answer: d   Diff: M**

Statement a is a sunk cost and sunk costs are never included in the capital budgeting analysis.  Therefore, statement a is not included.  Statement b is an opportunity cost and should be included in the capital budgeting analysis.  Statement c is the cannibalization of existing products, which will cause the company to forgo cash flows and profits in another division.  Therefore, it is included in the capital budgeting analysis.  Therefore, the correct answer is statement d.

**25.    Relevant cash flows                                      Answer: d  Diff: M**

Statements b and c are true; therefore, statement d is the correct choice. The cost of clearing the land is a sunk cost and should not be considered in the analysis. The expected impact of the new store on the existing store should be considered. In addition, the opportunity to lease the land represents an opportunity cost of opening the new store on the land and should be considered.

**26.    Relevant cash flows                                      Answer: d  Diff: M**

Statements a and c are true; therefore, statement d is the correct choice. Externalities and opportunity costs should be considered in the analysis, while sunk costs should not be included.

**27.    Incremental cash flows                                   Answer: d  Diff: M**

**28.    Incremental cash flows                                   Answer: d  Diff: M**

**29.    Cash flow estimation                                     Answer: b  Diff: M**

**30.    Cash flow estimation                                     Answer: d  Diff: M**

Statement d is true. The forgone rent is an "opportunity cost" that should be charged to the project under consideration. Note that Statements a and b are false. The cash flows should not consider interest because financial costs are included in the analysis by discounting at the WACC. If interest were deducted to find cash flows, then this cost would be "double counted," and the NPV would be downward biased. Ignoring interest when determining cash flows produces no bias in the NPV whatsoever. Note also that externalities can be either positive or negative--they tend to be negative if the new project is a substitute for an existing product, but positive if the new project is complementary to the firm's other products.

**31.    Corporate risk                                           Answer: e  Diff: M**

**32.    Sensitivity, scenario, and simulation analyses          Answer: a  Diff: M**

**33.    Monte Carlo simulation                                   Answer: e  Diff: M**

**34.    Risk adjustment                                          Answer: a  Diff: M**

$k_A$ = 13% - 3% = 10%. If the cash flows are cost-only outflows, and the analyst wants to correctly reflect their risk, the discount rate should be adjusted downward (in this case by subtracting 3 percentage points) to make the discounted flows comparatively larger.

**35.    Taxes on gain on sale**                                    **Answer: b  Diff: E**

When the machine is sold the total accumulated depreciation on it is: $(0.20 + 0.32 + 0.19) \times \$1,000,000 = \$710,000$.  The book value of the equipment is:  $\$1,000,000 - \$710,000 = \$290,000$.  The machine is sold for $400,000, so the gain is $\$400,000 - \$290,000 = \$110,000$.  Taxes are calculated as $\$110,000 \times 0.4 = \$44,000$.

**36.    Inventory and NPV**                                        **Answer: d  Diff: E  N**

We are given the up-front cost.  The new software system's cash flows are the annual cash amounts freed up by not having to invest in inventory.

```
   0      10%     1              2              3              4              5  Years
   |--------------|--------------|--------------|--------------|--------------|
-75,000,000    +200,000,000  +200,000,000  +200,000,000  +300,000,000  +300,000,000
```

$$\text{NPV} = -\$75,000,000 + \frac{\$200,000,000}{(1.1)} + \frac{\$200,000,000}{(1.1)^2} + \frac{\$200,000,000}{(1.1)^3}$$
$$+ \frac{\$300,000,000}{(1.1)^4} + \frac{\$300,000,000}{(1.1)^5}$$

NPV = -$75,000,000 + $181,818,000 + $165,289,000 + $150,263,000 + $204,904,000 + $186,276,000

NPV = $813,550,000.

**37.    NPV with externalities**                                  **Answer: c  Diff: E**

Step 1:  Calculate the NPV of the negative externalities due to the cannibalization of existing projects:
Enter the following input data in the calculator:
$CF_0 = 0$; $CF_{1-10} = -500000$; $I = 10$; and then solve for NPV = $3,072,283.55.

Step 2:  Recalculate the new project's NPV after considering externalities:
+$3,000,000 - $3,072,283.55 = -$72,283.55.

**38.    After-tax salvage value**                                **Answer: c  Diff: M  N**

The book value of the machinery at the end of Year 4 is $0.17 \times \$300,000,000 = \$51,000,000$.  The salvage value of the machinery is $50,000,000, so the company has a loss of $\$50,000,000 - \$51,000,000 = \$1,000,000$.  However, the firm will receive a tax credit on the sale of the machinery of $0.4 \times \$1,000,000 = \$400,000$.  So, the after-tax cash flow received from the sale of the machinery is $\$50,000,000 + \$400,000 = \$50,400,000$.

**39. New project NPV**                                    Answer: e  Diff: M

Time line:

```
     0   k = 18%   1          2          3   Years
     ├───────────┼──────────┼──────────┤
  -3,000        1,728      1,920      1,152
NPV = ?
```

Depreciation cash flows:

|      | MACRS Depreciation Rates | Depreciable Basis | Annual Depreciation |
|------|--------------------------|-------------------|---------------------|
| Year |                          |                   |                     |
| 1    | 0.33                     | $4,000            | $1,320              |
| 2    | 0.45                     | 4,000             | 1,800               |
| 3    | 0.15                     | 4,000             | 600                 |
| 4    | 0.07                     | 4,000             | 280                 |
|      |                          |                   | $4,000              |

Project analysis worksheet:

|                                              | 0         | 1      | 2      | 3      |
|----------------------------------------------|-----------|--------|--------|--------|
| I    Initial outlay                          |           |        |        |        |
| 1) Cost                                      | ($4,000)  |        |        |        |
| 2) Decrease in NOWC                          | 1,000     |        |        |        |
| 3) Total net investment                      | ($3,000)  |        |        |        |
| II   Operating flows:                        |           |        |        |        |
| 4) EBT and depreciation                      |           | $2,000 | $2,000 | $2,000 |
| 5) Oper. income after taxes (line 4 × 0.6)   |           | 1,200  | 1,200  | 1,200  |
| 6) Depreciation (from table)                 |           | 1,320  | 1,800  | 600    |
| 7) Tax savings from depreciation (line 6 × 0.4) |        | 528    | 720    | 240    |
| 8) Net operating cash flows (lines 5 + 7)    |           | $1,728 | $1,920 | $1,440 |
| III Terminal year cash flows:                |           |        |        |        |
| 9) Estimated salvage value                   |           |        |        | $1,000 |
| 10) Tax on salvage value (($1,000 - $280) × 0.4) |       |        |        | (288)  |
| 11) Return of NOWC                           |           |        |        | (1,000)|
| 12) Total termination CFs                    |           |        |        | ($ 288)|
| IV  Net cash flows:                          |           |        |        |        |
| 13) Net CFs                                  | ($3,000)  | $1,728 | $1,920 | $1,152 |

Numerical solution:

$$NPV = -\$3,000 + \frac{\$1,728}{1.18} + \frac{\$1,920}{(1.18)^2} + \frac{\$1,152}{(1.18)^3} = \$544.46 \approx \$544.$$

Financial calculator solution:
Inputs:  $CF_0 = -3000$; $CF_1 = 1728$; $CF_2 = 1920$; $CF_3 = 1,152$; $I = 18$.
Output:  NPV = $544.46 \approx $544.

**40.** **New project NPV**                                    **Answer: d  Diff: M**

Time line:

```
   0   k = 12%    1          2          3          4         5 Years
   ├──────────────┼──────────┼──────────┼──────────┼──────────┤
 -45,000        7,800     10,680      7,560      5,880     -1,920
```
NPV = ?

Depreciation cash flows:

|  | MACRS Depreciation | Depreciable | Annual |
| --- | --- | --- | --- |
| Year | Rates | Basis | Depreciation |
| 1 | 0.20 | $60,000 | $12,000 |
| 2 | 0.32 | 60,000 | 19,200 |
| 3 | 0.19 | 60,000 | 11,400 |
| 4 | 0.12 | 60,000 | 7,200 |
| 5 | 0.11 | 60,000 | 6,600 |
| 6 | 0.06 | 60,000 | 3,600 |
|  |  |  | $60,000 |

Project analysis worksheet:

|  | 0 | 1 | 2 | 3 | 4 | 5 |
| --- | --- | --- | --- | --- | --- | --- |
| I  Initial outlay |  |  |  |  |  |  |
|   1) Machine cost | ($60,000) |  |  |  |  |  |
|   2) Decrease in NOWC | 15,000 |  |  |  |  |  |
|   3) Total net inv. | ($45,000) |  |  |  |  |  |
| II  Operating cash flows |  |  |  |  |  |  |
|   4) BT Reduction in cost |  | $ 5,000 | $ 5,000 | $ 5,000 | $ 5,000 | $ 5,000 |
|   5) After-tax dec. in cost |  | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 |
|   6) Deprec. (from table) |  | 12,000 | 19,200 | 11,400 | 7,200 | 6,600 |
|   7) Tax savings deprec. (line 6 × 0.4) |  | 4,800 | 7,680 | 4,560 | 2,880 | 2,640 |
|   8) Net operating CFs (lines 5 + 7) |  | $ 7,800 | $10,680 | $ 7,560 | $ 5,880 | $ 5,640 |
| III Terminal year CFs |  |  |  |  |  |  |
|   9) Estimated salvage value |  |  |  |  |  | $10,000 |
|   10) Tax on salvage value [($10,000 - $3,600)(0.4)] |  |  |  |  |  | (2,560) |
|   11) Return of NOWC |  |  |  |  |  | (15,000) |
|   12) Total termination CFs |  |  |  |  |  | (7,560) |
| IV Net CFs |  |  |  |  |  |  |
|   13) Net CFs | ($45,000) | $ 7,800 | $10,680 | $ 7,560 | $ 5,880 | ($ 1,920) |

Numerical solution:

$$NPV = -\$45,000 + \frac{\$7,800}{1.12} + \frac{\$10,680}{(1.12)^2} + \frac{\$7,560}{(1.12)^3} + \frac{\$5,880}{(1.12)^4} + \frac{-\$1,920}{(1.12)^5}$$

$$= -\$21,493.24 \approx -\$21,493.$$

Financial calculator solution:

Inputs:  $CF_0$ = -45000; $CF_1$ = 7800; $CF_2$ = 10680; $CF_3$ = 7560; $CF_4$ = 5880; $CF_5$ = -1920; I = 12.

Output:  NPV = -$21,493.24 ≈ -$21,493.

