

## CHAPTER 6

### *Problems and Questions*

1. A small manufacturing firm, which has limited access to capital, has a capital rationing constraint of \$150 million and is faced with the following investment projects (numbers in millions):

<i>Project</i>	<i>Initial Investment</i>	<i>NPV</i>
A	\$25	\$10
B	\$30	\$25
C	\$40	\$20
D	\$10	\$10
E	\$15	\$10
F	\$60	\$20
G	\$20	\$10
H	\$25	\$20
I	\$35	\$10
J	\$15	\$5

- a. Which of these projects would you accept? Why?
- b. What is the cost of the capital rationing constraint?

2. A closely held, publicly traded firm faces self-imposed capital rationing constraints of \$100 million in this period and \$75 million in the next period. It has to choose among the following projects (in millions):

<i>Project</i>	<i>Investment Outlay</i>		<i>NPV</i>
	<i>Current Period</i>	<i>Next Period</i>	
A	\$20	\$10	\$20
B	\$25	\$15	\$20
C	\$30	\$30	\$15

D	\$15	\$15	\$20
E	\$40	\$25	\$30
F	\$10	\$10	\$10
G	\$20	\$15	\$20
H	\$30	\$25	\$35
I	\$35	\$25	\$25
J	\$25	\$15	\$10

Set up the linear programming problem, assuming that fractions and multiples of projects cannot be taken.

3. You own a rental building in the city and are interested in replacing the heating system. You are faced with the following alternatives:

- a. A solar heating system, which will cost \$12,000 to install and \$500 a year to run and will last forever (assume that your building will, too).
- b. A gas heating system, which will cost \$5,000 to install and \$1,000 a year to run and will last twenty years.
- c. An oil heating system, which will cost \$3,500 to install and \$1,200 a year to run and will last fifteen years.

If your opportunity cost is 10 percent, which of these three options is best for you?

4. You are trying to choose a new siding for your house. A salesman offers you two choices:

- a. Wood siding, which will last ten years and cost \$5,000 to install and \$1,000/year to maintain
- b. Aluminum siding, which will last forever, cost \$15,000 to install, and will have a lower maintenance cost per year

If your discount rate is 10 percent, how low would your maintenance costs have to be for you to choose the aluminum siding?

5. You have just been approached by a magazine with an offer for renewing your subscription. You can renew for one year at \$20, two years for \$36, or three years at \$45.

Assuming that you have an opportunity cost of 20 percent and the cost of a subscription will not change over time, which of these three options should you choose?

6. You have been hired as a capital budgeting analyst by a sporting goods firm that manufactures athletic shoes and has captured 10 percent of the overall shoe market (the total market is worth \$100 million a year). The fixed costs associated with manufacturing these shoes is \$2 million a year, and variable costs are 40 percent of revenues. The company's tax rate is 40 percent. The firm believes that it can increase its market share to 20 percent by investing \$10 million in a new distribution system (which can be depreciated over the system's life of 10 years to a salvage value of zero) and spending \$1 million a year in additional advertising. The company proposes to continue to maintain working capital at 10 percent of annual revenues. The discount rate to be used for this project is 8 percent.

- a. What is the initial investment for this project?
- b. What is the annual operating cash flow from this project?
- c. What is the NPV of this project?
- d. How much would the firm's market share have to increase for you to be indifferent to taking or rejecting this project?

7. You are considering the possibility of replacing an existing machine that has a book value of \$500,000, a remaining depreciable life of five years, and a salvage value of \$300,000. The replacement machine will cost \$2 million and have a ten-year life. Assuming that you use straight-line depreciation and that neither machine will have any salvage value at the end of the next ten years, how much would you need to save each year to make the change (the tax rate is 40 percent)?

8. You are helping a bookstore decide whether it should open a coffee shop on the premises. The details of the investment are as follows:

- The coffee shop will cost \$50,000 to open; it will have a five-year life and be depreciated straight line over the period to a salvage value of \$10,000.