**41.** **New project NPV** Answer: b Diff: M

Time line:

```
    0  k = 9%   1         2         3         4        5 Years
    ├─────────┼─────────┼─────────┼─────────┼─────────┤
 -40,000     9,800    11,720     9,640     8,520    15,320
NPV = ?
```

Depreciation cash flows:

| Year | MACRS Depreciation Rates | Depreciable Basis | Annual Depreciation |
|------|--------------------------|-------------------|---------------------|
| 1 | 0.20 | $40,000 | $ 8,000 |
| 2 | 0.32 | 40,000 | 12,800 |
| 3 | 0.19 | 40,000 | 7,600 |
| 4 | 0.12 | 40,000 | 4,800 |
| 5 | 0.11 | 40,000 | 4,400 |
| 6 | 0.06 | 40,000 | 2,400 |
| | | | $40,000 |

Project analysis worksheet:

| | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| **I Initial outlay** | | | | | | |
| 1) Machine cost | ($40,000) | | | | | |
| 2) NOWC | -- | | | | | |
| 3) Total net inv. | ($40,000) | | | | | |
| **II Operating cash flows** | | | | | | |
| 4) Inc. in earnings before deprec. & taxes | | $ 6,000 | $ 6,000 | $ 6,000 | $ 6,000 | $ 6,000 |
| 5) After-tax increase in earnings (line 4 × 0.6) | | 3,600 | 3,600 | 3,600 | 3,600 | 3,600 |
| 6) Before tax reduction in cost | | 5,000 | 5,000 | 5,000 | 5,000 | 5,000 |
| 7) After tax reduction in cost (line 6 × 0.4) | | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 |
| 8) Deprec. (from table) | | 8,000 | 12,800 | 7,600 | 4,800 | 4,400 |
| 9) Deprec. tax savings (line 8 × 0.4) | | 3,200 | 5,120 | 3,040 | 1,920 | 1,760 |
| 10) Net operating CFs (lines 5 + 7 + 9) | | $ 9,800 | $11,720 | $ 9,640 | $ 8,520 | $ 8,360 |
| **III Terminal year CFs** | | | | | | |
| 11) Estimated salvage value | | | | | | $10,000 |
| 12) Tax on salvage value [($10,000 - $2,400)(0.4)] | | | | | | (3,040) |
| 13) Return of NOWC | | | | | | -- |
| 14) Total termination CFs | | | | | | 6,960 |
| **IV Net CFs** | | | | | | |
| 15) Net CFs | ($40,000) | $ 9,800 | $11,720 | $ 9,640 | $ 8,520 | $15,320 |

Numerical solution:

$$NPV = -\$40,000 + \frac{\$9,800}{1.09} + \frac{\$11,720}{(1.09)^2} + \frac{\$9,640}{(1.09)^3} + \frac{\$8,520}{(1.09)^4} + \frac{\$15,320}{(1.09)^5}$$

$$= \$2,291.90 \approx \$2,292.$$

Financial calculator solution:
Inputs: $CF_0 = -40000$; $CF_1 = 9800$; $CF_2 = 11720$; $CF_3 = 9640$; $CF_4 = 8520$; $CF_5 = 15320$; I = 9.
Output: NPV = $2,291.90 ≈ $2,292.

**42.    New project NPV**                                                          Answer: a   Diff: M

|                       | 0          | 1           | 2           | 3           |
|-----------------------|-----------|-------------|-------------|-------------|
| Equipment purchase    | -$ 600,000 |             |             |             |
| NOWC                  | -50,000   |             |             |             |
| Sales increase        |           | $2,000,000  | $2,000,000  | $2,000,000  |
| Operating costs       |           | 1,400,000   | 1,400,000   | 1,400,000   |
| Depreciation          |           | 200,000     | 200,000     | 200,000     |
| Oper. inc. before taxes |         | $ 400,000   | $ 400,000   | $ 400,000   |
| Taxes (35%)           |           | 140,000     | 140,000     | 140,000     |
| Oper. inc. after taxes |          | $ 260,000   | $ 260,000   | $ 260,000   |
| +Depreciation         |           | 200,000     | 200,000     | 200,000     |
| Operating cash flow   |           | $ 460,000   | $ 460,000   | $ 460,000   |
| Recovery of NOWC      |           |             |             | 50,000      |
| Equipment sale        |           |             |             | +100,000    |
| Taxes on sale         |           |             |             | -35,000     |
| Net CFs               | -$ 650,000 | $ 460,000  | $ 460,000   | $ 575,000   |

$$\text{NPV} = -\$650{,}000 + \$460{,}000/1.12 + \$460{,}000/(1.12)^2 + \$575{,}000/(1.12)^3$$
$$= -\$650{,}000 + \$410{,}714.29 + \$366{,}709.18 + \$409{,}273.64$$
$$= \$536{,}697.11 \approx \$536{,}697.$$

**43.    New project NPV**                                                          Answer: b   Diff: M

Depreciation cash flows:

| Year | MACRS Depreciation Rates | Depreciable Basis | Annual Depreciation |
|------|--------------------------|-------------------|---------------------|
| 1    | 0.33                     | $5,000,000        | $1,650,000          |
| 2    | 0.45                     | $5,000,000        | 2,250,000           |
| 3    | 0.15                     | $5,000,000        | 750,000             |
| 4    | 0.07                     | $5,000,000        | 350,000             |
|      |                          |                   | $5,000,000          |

| Year                    | 0           | 1           | 2           | 3           | 4          |
|-------------------------|-------------|-------------|-------------|-------------|------------|
| Project cost            | -$5,000,000 |             |             |             |            |
| NOWC*                   | -300,000    |             |             |             |            |
| Sales                   |             | $3,000,000  | $4,000,000  | $5,000,000  | $2,000,000 |
| Operating costs (75%)   |             | 2,250,000   | 3,000,000   | 3,750,000   | 1,500,000  |
| Depreciation            |             | 1,650,000   | 2,250,000   | 750,000     | 350,000    |
| Oper. inc. before taxes |             | -$ 900,000  | -$1,250,000 | $ 500,000   | $ 150,000  |
| Taxes (40%)             |             | -360,000    | -500,000    | 200,000     | 60,000     |
| Oper. inc. after taxes  |             | -$ 540,000  | -$ 750,000  | $ 300,000   | $ 90,000   |
| Plus: Depreciation      |             | 1,650,000   | 2,250,000   | 750,000     | 350,000    |
| Operating CF            |             | $1,110,000  | $1,500,000  | $1,050,000  | $ 440,000  |
| Recovery of NOWC        |             |             |             |             | 300,000    |
| Net CFs                 | -$5,300,000 | $1,110,000  | $1,500,000  | $1,050,000  | $ 740,000  |

*An increase in inventories is a use of funds for the company, and an increase in
accounts payable is a source of funds for the company.  Thus, the change in net
operating working capital will be $200,000 - $500,000 = -$300,000 at time 0.

$$\text{NPV} = -\$5{,}300{,}000 + \$1{,}110{,}000/1.10 + \$1{,}500{,}000/(1.10)^2 +$$
$$\$1{,}050{,}000/(1.10)^3 + \$740{,}000/(1.10)^4$$
$$\text{NPV} = -\$5{,}300{,}000 + \$1{,}009{,}091 + \$1{,}239{,}669 + \$788{,}881 + \$505{,}430$$
$$\text{NPV} = -\$1{,}756{,}929.$$

**44. New project NPV**                                                  **Answer: a   Diff: M**

Depreciation cash flows:

| Year | MACRS Depreciation Rates | Depreciable Basis | Annual Depreciation |
|---|---|---|---|
| 1 | 0.33 | $500,000 | $165,000 |
| 2 | 0.45 | 500,000 | 225,000 |
| 3 | 0.15 | 500,000 | 75,000 |
| 4 | 0.07 | 500,000 | 35,000 |
|  |  |  | $500,000 |

| | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Project cost | ($500,000) | | | | |
| NOWC | (40,000) | | | | |
| Sales | | $800,000 | $800,000 | $500,000 | $500,000 |
| Operating costs | | 480,000 | 480,000 | 300,000 | 300,000 |
| Depreciation | | 165,000 | 225,000 | 75,000 | 35,000 |
| Oper. costs bef. taxes | | $155,000 | $ 95,000 | $125,000 | $165,000 |
| Taxes (40%) | | 62,000 | 38,000 | 50,000 | 66,000 |
| Oper. costs after taxes | | $ 93,000 | $ 57,000 | $ 75,000 | $ 99,000 |
| Plus: Depreciation | | 165,000 | 225,000 | 75,000 | 35,000 |
| Recovery of NOWC | | | | | 40,000 |
| Net CFs | ($540,000) | $258,000 | $282,000 | $150,000 | $174,000 |

$$\text{NPV} = -\$540,000 + \$258,000/1.10 + \$282,000/(1.10)^2 + \$150,000/(1.10)^3 + \$174,000/(1.10)^4$$
$$= -\$540,000 + \$234,545.45 + \$233,057.85 + \$112,697.22 + \$118,844.34$$
$$= \$159,144.86 \approx \$159,145.$$

**45. New project NPV**                                                  **Answer: b   Diff: M**

| | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Cost | ($1,000) | | | |
| NOWC | (200) | | | |
| Sales | | $900 | $900 | $900 |
| Costs | | 450 | 450 | 450 |
| Depreciation | | 500 | 300 | 200 |
| Oper. inc. before taxes | | ($ 50) | $150 | $250 |
| Taxes (40%) | | (20) | 60 | 100 |
| Oper. inc. after taxes | | ($ 30) | $ 90 | $150 |
| Add Depreciation | | 500 | 300 | 200 |
| Operating CFs | | $470 | $390 | $350 |
| Salvage value | | | | 100 |
| Tax on SV | | | | (40) |
| Recovery of NOWC | | | | 200 |
| Net CFs | ($1,200) | $470 | $390 | $610 |

```
                   0   k = 10%   1          2          3   Years
                   ├──────────────┼──────────┼──────────┤
                 -1,200          470        390        610
```

$$\text{NPV} = -\$1,200 + \frac{\$470}{1.10} + \frac{\$390}{(1.10)^2} + \frac{\$610}{(1.10)^3}$$
$$= \$7.89.$$

**46. New project NPV**                                         **Answer: a   Diff: M**

```
              0   k = 15%   1            2            3  Years
              |------------|------------|------------|
Cost        -50,000
Sales                     $50,000      $50,000      $50,000
VC                         20,000       20,000       20,000
Depreciation               40,000        5,000        5,000
Oper. inc. before taxes  ($10,000)     $25,000      $25,000
Taxes (40%)                (4,000)      10,000       10,000
Oper. inc. after taxes   ($ 6,000)     $15,000      $15,000
Depreciation               40,000        5,000        5,000
Operating CFs             $34,000      $20,000      $20,000
NOWC        (12,000)                                 12,000
AT Salvage                                            6,000
NCFs        ($62,000)     $34,000      $20,000      $38,000
```

$$\text{NPV} = -\$62{,}000 + \frac{\$34{,}000}{1.15} + \frac{\$20{,}000}{(1.15)^2} + \frac{\$38{,}000}{(1.15)^3} = \$7{,}673.71.$$

**47. New project NPV**                                       **Answer: d  Diff: M**

The equipment is purchased for $10,000,000 and is depreciated over 5 years. The depreciation table looks like this:

| Year | Straight-Line Depreciation Rate | Depreciation | Book Value |
|------|------------------|--------------|------------|
| 1 | 1/5 | $2,000,000 | $8,000,000 |
| 2 | 1/5 | 2,000,000 | 6,000,000 |
| 3 | 1/5 | 2,000,000 | 4,000,000 |
| 4 | 1/5 | 2,000,000 | 2,000,000 |
| 5 | 1/5 | 2,000,000 | 0 |

Notice that the project has a life of only 4 years, while the equipment is depreciated over 5 years.  At the end of Year 4, the company sells the equipment for $3 million, but its book value is only $2 million.  The equipment is sold for $1 million more than its book value; therefore, the firm will be taxed on this $1 million.  Consequently, at the end of the project, it receives $3 million for the sale, but it has to pay $400,000 in taxes (40% of $1 million).

Net operating working capital required at t = 0 will be $1 million. (Inventories are a use of working capital, so they increase operating working capital by $2 million.  Accounts payable are a source of operating working capital, so they decrease operating working capital by $1 million. Net operating working capital increases by $1 million). Remember that the firm gets this back at t = 4.

| Year | 0 | 1 | 2 | 3 | 4 |
|------|---|---|---|---|---|
| Sales | | $ 7,000,000 | $ 7,000,000 | $ 7,000,000 | $ 7,000,000 |
| Op. costs | | 3,000,000 | 3,000,000 | 3,000,000 | 3,000,000 |
| Dep'n | | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| Oper. inc. before taxes | | $ 2,000,000 | $ 2,000,000 | $ 2,000,000 | $ 2,000,000 |
| Taxes (40%) | | 800,000 | 800,000 | 800,000 | 800,000 |
| Oper. inc. after taxes | | $ 1,200,000 | $ 1,200,000 | $ 1,200,000 | $ 1,200,000 |
| Dep'n | | 2,000,000 | 2,000,000 | 2,000,000 | 2,000,000 |
| Oper. cash flow | | $ 3,200,000 | $ 3,200,000 | $ 3,200,000 | $ 3,200,000 |
| Equipment cost | ($10,000,000) | | | | 3,000,000 |
| Taxes on sale | | | | | (400,000) |
| Change in NOWC | (1,000,000) | | | | 1,000,000 |
| Net cash flow | ($11,000,000) | $ 3,200,000 | $ 3,200,000 | $ 3,200,000 | $ 6,800,000 |

Now, enter the net cash flows into the cash flow register and enter the discount rate, I/YR = 12, and solve for the project's NPV = $1,007,383 ≈ $1.01 million.

**48.    New project NPV**                                      **Answer: e  Diff: M  N**

| | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| Equipment outlay | -$500,000 | | | |
| Change in NOWC | -30,000 | | | |
| Sales | | $1,000,000 | $1,200,000 | $1,500,000 |
| Op. costs excl.deprec. (70%) | | 700,000 | 840,000 | 1,050,000 |
| Depreciation | | 100,000 | 100,000 | 100,000 |
| Oper. inc. before taxes | | $ 200,000 | $ 260,000 | $ 350,000 |
| Taxes (40%) | | 80,000 | 104,000 | 140,000 |
| Oper. inc. after taxes | | $ 120,000 | $ 156,000 | $ 210,000 |
| Add back:  Depreciation | | 100,000 | 100,000 | 100,000 |
| Oper. cash flows | | $ 220,000 | $ 256,000 | $ 310,000 |
| AT salvage value | | | | 200,000 |
| Recovery of NOWC | | | | 30,000 |
| Net cash flows | -$530,000 | $ 220,000 | $ 256,000 | $ 540,000 |

$CF_0 = -530000$; $CF_1 = 220000$; $CF_2 = 256000$; $CF_3 = 540000$; I/YR = 14; and
then solve for NPV = $224,450.76 ≈ $224,451.

**49.    New project NPV**                                      **Answer: c  Diff: M  R**

Get the depreciation using the MACRS table provided in the question.

| | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Cost | ($500,000) | | | | |
| NOWC | (40,000) | | | | |
| Sales | | $600,000 | $600,000 | $600,000 | $600,000 |
| Operating Cost | | 400,000 | 400,000 | 400,000 | 400,000 |
| Depreciation | | 165,000 | 225,000 | 75,000 | 35,000 |
| Oper. inc. before taxes | | $ 35,000 | ($ 25,000) | $125,000 | $165,000 |
| Taxes (40%) | | 14,000 | (10,000) | 50,000 | 66,000 |
| Oper. inc. after taxes | | $ 21,000 | ($ 15,000) | $ 75,000 | $ 99,000 |
| After-tax salvage value | | | | | 30,000 |
| Return of NOWC | | | | | 40,000 |
| + Depreciation | | 165,000 | 225,000 | 75,000 | 35,000 |
| Net CFs | ($540,000) | $186,000 | $210,000 | $150,000 | $204,000 |

Note in year 4 your $40,000 of net operating working capital is
recovered plus the after tax salvage value of $30,000.

Enter the cash flows into the cash flow register and solve for the NPV
using the WACC of 10%.  NPV = $54,676.59.

**50.  New project IRR**                                    **Answer: b  Diff: M**

Step 1:  Set up a time line in an income statement format to lay out the cash flows:

|                          | 0       | 1      | 2      | 3      | 4      | 5      |
|--------------------------|---------|--------|--------|--------|--------|--------|
| Building                 | -$14.0  |        |        |        |        |        |
| NOWC                     | -5.0    |        |        |        |        |        |
| Revenues                 |         | $15.0  | $15.0  | $15.0  | $15.0  | $15.0  |
| Oper. costs              |         | 10.0   | 10.0   | 10.0   | 10.0   | 10.0   |
| Depreciation             |         | 2.0    | 2.0    | 2.0    | 2.0    | 2.0    |
| Oper. inc. before taxes  |         | $ 3.0  | $ 3.0  | $ 3.0  | $ 3.0  | $ 3.0  |
| Taxes (40%)              |         | 1.2    | 1.2    | 1.2    | 1.2    | 1.2    |
| Oper. inc. after taxes   |         | $ 1.8  | $ 1.8  | $ 1.8  | $ 1.8  | $ 1.8  |
| Plus Depreciation        |         | 2.0    | 2.0    | 2.0    | 2.0    | 2.0    |
| Oper. CFs                |         | $ 3.8  | $ 3.8  | $ 3.8  | $ 3.8  | $ 3.8  |
| Sale of building         |         |        |        |        |        | 8.0    |
| Taxes on sale            |         |        |        |        |        | -1.6*  |
| Recovery of NOWC         |         |        |        |        |        | 5.0    |
| Net cash flows           | -$19.0  | $ 3.8  | $ 3.8  | $ 3.8  | $ 3.8  | $15.2  |

*At the end of 5 years, the BV of the building will be $14,000,000 - (5 × $2,000,000) = $4,000,000.  The company sells it for $8 million; however, the BV is only $4 million.  So, the company will have a "profit" of $4 million, on which it will owe taxes.  The taxes owed are calculated as:  Taxes = 0.4 × $4 million = $1.6 million.

Step 2:  Solve for the project's IRR:
Enter the following data in the calculator:
$CF_0 = -19$; $CF_{1-4} = 3.8$; $CF_5 = 15.2$; and then solve for IRR = 13.94%.

**51.  Risk-adjusted NPV**                                  **Answer: c  Diff: M  N**

(In thousands of dollars)

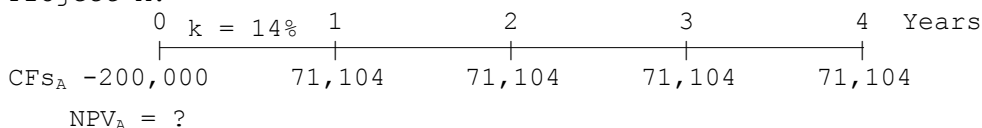|                       | 0       | 1      | 2      | 3      | 4      |
|-----------------------|---------|--------|--------|--------|--------|
| Initial cost          | -$2,000 |        |        |        |        |
| Change in NOWC        | -100    |        |        |        |        |
| Initial outlay        | -2,100  |        |        |        |        |
| Sales                 |         | $1,000 | $2,000 | $2,000 | $1,000 |
| Operating costs       |         | 500    | 1,000  | 1,000  | 500    |
| Depreciation          |         | 500    | 500    | 500    | 500    |
| Operating income      |         | $   0  | $  500 | $  500 | $    0 |
| Taxes (40%)           |         | 0      | 200    | 200    | 0      |
| Operating income      |         | $   0  | $  300 | $  300 | $    0 |
| Depreciation          |         | 500    | 500    | 500    | 500    |
| Externalities         |         | -250   | -250   | -250   | -250   |
| Return of NOWC        |         |        |        |        | + 100  |
| Net cash flow (NCF)   | -$2,100 | $  250 | $  550 | $  550 | $  350 |

Entering the NCF amounts into the cash flow register (at 12%) gives you a NPV of -$824,418.62.
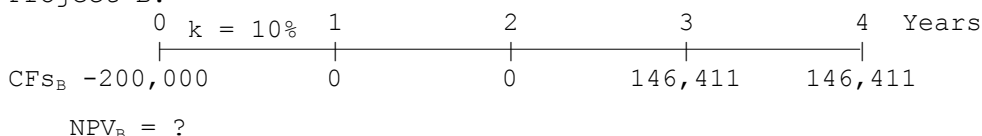
**52.  Risk-adjusted NPV**                                    **Answer: a   Diff: M**

Time lines:
Project A:

```
            0   k = 14%   1          2          3          4   Years
            |————————————|——————————|——————————|——————————|
CFs_A  -200,000        71,104     71,104     71,104     71,104
```

   $NPV_A = ?$

Project B:

```
            0   k = 10%   1          2          3          4   Years
            |————————————|——————————|——————————|——————————|
CFs_B  -200,000           0          0       146,411    146,411
```

   $NPV_B = ?$

Calculate required returns on A and B:
Project A   High risk   $k_{Risk\ adjusted}$ = 12% + 2% = 14%.
Project B   Low risk    $k_{Risk\ adjusted}$ = 12% - 2% = 10%.