- The sales at the shop are expected to be \$15,000 in the first year and grow 5 percent a year for the following four years. <AQ: Should this be the following four years instead of five? Yes...>
  - The operating expenses will be 50 percent of revenues.
  - The tax rate is 40 percent.
  - The coffee shop is expected to generate additional sales of \$20,000 next year for the book shop, and the pretax operating margin is 40 percent. These sales will grow 10 percent a year for the following four years.
- a. Estimate the net present value of the coffee shop without the additional book sales.
  - b. Estimate the present value of the cash flows accruing from the additional book sales.
  - c. Would you open the coffee shop?

9. The lining of a plating tank must be replaced every three years at the cost of approximately \$2,000. A new lining material has been developed that is more resistant to the corrosive effects of the plating liquid and will cost approximately \$4,000. If the required rate of return is 20 percent and annual property taxes and insurance amount to about 4 percent of the initial investment, how long must the new lining last to be more economical than the present one?

10. You are a small business owner considering two alternatives for your phone system.

	<i>Plan A</i>	<i>Plan B</i>
Initial cost	\$50,000	\$120,000
Annual maintenance cost	\$9,000	\$6,000
Salvage value	\$10,000	\$20,000
Life	20 years	40 years

The discount rate is 8 percent. Which alternative would you pick?

11. You have been asked to compare three alternative investments and make a recommendation.

- Project A has an initial investment of \$5 million and after-tax cash flows of \$2.5 million a year for the next five years.

- Project B has no initial investment, after-tax cash flows of \$1 million a year for the next ten years, and a salvage value of \$2 million (from working capital).
- Project C has an initial investment of \$10 million, another investment of \$5 million in ten years, and after-tax cash flows of \$2.5 million a year forever.

The discount rate is 10 percent for all three projects. Which of the three projects would you pick? Why?

12. You are the manager of a pharmaceutical company and are considering what type of laptop computers to buy for your salespeople to take with them on their calls.

- You can buy fairly inexpensive (and less powerful) older machines for about \$2,000 each. These machines will be obsolete in three years and are expected to have an annual maintenance cost of \$150.
- You can buy newer and more powerful laptops for about \$4,000 each. These machines will last five years and are expected to have an annual maintenance cost of \$50.

If your cost of capital is 12 percent, which option would you pick and why?

13. You are the supervisor of a town where the roads are in need of repair. You have a limited budget and are considering two options:

- You can patch up the roads for \$100,000, but you will have to repeat this expenditure every year to keep the roads in reasonable shape.
- You can spend \$400,000 to repave and repair the roads, in which case your annual expenditures on maintenance will drop.

If your discount rate is 10 percent, how much would the annual expenditures have to drop in the second option for you to consider it?

14. You are the manager of a specialty retailing firm that is considering two strategies for getting into the Malaysian retail market. Under the first strategy, the firm will make an initial investment of \$10 million and can expect to capture about 5 percent of the overall market share. Under the second strategy, the firm will make a much larger commitment of \$40 million for advertising and promotion and can expect to capture about 10 percent

of the market share. If the overall size of the market is \$200 million, the firm's cost of capital is 12 percent, and the typical life of a project in the firm is fifteen years, what would the operating margin have to be for the firm to consider the second strategy? (You can assume that the firm leases its stores and has no depreciation or capital expenditures.)

15. You work for a firm that has limited access to capital markets. As a consequence, it has only \$20 million available for new investments this year. The firm does have a ready supply of good projects, and you have listed all the projects.

<i>Project</i>	<i>Initial Investment (million)</i>	<i>NPV (million)</i>	<i>IRR (%)</i>
I	\$10	\$3	21%
II	\$5	\$2.5	28%
III	\$15	\$4	19%
IV	\$10	\$4	24%
V	\$5	\$2	20%

- Based on the profitability index, which of these projects would you take?
- Based on the IRR, which of these projects would you take?
- Why might the two approaches give you different answers?

16. You are the owner of a small hardware store, and you are considering opening a gardening store in a vacant area in the back of your present store. You estimate that it will cost you \$50,000 to set up the new store, and that you will generate \$10,000 in after-tax cash flows from the store for the life of the store (which is expected to be ten years). The one concern you have is that you have limited parking; by opening the gardening store you run the risk of not having enough parking for customers who shop at your hardware store. You estimate that the lost sales from such occurrence would amount to \$3,000 a year, and that your after-tax operating margin on sales at the hardware store is 40 percent. If your discount rate is 14 percent, would you open the gardening store?