A Inputs:  $CF_0$ = -200000; $CF_1$ = 71104; $N_j$ = 4; I = 14.
   Output: $NPV_A$ = \$7,176.60 ≈ \$7,177.
B Inputs:  $CF_0$ = -200000; $CF_1$ = 0; $N_j$ = 2; $CF_2$ = 146411; $N_j$ = 2; I = 10.
   Output: $NPV_B$ = \$10,001.43 ≈ \$10,001.

**53.  Risk-adjusted NPV**                                    **Answer: e   Diff: M**

Time line:

```
       0   k = 12%   1          2                      10 Years
       |————————————|——————————|—————————  • • •  ————|
    -50,000        6,000      6,000                  6,000
NPV = ?                                Salvage value  10,000
                                                      ——————
                                                      16,000
```
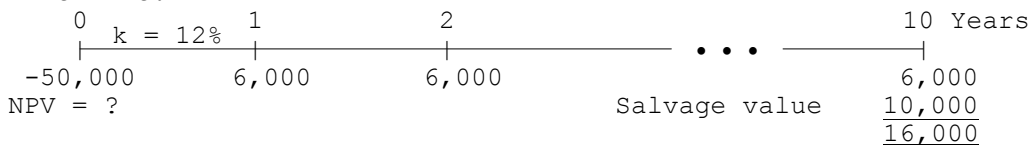
$k_{Project}$ = 6% + 4%(1.5) = 12%.
Inputs:  $CF_0$ = -50000; $CF_1$ = 6000; $N_j$ = 9; $CF_{10}$ = 16000; I = 12%.
Output:  NPV = -\$12,878.93 ≈ -\$12,879.

**54.  Risk-adjusted NPV**                                    **Answer: c   Diff: M**

Time lines:

```
            0   k = 12%   1          2          3  Years
            |————————————|——————————|——————————|
CFs_A  -5,000         2,000      2,500      2,250
NPV_A = ?
```

```
            0   k = 14%   1          2          3  Years
            |————————————|——————————|——————————|
CFs_B  -5,000         3,000      2,600      2,900
NPV_B = ?
```
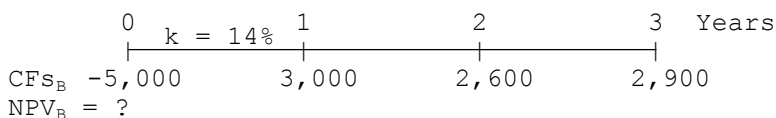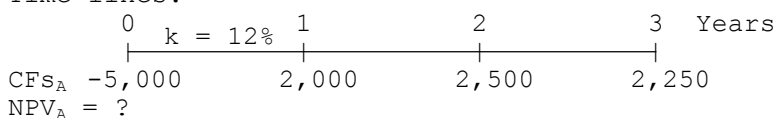
Project A:  $k_{Average\ risk}$ = 12%.
Project B:  $k_{High\ risk}$ = 12% + 2% = 14%.

A: Inputs: $CF_0$ = -5000; $CF_1$ = 2000; $CF_2$ = 2500; $CF_3$ = 2250; I = 12.
   Output: NPV = \$380.20 ≈ \$380.
B: Inputs: $CF_0$ = -5000; $CF_1$ = 3000; $CF_2$ = 2600; $CF_3$ = 2900; I = 14.
   Output: NPV = \$1,589.61 ≈ \$1,590.

**55. Risk-adjusted discount rate**                    **Answer: b   Diff: M**

Time lines:
Project A

```
          0 k = 12% 1      2      3      4      5      6   Years
          ├────────┼──────┼──────┼──────┼──────┼──────┤
CFs_A  -15,000  4,000  4,000  4,000  4,000  4,000  4,000
  NPV_A = ? = 3,978.78                             5,000 Salvage value
                              Terminal CF = 9,000
```

Project B

```
          0 k = ? 1      2                          6   Years
          ├──────┼──────┼──────── • • • ───────────┤
CFs_B  -14,815  5,100  5,100                     5,100
  NPV_B = NPV_A = 3,978.78                            0 Salvage value
                              Terminal CF = 5,100
```
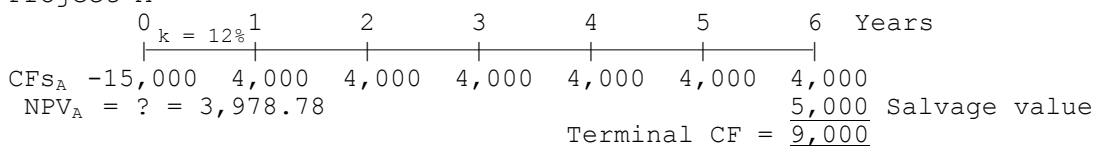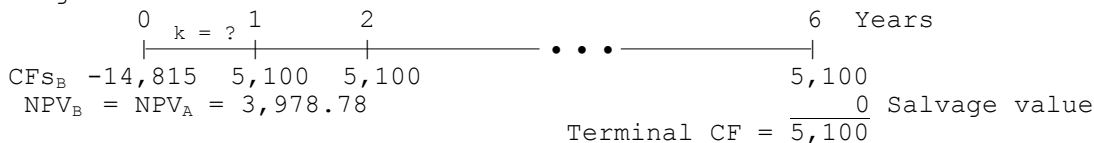
Calculate Project A's NPV:
Inputs:  $CF_0$ = -15000; $CF_1$ = 4000; $N_j$ = 5; $CF_2$ = 9000; I = 12.
Output:  NPV = \$3,978.78.

To calculate the discount rate at which Project B's NPV is equal to Project A's, calculate Project B's IRR with an initial cash flow ($CF_0$) that is \$3,978.78 greater than its current $CF_0$.  $CF_0$ = -\$14,815 + (-\$3,978.78) = -\$18,793.78.  Now calculate Project B's IRR:
Inputs:  $CF_0$ = -18793.78; $CF_1$ = 5100; $N_j$ = 6.
Output:  IRR = 15.997% ≈ 16%.

Check:  Calculate Project B's NPV at k = 16%:
Inputs:  $CF_0$ = -14815; $CF_1$ = 5100; $N_j$ = 6.
Output:  NPV = \$3,977.15.  (Difference is due to rounding k up to 16%.)

**56. Risk-adjusted discount rate**                    **Answer: e   Diff: M**

Time lines:
Project A:

```
          0 k = 12%   1          2          3          4   Years
          ├───────────┼──────────┼──────────┼──────────┤
CFs_A  -25,000      13,000     13,000     13,000     13,000
  NPV_A = ? = 17,663.13                               5,000 Salvage Value
                              Terminal CF = 18,000
```

Project B:

```
          0 k = ?     1          2          3          4   Years
          ├───────────┼──────────┼──────────┼──────────┤
CFs_B  -25,000      15,247     15,247     15,247     15,247
  NPV_B = NPV_A = 17,663.13                              0 Salvage Value
                              Terminal CF = = 15,247
```
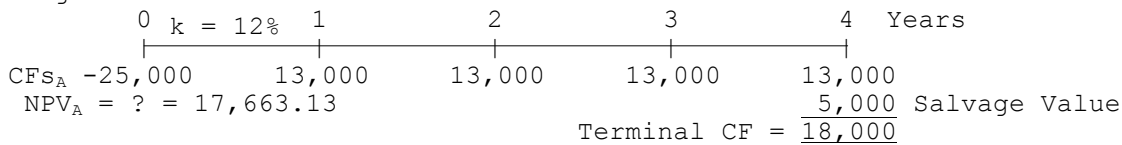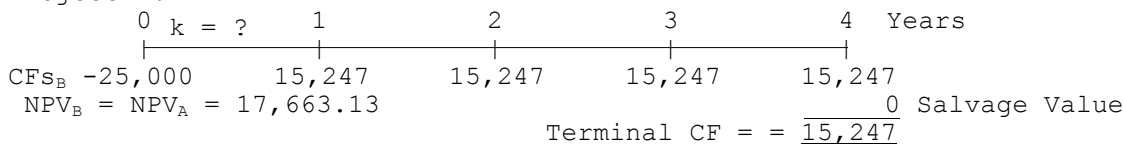
A:  Inputs:  $CF_0$ = -25000; $CF_1$ = 13000; $N_j$ = 3; $CF_2$ = 18000; I = 12.
    Output:  $NPV_A$ = 17,663.13.

B:  Inputs:  $CF_0$ = -42663.13 (-25000 + -17663.13); $CF_1$ = 15247; $N_j$ = 4.
    Output:  IRR = 16.0% = k.

57.  **Discounting risky outflows**                    **Answer: e  Diff: M**

Time line:

```
              0          1          2          3          4
              ├──────────┼──────────┼──────────┼──────────┤
CFs_New Tech -1,500     -315       -315       -315       -315
  NPV_New Tech = ?
CFs_Old Tech  -600      -600       -600       -600       -600
  NPV_Old Tech = ?
```

Recognize that (1) risky outflows must be discounted at lower rates, and (2) since Project New Tech is risky, it must be discounted at a rate of 12% - 3% = 9%. Project Old Tech must be discounted at 12%.

Project New Tech:  Inputs:  $CF_0$ = -1500; $CF_1$ = -315; $N_j$ = 4; I = 9.
                   Output:  NPV = -$2,520.51.
Project Old Tech:  Inputs:  $CF_0$ = -600; $CF_1$ = -600; $N_j$ = 4; I = 12.
                   Output:  NPV = -$2,422.41.

58.  **Discounting risky outflows**                    **Answer: c  Diff: M**

The first thing to note is that risky cash outflows should be discounted at a lower discount rate, so in this case we would discount the riskier Project B's cash flows at 10% - 2% = 8%.  Project A's cash flows would be discounted at 10%.

Now we would find the PV of the costs as follows:
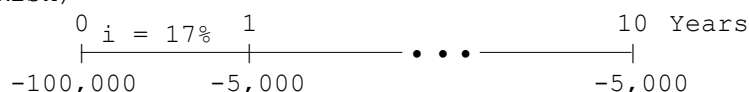Project A: $CF_0$ = -1000; $CF_{1-10}$ = -100; I = 10.0; and then solve for NPV = -$1,614.46.
Project B: $CF_0$ = -300; $CF_{1-10}$ = -200; I = 8.0; and then solve for NPV = -$1,642.02.

Project A has the lower PV of costs. If Project B had been evaluated with a 12% cost of capital, its PV of costs would have been -$1,430.04, but that would have been wrong.

**59.  Discounting risky outflows**                          **Answer: c  Diff: M**

Plan 1:  (Low Risk)

$$0 \quad i = 17\% \quad 1 \qquad\qquad\qquad 10 \text{ Years}$$

$$-100{,}000 \qquad -5{,}000 \qquad\qquad\qquad -5{,}000$$

With a financial calculator input the following:
$CF_0 = -100000$; $CF_{1-10} = -5000$; $I = 17$; and then solve for $NPV_1 = -\$123{,}293.02$.

Plan 2:  (High Risk)

$$0 \quad i = 13\% \quad 1 \qquad\qquad\qquad 10 \text{ Years}$$
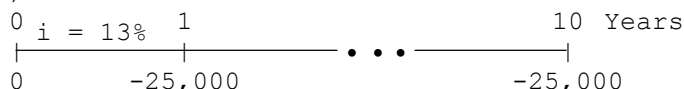
$$0 \qquad -25{,}000 \qquad\qquad\qquad -25{,}000$$

With a financial calculator input the following:
$CF_0 = 0$; $CF_{1-10} = -25000$; $I = 13$; and then solve for $NPV_2 = -\$135{,}656.09$.

Note that because we are dealing with cash outflows, the higher-risk project's discount rate must be lowered, while the lower-risk project's discount rate must be increased. Thus, Plan 1 has the lower costs and should be accepted.

**60.  Risky projects**                          **Answer: d  Diff: M**

Look at the NPV, IRR, and hurdle rate for each project:

| Project | A | B | C | D | E |
|---|---|---|---|---|---|
| Hurdle rate | 9.00% | 9.00% | 11.00% | 13.00% | 13.00% |
| NPV | $13,822 | $11,998 | | | |
| IRR | 12.11% | 14.04% | 10.85% | 16.64% | 11.63% |

$$NPV_A = -\$200{,}000 + \frac{\$66{,}000}{1.09} + \frac{\$66{,}000}{(1.09)^2} + \frac{\$66{,}000}{(1.09)^3} + \frac{\$66{,}000}{(1.09)^4} = \$13{,}821.51 \approx \$13{,}822.$$

$$NPV_B = -\$100{,}000 + \frac{\$30{,}000}{1.09} + \frac{\$30{,}000}{(1.09)^2} + \frac{\$40{,}000}{(1.09)^3} + \frac{\$40{,}000}{(1.09)^4} = \$11{,}997.68 \approx \$11{,}998.$$

Projects A and B are mutually exclusive, so we cannot use the IRR method, so their NPVs must be calculated.  We pick project A because it has the largest NPV. Projects C, D, and E are independent so we pick the ones whose IRR exceeds the cost of capital, in this case, just D. Therefore, the projects undertaken are A and D.

**61.  Scenario analysis**                                    **Answer: c  Diff: M**

Calculate expected value of NPV (in thousands):

| | Probability of Outcome, $P_i$ | Unit Sales Volume | Sales Price | NPV (In 1000s) | $P_i(x)$ | |
|---|---|---|---|---|---|---|
| Worst case | 0.30 | 6,000 | $3,600 | -$6,000 | 0.3(-6,000) = | -1,800 |
| Base case | 0.50 | 10,000 | 4,200 | 13,000 | 0.5(13,000) = | 6,500 |
| Best case | 0.20 | 13,000 | 4,400 | 28,000 | 0.2(28,000) = | 5,600 |
| | | | | | Expected NPV = | $10,300 |

Calculate standard deviation of NPV (in thousands):

| | $P_i(x - \bar{x})^2$ | $(x - \bar{x})^2$ | $P_i(x - \bar{x})^2$ |
|---|---|---|---|
| Worst case | $0.3(-6,000 - 10,300)^2$ | 265,690,000 | 79,707,000 |
| Base case | $0.5(13,000 - 10,300)^2$ | 7,290,000 | 3,645,000 |
| Best case | $0.2(28,000 - 10,300)^2$ | 313,290,000 | 62,658,000 |
| | | $\sigma^2 =$ | 146,010,000 |

$\sigma_{NPV} = (146,010,000)^{1/2} = 12,083.$

Calculate coefficient of variation (CV) of NPV:
$CV_{NPV} = \sigma_{NPV}/E(NPV) = \$12,083/\$10,300 = 1.17.$

**62.  Optimal project selection**                            **Answer: a  Diff: M  N**

Calculate the after-tax component cost of debt as 10%(1 - 0.3) = 7%.  If
the company has earnings of $100,000 and pays out 50% or $50,000 in
dividends, then it will retain earnings of $50,000.  The retained earnings
breakpoint is $50,000/0.4 = $125,000.  Since it will require financing in
excess of $125,000 to undertake any of the alternatives, we can conclude
the firm must issue new equity.  Therefore, the pertinent component cost of
equity is the cost of new equity.  Calculate the expected dividend per
share (note this is $D_1$) as $50,000/10,000 = $5. Thus, the cost of new
equity is $5/[($35(1 - 0.12)] + 6% = 22.23%. Jackson's WACC is 7%(0.6) +
22.23%(0.4) = 13.09%.  Only the return on Project A exceeds the WACC, so
only Project A will be undertaken.

**63. New project NPV** **Answer: b Diff: T**

Depreciation Schedule  Depreciable Basis:  $5,000,000

| Year | MACRS Depreciation Rates | Annual Depreciation |
|------|--------------------------|---------------------|
| 1 | 0.33 | $1,650,000 |
| 2 | 0.45 | 2,250,000 |
| 3 | 0.15 | 750,000 |
| 4 | 0.07 | 350,000 |

The following table shows how to compute the cash flows:

| | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Cost | ($5,000,000) | | | | |
| Net operating working capital | (500,000) | | | | |
| Sales | | $3,000,000 | $3,500,000 | $4,500,000 | $4,000,000 |
| Operating costs, excl. depr. (60%) | | 1,800,000 | 2,100,000 | 2,700,000 | 2,400,000 |
| Depreciation | | 1,650,000 | 2,250,000 | | |
| Operating income before taxes | | ($ 450,000) | ($ 850,000) | $1,050,000 | $1,250,000 |
| Taxes (40%) | | (180,000) | (340,000) | 420,000 | 500,000 |
| After-tax operating income | | ($ 270,000) | ($ 510,000) | $ 630,000 | $ 750,000 |
| Plus: Depreciation | | 1,650,000 | 2,250,000 | 750,000 | 350,000 |
| After-tax operating cash flows | | $1,380,000 | $1,740,000 | $1,380,000 | $1,100,000 |
| After-tax loss of rental income | | (180,000) | (180,000) | (180,000) | (180,000) |
| Recovery of net operating working | | | | | $ 500,000 |
| Net cash flow | ($5,500,000) | $1,200,000 | $1,560,000 | $1,200,000 | $1,420,000 |

Enter the NCF amounts into the cash flow register (at 10%) and obtain the
NPV of the cash flows is -$1,248,378.

**64. New project NPV** **Answer: d Diff: T**

Step 1:  Calculate depreciation:
  $Dep_1 = \$100,000(0.33) = \$33,000.$
  $Dep_2 = \$100,000(0.45) = \$45,000.$
  $Dep_3 = \$100,000(0.15) = \$15,000.$
  $Dep_4 = \$100,000(0.07) = \$ 7,000.$

Step 2:  Calculate cash flows:
  $CF_0 = -\$100,000 - \$ 5,000 = -\$105,000.$
  $CF_1 = \$50,000 + \$33,000 = \$ 83,000.$
  $CF_2 = \$60,000 + \$45,000 = \$105,000.$
  $CF_3 = \$70,000 + \$15,000 = \$ 85,000.$
  $CF_4 = \$60,000 + \$ 7,000 + \$5,000 + \$15,000 = \$87,000.$

Step 3:  Calculate NPV with your financial calculator:
  $CF_0 = -105000; CF_1 = 83000; CF_2 = 105000; CF_3 = 85000; CF_4 = 87000;$
  I = 12; and then solve for NPV.  NPV = $168,603.89 ≈ $168,604.

**65.** **New project NPV** **Answer: d  Diff: T**

First, find the after-tax CFs associated with the project.  This is accomplished by subtracting the depreciation expense from the raw CF, reducing this net CF by taxes and then adding back the depreciation expense.

For t = 1: ($45,000 - $33,000)(1 - 0.4) + $33,000 = $40,200.
Similarly, the after-tax CFs for t = 2, t = 3, and t = 4 are $45,000, $33,000, and $29,800, respectively.

Now, enter these CFs along with the cost of the equipment to find the pre-salvage NPV (note that the after-tax salvage value is not yet accounted for in these CFs).  The appropriate discount rate for these CFs is 11 percent. This yields a pre-salvage NPV of $16,498.72.

Finally, the after-tax salvage value must be discounted.  The PV of the after-tax salvage value is calculated as follows:  N = 4; I = 12; PMT = 0; FV = -10000; and PV = $6,355.18.  Adding the PV of the after-tax salvage value to the pre-salvage NPV yields the project NPV of $22,853.90.

**66.** **New project NPV** **Answer: d  Diff: T**

The cash flows for each of the years are as follows:

```
0                                                             -100,000
1 [90,000 - 50,000 - (100,000)(0.20)](1 - 0.4) + (100,000)(0.20)    =   32,000
2 [90,000 - 50,000 - (100,000)(0.32)](1 - 0.4) + (100,000)(0.32)    =   36,800
3 [90,000 - 50,000 - (100,000)(0.19)](1 - 0.4) + (100,000)(0.19)    =   31,600
4 [90,000 - 50,000 - (100,000)(0.12)](1 - 0.4) + (100,000)(0.12)    =   28,800
5 [90,000 - 50,000 - (100,000)(0.11)](1 - 0.4) + (100,000)(0.11)    =   28,400
6 [90,000 - 50,000 - (100,000)(0.06)](1 - 0.4) + (100,000)(0.06) +
  (10,000)(1 - 0.4)                                                 =   32,400
```
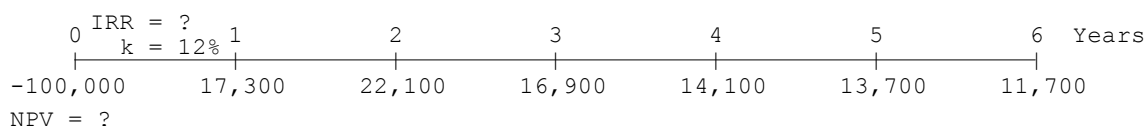
Enter the cash flows into the cash flow register (at 10%) and solve for the NPV = $38,839.59 ≈ $38,840.