17. You are the manager of a grocery store, and you are considering offering baby-sitting services to your customers. You estimate that the licensing and set up costs will amount to \$150,000 initially and that you will be spending about \$60,000 annually to provide the

service. As a result of the service, you expect sales at the store, which is \$5 million currently, to increase by 20 percent; your after-tax operating margin is 10 percent. If your cost of capital is 12 percent, and you expect the store to remain open for ten years, would you offer the service?

18. You run a financial service firm where you replace your employee's computers every three years. You have 5000 employees, and each computer costs \$2,500 currently—the old computers can be sold for \$500 each. The new computers are generally depreciated straight line over their three-year lives to a salvage value of \$500. A computer-service firm offers to lease you the computers and replace them for you at no cost, if you will pay a leasing fee of \$5 million a year (which is tax-deductible). If your tax rate is 40 percent, would you accept the offer?

19. You are examining the viability of a capital investment in which your firm is interested. The project will require an initial investment of \$500,000 and the projected revenues are \$400,000 a year for five years. The projected cost-of-goods-sold is 40 percent of revenues and the tax rate is 40 percent. The initial investment is primarily in plant and equipment and can be depreciated straight line over five years (the salvage value is zero). The project makes use of other resources that your firm already owns:

- Two employees of the firm, each with a salary of \$40,000 a year, who are currently employed by another division, will be transferred to this project. The other division has no alternative use for them, but they are covered by a union contract that will prevent them from being fired for three years (during which they would be paid their current salary).
- The project will use excess capacity in the current packaging plant. Although this excess capacity has no alternative use now, it is estimated that the firm will have to invest \$250,000 in a new packaging plant in year four as a consequence of this project using up excess capacity (instead of year eight as originally planned).
- The project will use a van currently owned by the firm. Although the van is not currently being used, it can be rented out for \$3,000 a year for five years. The book value of the van is \$10,000 and it is being depreciated straight line (with five years remaining for depreciation).

- The discount rate to be used for this project is 10 percent.
- a. What (if any) is the opportunity cost associated with using the two employees from another division?
  - b. What (if any) is the opportunity cost associated with the use of excess capacity of the packaging plant?
  - c. What (if any) is the opportunity cost associated with the use of the van ?
  - d. What is the after-tax operating cash flow each year on this project?
  - e. What is the NPV of this project?

20. Your company is considering producing a new product. You have a production facility that is currently used to only 50 percent of capacity, and you plan to use some of the excess capacity for the new product. The production facility cost \$50 million five years ago when it was built and is being depreciated straight line over twenty-five years (in real dollars, assume that this cost will stay constant over time).

<i>Product Line</i>	<i>Capacity Used (%)</i>	<i>Growth Rate (%) /Year Currently</i>	<i>Revenues Currently (\$ million)</i>	<i>Fixed Cost (\$ million) /Year</i>	<i>Variable Cost (\$ million)/Year</i>
Old product	50	5	100	25	50
New product	30	10	80	20	44

The new product has a life of ten years, the tax rate is 40 percent, and the appropriate discount rate (real) is 10 percent.

- a. If you take on this project, when would you run out of capacity?
- b. When you run out of capacity, what would you lose if you chose to cut back production (in present value after-tax dollars)? (You have to decide which product you are going to cut back production on.)
- c. What would the opportunity cost to be assigned to this new product be if you chose to build a new facility when you run out of capacity instead of cutting back on production?

21. You are an analyst for a sporting goods corporation that is considering a new project that will take advantage of excess capacity in an existing plant. The plant has a capacity



to produce 50,000 tennis racquets, but only 25,000 are being produced currently though sales of the rackets are increasing 10 percent a year. You want to use some of the remaining capacity to manufacture 20,000 squash rackets each year for the next ten years (which will use up 40 percent of the total capacity), and this market is assumed to be stable (no growth). An average tennis racquet sells for \$100 and costs \$40 to make. The tax rate for the corporation is 40 percent, and the discount rate is 10 percent. Is there an opportunity cost involved? If so, how much is it?