**67. New project IRR**                                 **Answer: b  Diff: T**

Time line:

```
    IRR = ?
  0   k = 12%  1         2         3         4         5         6  Years
  +----------+---------+---------+---------+---------+---------+
-100,000   17,300    22,100    16,900    14,100    13,700    11,700
NPV = ?
```

| Year | MACRS Depreciation Rates | Depreciable Basis | Annual Depreciation |
|------|--------------------------|-------------------|---------------------|
| 1 | 0.20 | $100,000 | $20,000 |
| 2 | 0.32 | 100,000 | 32,000 |
| 3 | 0.19 | 100,000 | 19,000 |
| 4 | 0.12 | 100,000 | 12,000 |
| 5 | 0.11 | 100,000 | 11,000 |
| 6 | 0.06 | 100,000 | 6,000 |
| | | | $100,000 |

Project analysis worksheet:

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| **I   Initial outlay** | | | | | | | |
| 1) Machine cost | ($100,000) | | | | | | |
| 2) NOWC | -- | | | | | | |
| 3) Total net inv. | ($100,000) | | | | | | |
| **II  Operating cash flows** | | | | | | | |
| 4) Inc. in before taxes & deprec. earnings | | $15,500 | $15,500 | $15,500 | $15,500 | $15,500 | $15,500 |
| 5) After-tax inc. in revenues (line 4 × 0.6) | | 9,300 | 9,300 | 9,300 | 9,300 | 9,300 | 9,300 |
| 6) Deprec. (from table) | | 20,000 | 32,000 | 19,000 | 12,000 | 11,000 | 6,000 |
| 7) Deprec. tax savings (line 6 × 0.4) | | 8,000 | 12,800 | 7,600 | 4,800 | 4,400 | 2,400 |
| 8) Net operating CFs (lines 5 + 7) | | $17,300 | $22,100 | $16,900 | $14,100 | $13,700 | $11,700 |
| **III Terminal year CFs** | | | | | | | |
| 9) Estimated salvage value | | | | | | | 0 |
| 10) Tax on salvage value | | | | | | | 0 |
| 11) Return of NOWC | | | | | | | 0 |
| 12) Total termination CFs | | | | | | | 0 |
| **IV  Net CFs** | | | | | | | |
| 13) Net CFs | ($100,000) | $17,300 | $22,100 | $16,900 | $14,100 | $13,700 | $11,700 |

Financial calculator solution:
Inputs:  $CF_0$ = -100000; $CF_1$ = 17300; $CF_2$ = 22100; $CF_3$ = 16900;
         $CF_4$ = 14100; $CF_5$ = 13700; $CF_6$ = 11700.
Output:  IRR = -1.32%.

**68.** **NPV and risk-adjusted discount rate** **Answer: e  Diff: T**

The following table shows the cash flows (in millions):

|  | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Initial invest. outlay | -$30.0 | | | | | |
| Sales | | $20.0 | $20.0 | $20.0 | $20.0 | $20.0 |
| Oper. cost | | 12.0 | 12.0 | 12.0 | 12.0 | 12.0 |
| Depreciation | | 10.0 | 10.0 | 10.0 | 0.0 | 0.0 |
| Oper. inc. before taxes | | -$ 2.0 | -$ 2.0 | -$ 2.0 | $ 8.0 | $ 8.0 |
| Taxes (40%) | | -0.8 | -0.8 | -0.8 | 3.2 | 3.2 |
| Oper. inc. after taxes | | -$ 1.2 | -$ 1.2 | -$ 1.2 | $ 4.8 | $ 4.8 |
| Add Depreciation | | 10.0 | 10.0 | 10.0 | 0.0 | 0.0 |
| Net oper. cash flows | -$30.0 | $ 8.8 | $ 8.8 | $ 8.8 | $ 4.8 | $ 4.8 |

Numerical solution:
Step 1:  Determine the NPV of net operating cash flows:

$$\text{NPV} = -\$30 + \$8.8/1.10 + \$8.8(1.10)^2 + \$8.8/(1.10)^3$$
$$+ \$4.8/(1.10)^4 + \$4.8/(1.10)^5$$
$$= -\$30 + \$8 + \$7.2727 + \$6.6116 + \$3.2785 + \$2.9804$$
$$= -\$1.8568 \text{ million.}$$

Step 2:  Determine the NPV of the project's AT salvage value:
$\$1.2/(1.12)^5 = \$0.6809$ million.

Step 3:  Determine the project's NPV:
Add the PV of the salvage value to the NPV of the cash flows to
get the project's NPV.
NPV = -$1.8568 + $0.6809 = -$1.1759 million ≈ -$1.18 million.

Financial calculator solution:
Step 1:  Determine the NPV of net operating cash flows:
Enter the following inputs in the calculator:
$CF_0 = -30$, $CF_{1-3} = 8.8$, $CF_{4-5} = 4.8$, $I = 10$, and then solve for
NPV = -$1.8568 million.

Step 2:  Determine the NPV of the project's AT salvage value:
Enter the following inputs in the calculator:
$CF_0 = 0$, $CF_{1-4} = 0$, $CF_5 = 1.2$, $I = 12$, and then solve for NPV =
$0.6809 million.

Step 3:  Determine the project's NPV:
Add the PV of the salvage value to the NPV of the cash flows to
get the project's NPV.
-$1.8568 + $0.6809 = -$1.1759 million ≈ $-1.18 million.

**69.    New project investment**                                    **Answer: a  Diff: E**

Initial investment:
Cost                             ($40,000)
Change in NOWC                     (2,000)
                                 ($42,000)

**70.    Operating cash flow**                                       **Answer: e  Diff: M**

Depreciation schedule:

|      | MACRS Depreciation Rates | Depreciable Basis | Annual Depreciation |
|------|--------------------------|-------------------|---------------------|
| Year |                          |                   |                     |
| 1    | 0.33                     | $40,000           | $13,200             |
| 2    | 0.45                     | 40,000            | 18,000              |
| 3    | 0.15                     | 40,000            | 6,000               |
| 4    | 0.07                     | 40,000            | 2,800               |
|      |                          |                   | $40,000             |

Operating cash flows:

|                                      | 1       | 2       | 3       |
|--------------------------------------|---------|---------|---------|
| 1) Increase in revenues              | $20,000 | $20,000 | $20,000 |
| 2) Increase in costs                 | (5,000) | (5,000) | (5,000) |
| 3) Before-tax change in earnings     | $15,000 | $15,000 | $15,000 |
| 4) After-tax change in earnings (line 3 × 0.60) | $ 9,000 | $ 9,000 | $ 9,000 |
| 5) Depreciation                      | 13,200  | 18,000  | 6,000   |
| 6) Deprec. tax savings (line 5 × 0.40) | 5,280 | 7,200   | 2,400   |
| 7) Net operating CFs (lines 4 + 6)   | $14,280 | $16,200 | $11,400 |

**71.    Non-operating cash flows**                                  **Answer: a  Diff: M**

Additional Year 3 cash flows:

|                        | 3        |
|------------------------|----------|
| Salvage value          | $25,000  |
| Tax on Salvage value   | (8,880)* |
| Recovery of NOWC       | 2,000    |
| Total terminal year CF | $18,120  |

*(Market value - Book value)(Tax rate) ($25,000 - $2,800)(0.40) = $8,880.

**72.    New project NPV**                                                          **Answer: c  Diff: M**

Time line:

```
  0    k = 14%   1           2            3   Years
  ├──────────────┼───────────┼────────────┤
-42,000      14,280      16,200       11,400
                                   TV =  18,120
                                         29,520
```

Numerical solution:

$$\text{NPV} = -\$42,000 + \frac{\$14,280}{1.14} + \frac{\$16,200}{(1.14)^2} + \frac{\$29,520}{(1.14)^3} = \$2,916.85 \approx \$2,917.$$

Financial calculator solution:
Inputs: $CF_0$ = -42000; $CF_1$ = 14280; $CF_2$ = 16200; $CF_3$ = 29520; I = 14.
Output: NPV = $2,916.85 ≈ $2,917.

**73.    New project investment**                                                   **Answer: d  Diff: E**

Initial investment:
```
Cost                     ($50,000)
Modification              (10,000)
Change in NOWC             (2,000)
  Total net investment   ($62,000)
```

**74.    Operating cash flow**                                                      **Answer: c  Diff: M**

Depreciation schedule:

| Year | MACRS Depreciation Rates | Depreciable Basis | Annual Depreciation |
|------|--------------------------|-------------------|---------------------|
| 1 | 0.33 | $60,000 | $19,800 |
| 2 | 0.45 | 60,000 | 27,000 |
| 3 | 0.15 | 60,000 | 9,000 |
| 4 | 0.07 | 60,000 | 4,200 |
| | | | $60,000 |

Operating cash flows:

| Year | 1 | 2 | 3 |
|------|-----|-----|-----|
| 1) Before-tax cost reduction | $20,000 | $20,000 | $20,000 |
| 2) After-tax cost reduction (line 1 × 0.6) | 12,000 | 12,000 | 12,000 |
| 3) Depreciation | 19,800 | 27,000 | 9,000 |
| 4) Deprec. tax savings (line 3 × 0.4) | 7,920 | 10,800 | 3,600 |
| 5) Net operating CFs (lines 2 + 4) | $19,920 | $22,800 | $15,600 |

**75.   Non-operating cash flows**                                    **Answer: c   Diff: M**

Additional Year 3 cash flows:

|                          |       3      |
|--------------------------|-------------|
| Salvage value            | $20,000     |
| Tax on salvage value     | (6,320)*    |
| Recovery of NOWC         | 2,000       |
|   Total terminal year CF | $15,680 |

*(Market value − Book value)(Tax rate) = ($20,000 − $4,200)(0.40) = $6,320.

**76.   New project NPV**                                             **Answer: a   Diff: M**

Time line:

```
  0   k = 10%  1          2          3   Years
  |------------|----------|----------|
-62,000    19,920     22,800     15,600
                                  TV = 15,680
                                       31,280
```

Numerical solution:

$$\text{NPV} = -\$62,000 + \frac{\$19,920}{1.10} + \frac{\$22,800}{(1.10)^2} + \frac{\$31,280}{(1.10)^3} = -\$1,546.81 \approx -\$1,547.$$

Financial calculator solution:
Inputs:  $CF_0 = -62000$; $CF_1 = 19920$; $CF_2 = 22800$; $CF_3 = 31280$; I = 10.
Output:  NPV = −$1,546.81 ≈ −$1,547.

**77.   Operating cash flows**                                        **Answer: e   Diff: E   N**

Operating cash flow is Net income + Depreciation, which is $5.2 million.

|              | t = 1 | t = 2 | t = 3 | t = 4 |
|--------------|-------|-------|-------|-------|
| Depreciation | $1.0  | $1.0  | $1.0  | $1.0  |
| Net income   | 4.2   | 4.2   | 4.2   | 4.2   |
| Oper. CFs    | $5.2  | $5.2  | $5.2  | $5.2  |

**78.   After-tax salvage value**                                     **Answer: d   Diff: M   N**

The original cost of the store is $10 million and the annual
depreciation expense is $1 million (since the store is being depreciated
on a straight-line basis over 10 years).  So after 4 years the remaining
BV = $10 − $4 = $6 million.  If the store is sold for $7.5 million, the
gain on the sale is $7.5 − $6.0 = $1.5 million.  The tax on the gain is
0.4($1.5) = $0.6 million.  The after-tax salvage value is $7.5 − $0.6 =
$6.9 million.

**79.** **New project NPV** **Answer: d** **Diff: M** **N**

The relevant cash flows are shown below:

|                     | t = 0    | t = 1 | t = 2 | t = 3 | t = 4  |
|---------------------|----------|-------|-------|-------|--------|
| Construction cost   | -$10.0   |       |       |       |        |
| NOWC                | -3.0     |       |       |       | $3.0   |
| Operating cash flow |          | $5.2  | $5.2  | $5.2  | 5.2    |
| AT Salvage value    |          |       |       |       | 6.9    |
| Total cash flow     | -$13.0   | $5.2  | $5.2  | $5.2  | $15.1  |

Numerical solution:

$$NPV = -\$13.0 + \frac{\$5.2}{1.10} + \frac{\$5.2}{(1.10)^2} + \frac{\$5.2}{(1.10)^3} + \frac{\$15.1}{(1.10)^4}$$

$$= -\$13.0 + \$4.7273 + \$4.2975 + \$3.9068 + \$10.3135$$

$$= \$10.245 \approx \$10.25 \text{ million.}$$

Financial calculator solution:
$CF_0 = -13$; $CF_1 = 5.2$; $CF_2 = 5.2$; $CF_3 = 5.2$; $CF_4 = 15.1$; $I = 10$; and then solve for NPV = $10.245 ≈ $10.25 million.

**80.** **Scenario analysis** **Answer: e** **Diff: M** **N**

The correct answer is statement e. The expected NPV for the project = 0.25 × $5 + 0.5 × $8 + 0.25 × $10 = $7.75 million. Therefore, statement a is correct. The standard deviation of the project is given as 2.06. So, the coefficient of variation, or CV, is 7.75/2.06 = 0.2658. Thus, the project falls into the "Average-risk" category, so statement b is correct. Recall that you discounted cash flows using 10%, which is the weighted average cost of capital for an "Average-risk" project. If the project were classified as a "High-risk" project, the company should go back and recalculate the project's NPV using the higher cost of capital estimate of 12%. So, statement c is also correct. Therefore, statements a, b, and c are correct, and the correct choice is statement e.

**81.** **New project NPV** **Answer: e** **Diff: M** **N**

|                          | t = 0        | t = 1        | t = 2        | t = 3        |
|--------------------------|--------------|--------------|--------------|--------------|
| Equipment                | -$1,000,000  |              |              |              |
| Net oper. working capital | -200,000     |              |              |              |
|                          |              |              |              |              |
| Sales                    |              | $1,000,000   | $1,000,000   | $1,000,000   |
| Oper. costs (60%)        |              | 600,000      | 600,000      | 600,000      |
| Depreciation             |              | 333,333      | 333,333      | 333,333      |
| EBIT                     |              | $ 66,667     | $ 66,667     | $ 66,667     |
| Taxes (40%)              |              | 26,667       | 26,667       | 26,667       |
| EBIT(1 - T)              |              | $ 40,000     | $ 40,000     | $ 40,000     |
| Depreciation             |              | 333,333      | 333,333      | 333,333      |
| AT Oper. CF              |              | $ 373,333    | $ 373,333    | $ 373,333    |
| Recovery of NOWC         |              |              |              | 200,000      |
| Net cash flows           | -$1,200,000  | $ 373,333    | $ 373,333    | $ 573,333    |

Enter the cash flows into the cash flow register (at 10%) and solve for the NPV = -$121,313.

**82.    After-tax salvage value**                         **Answer: c  Diff: E  N**

The tax due on the sale of equipment would be:
($400,000 - $333,333.33) × 40% = $26,666.67.

Then, subtracting this tax from the sale price, ($400,000 - $26,666.67)
you get $373,333.33.

**83.    Operating cash flows**                            **Answer: e  Diff: M  N**

After-tax operating CF = EBIT(1 - T) + Depreciation.

Depreciation expense = $300,000,000/4 = $75,000,000.

For each year, EBIT = Sales - Operating costs – Depreciation
              = $200,000,000 - $100,000,000 – 75,000,000
              = $25,000,000.

After-tax operating CF = $25,000,000(1 – 0.4) + $75,000,000
              = $15,000,000 + $75,000,000
              = $90,000,000.

**84.    New project NPV**                                 **Answer: a  Diff: M  N**

The project cash flows are shown below (in millions of dollars):

|                     | 0     | 1    | 2    | 3    | 4    |
|---------------------|-------|------|------|------|------|
| Up-front costs      | -300  |      |      |      |      |
| Increase in NOWC    | -50   |      |      |      |      |
|                     |       |      |      |      |      |
| Sales               |       | 200  | 200  | 200  | 200  |
| Operating costs     |       | -100 | -100 | -100 | -100 |
| Depreciation        |       | -75  | -75  | -75  | -75  |
| EBIT                |       | 25   | 25   | 25   | 25   |
| Taxes (40%)         |       | -10  | -10  | -10  | -10  |
| EBIT(1 - T)         |       | 15   | 15   | 15   | 15   |
| Depreciation        |       | 75   | 75   | 75   | 75   |
| Operating CF        |       | 90   | 90   | 90   | 90   |
| AT(SV)              |       |      |      |      | 30   |
| NOWC recovery       |       |      |      |      | 50   |
| Net CF              | -350  | 90   | 90   | 90   | 170  |

Using your financial calculator, enter the following data inputs:
$CF_0$ = -350; $CF_{1-3}$ = 90; $CF_4$ = 170; I = 10; and then solve for NPV =
-$10.07 million.

# WEB APPENDIX 11A SOLUTIONS

**11A-1.  NPV and depreciation**                    **Answer: c  Diff: E**

**11A-2.  Depreciation cash flows**                 **Answer: c  Diff: M**


# WEB APPENDIX 11B SOLUTIONS
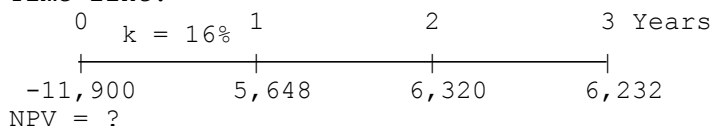
**11B-1.  Replacement cash outflows**               **Answer: d  Diff: M**

```
Cost plus installation              ($10,000)
Sale of old machine                    2,000
Tax effect of sale ($1,000 × 0.34)      (350)
Decrease in working capital            1,500
Total investment at t = 0           ($ 6,850)
```

**11B-2. Replacement decision**                           **Answer: b   Diff: T**

Time line:
```
    0   k = 16%  1              2              3 Years
    ├──────────────┼──────────────┼──────────────┤
  -11,900        5,648          6,320          6,232
NPV = ?
```

Depreciation cash flows:

| Year | MACRS Depreciation Rates | New Asset Depreciation | Old Asset Depreciation | Change in Depreciation |
|------|--------------------------|------------------------|------------------------|------------------------|
| 1 | 0.33 | $4,620 | $1,000 | $3,620 |
| 2 | 0.45 | 6,300 | 1,000 | 5,300 |
| 3 | 0.15 | 2,100 | 1,000 | 1,100 |
| 4 | 0.07 | 980 | -- | 980 |

Project analysis worksheet:

I   Initial outlay

   1) Machine cost                       ($14,000)

   2) Sale of old machine            1,500*

   3) Tax savings old machine        600

   4) Total net inv.                ($11,900)

   *($3,000 - $1,500) = Loss; Loss × Tax rate = Savings;

   $1,500 × 0.40 = $600.

II   Operating cash flows

| | Year: | 0 | 1 | 2 | 3 |
|---|---|---|---|---|---|
| 5) Reduction in cost | | | $7,000 | $7,000 | $7,000 |
| 6) After-tax decrease in cost (line 5 × 0.60) | | | 4,200 | 4,200 | 4,200 |
| 7) Deprec. new machine | | | 4,620 | 6,300 | 2,100 |
| 8) Deprec. old machine | | | 1,000 | 1,000 | 1,000 |
| 9) Change in depreciation (line 7 - 8) | | | 3,620 | 5,300 | 1,100 |
| 10) Tax savings from deprec. (line 9 × 0.40) | | | 1,448 | 2,120 | 440 |
| 11) Net operating cash flows (line 6 + 10) | | | $5,648 | $6,320 | $4,640 |

III Terminal year CFs

   12) Estimated salvage value                     $2,000

   13) Tax on salvage value

      (2,000 - 980)(0.4)                     (408)

   14) Return of NWC                            --

   15) Total termination CFs                   1,592

IV   Net CFs

| | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| 16) Total Net Cfs | ($11,900) | $5,648 | $6,320 | $6,232 |

Financial calculator solution:

Inputs: $CF_0$ = -11900; $CF_1$ = 5648; $CF_2$ = 6320; $CF_3$ = 6232; I = 16.

Output: NPV = $1,658.33 ≈ $1,658.

**11B-3.  Replacement decision**                                      **Answer: a  Diff: T**

Time line:

```
  0    k = 10%  1          2          3          4          5 Years
  ├─────────────┼──────────┼──────────┼──────────┼──────────┤
-148,750   21,625     30,025     20,925     16,025     27,325
NPV = ?
```

Depreciation cash flows*:

| Year | MACRS Depreciation Rates | New Asset Depreciation | Old Asset Depreciation | Change in Depreciation |
|------|------|------|------|------|
| 1 | 0.20 | $40,000 | $7,000 | $33,000 |
| 2 | 0.32 | 64,000 | 7,000 | 57,000 |
| 3 | 0.19 | 38,000 | 7,000 | 31,000 |
| 4 | 0.12 | 24,000 | 7,000 | 17,000 |
| 5 | 0.11 | 22,000 | 7,000 | 15,000 |
| 6 | 0.06 | 12,000 | -- | 12,000 |

*Depreciation old equipment: 105,000/15 = 7,000 per year × 10 years = 70,000 in accumulated depreciation.

```
Book value =  $105,000
           -   70,000
              $ 35,000
```

Replacement analysis worksheet:
I   Initial outlay
   1) New equipment cost         ($200,000)
   2) Market value old equip.     60,000
   3) Taxes on sale of old equip.   (8,750)*
   4) Increase in NWC           --
   5) Total net investment     ($148,750)
     *(Market value - Book value)(Tax rate)
     (60,000 - 35,000)(0.35) = $8,750.
II  Operating cash flows

| Year: | 0 | 1 | 2 | 3 | 4 | 5 |
|------|---|---|---|---|---|---|
| 6) Increase in revenues | | $18,000 | $18,000 | $18,000 | $18,000 | $18,000 |
| 7) Increase in expenses | | (2,500) | (2,500) | (2,500) | (2,500) | (2,500) |
| 8) AT change in earnings ((line 6 + 7) × 0.65) | | 10,075 | 10,075 | 10,075 | 10,075 | 10,075 |
| 9) Deprec. on new machine | | 40,000 | 64,000 | 38,000 | 24,000 | 22,000 |
| 10) Deprec. on old machine | | 7,000 | 7,000 | 7,000 | 7,000 | 7,000 |
| 11) Change in deprec. (line 9 - 10) | | 33,000 | 57,000 | 31,000 | 17,000 | 15,000 |
| 12) Tax savings from deprec. (line 11 × 0.35) | | 11,550 | 19,950 | 10,850 | 5,950 | 5,250 |
| 13) Net operating CFs (line 8 + 12) | | $21,625 | $30,025 | $20,925 | $16,025 | $15,325 |

III Terminal year CFs
   14) Estimated salvage value                 $12,000
   15) Tax on salvage value                    --
   16) Return of NWC                        --
   17) Total termination CFs                12,000
IV  Net CFs
   18) Total Net CFs ($148,750) $21,625 $30,025 $20,925 $16,025 $27,325
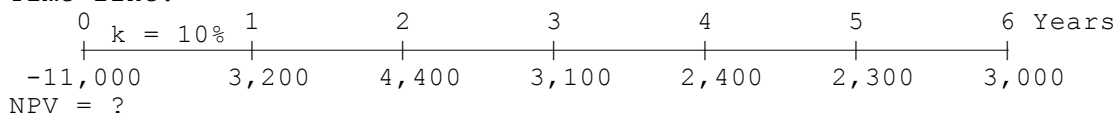
Financial calculator solution:
Inputs: CF$_0$ = -148750; CF$_1$ = 21625; CF$_2$ = 30025; CF$_3$ = 20925;
       CF$_4$ = 16025; CF$_5$ = 27325; I = 10.
Output: NPV = -$60,643.63 ≈ -$60,644.

**11B-4. Replacement decision**                       **Answer: c   Diff: T**

Time line:

```
    0  k = 10%  1        2        3        4        5        6 Years
    ├──────────┼────────┼────────┼────────┼────────┼────────┤
 -11,000      3,200    4,400    3,100    2,400    2,300    3,000
NPV = ?
```

Depreciation cash flows:

| Year | MACRS Depreciation Rates | New Asset Depreciation | Old Asset Depreciation | Change in Depreciation |
|------|------|------|------|------|
| 1 | 0.20 | $ 5,000 | $ 3,000 | $ 2,000 |
| 2 | 0.32 | 8,000 | 3,000 | 5,000 |
| 3 | 0.19 | 4,750 | 3,000 | 1,750 |
| 4 | 0.12 | 3,000 | 3,000 | 0 |
| 5 | 0.11 | 2,750 | 3,000 | (250) |
| 6 | 0.06 | 1,500 | | 1,500 |
| | | $25,000 | $15,000 | $10,000 |

Project analysis worksheet:

I   Initial outlay

  1) New equipment cost             ($25,000.00)
  2) Market value old equip.       13,333.33
  3) Tax savings sale of old equip.    666.67*
  4) Increase in NWC              --
  5) Total net investment        ($11,000.00)
    *(Market value - Book value)(Tax rate)
     ($13,333.33 - $15,000)(0.4) = $666.67.

II   Operating cash flows

| Year: | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|------|---|---|---|---|---|---|---|
| 6) Before-tax savings new equip. | | $4,000 | $4,000 | $4,000 | $4,000 | $4,000 | $4,000 |
| 7) After-tax savings new equip.(line 6 × 0.6) | | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 | 2,400 |
| 8) Deprec. new machine | | 5,000 | 8,000 | 4,750 | 3,000 | 2,750 | 1,500 |
| 9) Deprec. old machine | | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 | 0 |
| 10) Change in deprec. (line 8 - 9) | | 2,000 | 5,000 | 1,750 | 0 | (250) | 1,500 |
| 11) Tax savings from deprec. (line 10 × 0.4) | | 800 | 2,000 | 700 | 0 | (100) | 600 |
| 12) Net operating CFs (line 7 + 11) | | $3,200 | $4,400 | $3,100 | $2,400 | $2,300 | $3,000 |

III Terminal year CFs

  13) Estimated salvage value               0
  14) Total terminal yr CF               0

IV   Net CFs

| 15) Total Net CFs | ($11,000) | $3,200 | $4,400 | $3,100 | $2,400 | $2,300 | $3,000 |
|------|---|---|---|---|---|---|---|

Financial calculator solution:
Inputs: $CF_0 = -11000$; $CF_1 = 3200$; $CF_2 = 4400$; $CF_3 = 3100$;
       $CF_4 = 2400$; $CF_5 = 2300$; $CF_6 = 3000$; I = 10.
Output: NPV = $2,635.30 ≈ $2,635.

Time line:

```
    0   IRR = ?   1          2          3          4          5
    ├──────────────┼──────────┼──────────┼──────────┼──────────┤
 -17,600        3,400      4,840      3,280      2,440      3,640
NPV = ?
```

Depreciation cash flows:

| Year | MACRS Depreciation Rates | New Asset Depreciation | Old Asset Depreciation | Change in Depreciation |
|------|------|------|------|------|
| 1 | 0.20 | $ 6,000 | $ 2,000 | $ 4,000 |
| 2 | 0.32 | 9,600 | 2,000 | 7,600 |
| 3 | 0.19 | 5,700 | 2,000 | 3,700 |
| 4 | 0.12 | 3,600 | 2,000 | 1,600 |
| 5 | 0.11 | 3,300 | 2,000 | 1,300 |
| 6 | 0.06 | 1,800 | | 1,800 |
| | | $30,000 | $10,000 | $20,000 |

Project analysis worksheet:
I   Initial outlay
    1) New asset cost          ($30,000)
    2) Sale of old asset          14,000
    3) Tax on sale of old asset  (1,600)*
    4) Increase in NWC             --
    5) Total net investment     ($17,600)
*(Sale value - Book value)(Tax rate) = (14,000 - 10,000)(0.40) = $1,600.
II  Operating cash flows

| | Year: | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| 6) Before-tax savings new asset | | | $3,000 | $3,000 | $3,000 | $3,000 | $3,000 |
| 7) After-tax savings new asset (line 6 × 0.6) | | | 1,800 | 1,800 | 1,800 | 1,800 | 1,800 |
| 8) Deprec. new asset | | | 6,000 | 9,600 | 5,700 | 3,600 | 3,300 |
| 9) Deprec. old asset | | | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| 10) Change in deprec. (line 8 - 9) | | | 4,000 | 7,600 | 3,700 | 1,600 | 1,300 |
| 11) Tax savings from deprec. (line 10 × 0.4) | | | 1,600 | 3,040 | 1,480 | 640 | 520 |
| 12) Net operating CFs (line 7 + 11) | | | 3,400 | 4,840 | 3,280 | 2,440 | 2,320 |

III Terminal year CFs
    13) Estimated salvage value                                    $1,000
    14) Tax on salvage value
         (1,000 - 1,800)(0.4)                                         320
    15) Return of NWC                                                  --
    16) Total termination CFs                                      $1,320
IV Net CFs
    17) Total Net CFs        ($17,600) $3,400 $4,840 $3,280 $2,440 $3,640

Financial calculator solution:
Inputs: $CF_0$ = -17600; $CF_1$ = 3400; $CF_2$ = 4840; $CF_3$ = 3280;
        $CF_4$ = 2440; $CF_5$ = 3640.
Output: IRR = 0.0%.

**11B-6. Replacement project**            **Answer: d   Diff: T**

First calculate $CF_0$: The old equipment can be sold for $8,000, but the book value (BV) of the old equipment is $10,000 - $1,800 = $8,200. Thus, the company will realize a loss on the sale of $200. The loss reduces taxes by $200(0.40) = $80. $CF_0$ includes the cost of the new equipment, net of the sale proceeds and the tax effect of the sale equipment, or -$15,000 + $8,000 + $80 = -$6,920.

Second, we must calculate the operating CFs. The operating CFs are comprised of the after-tax change in operating income and any tax effect of the change in depreciation expense from the old machine to the new. The new equipment will reduce costs by $1,000 per year and increase sales by $2,000 so before-tax operating income will increase by $3,000 per year. The after-tax increase in operating income for t = 1 - 4 is $3,000(1 - 0.4) = $1,800. The operating CFs are calculated as follows:

| Time | Dep. New | Dep. Old | Diff. | Tax Effect | + Increased Op Inc. = | CF |
|---|---|---|---|---|---|---|
| 1 | $15,000(0.33) = $4,950 | $1,800 | $3,150 | $3,150(0.4) = $1,260 | $1,800 | $3,060 |
| 2 | $15,000(0.45) = 6,750 | 1,800 | 4,950 | 4,950(0.4) = 1,980 | 1,800 | 3,780 |
| 3 | $15,000(0.15) = 2,250 | 1,800 | 450 | 450(0.4) = 180 | 1,800 | 1,980 |
| 4 | $15,000(0.07) = 1,050 | 1,800 | -750 | -750(0.4) = -300 | 1,800 | 1,500 |

The old machine could have been sold for its BV or $1,000 at t = 4. This represents an opportunity cost of replacement. Thus, $CF_4$ = $1,500 - $1,000 = $500. The relevant cash flows are then $CF_0$ = -$6,920, $CF_1$ = $3,060, $CF_2$ = $3,780, $CF_3$ = $1,980, and $CF_4$ = $1,500. Discounting at 12 percent yields an NPV of $552.62.

**11B-7. New project NPV**            **Answer: d   Diff: T**

Step 1: Calculate depreciation:
         Dep 1 = 100,000(0.33) = 33,000.
         Dep 2 = 100,000(0.45) = 45,000.
         Dep 3 = 100,000(0.15) = 15,000.
         Dep 4 = 100,000(0.07) = 7,000.

Step 2: Calculate cash flows:
         CF 0 = -100,000 - 5,000 = -105,000.
         CF 1 = 50,000 + 33,000 = 83,000.
         CF 2 = 60,000 + 45,000 = 105,000.
         CF 3 = 70,000 + 15,000 = 85,000.
         CF 4 = 60,000 + 7,000 + 5,000 + 15,000 = 87,000.

Step 3: Calculate NPV:
         Use CF key on calculator. Enter cash flows shown above.
         Enter I/YR = 12%. Solve for NPV = $168,604.