ESERCIZI

1 ACCOUNTING RATE OF RETURN

Each of the following scenarios is independent. Assume that all cash flows are after-tax cash flows.

A. Nomander Company is considering the purchase of new equipment that will speed up the process for extracting copper. The equipment will cost $2,400,000 and have a life of five years with no expected salvage value. The expected cash flows associated with the project are as follows:

1	$4,000,000	$3,200,000
2	4,000,000	3,200,000
3	4,000,000	3,200,000
4	4,000,000	3,200,000
5	4,000,000	3,200,000

a.Marlene Straithe is considering investing in one of the following two projects. Either project will require an investment of $30,000. The expected revenues less cash expenses for the two projects follow. Assume each project is depreciable.

1	$ 9,000	$ 9,000
2	12,000	12,000
3	15,000	18,000
4	30,000	9,000
5	30,000	9,000

b. Suppose that a project has an accounting rate of return of 40 percent (based on initial investment) and that the average net income of the project is $160,000.
c. Suppose that a project has an accounting rate of return of 25 percent and that the investment is $100,000.

Required:

1.Compute the ARR on the new equipment that Nomander Company is considering.
2.Which project should Marlene Straithe choose based on the ARR?
3.How much did the company in scenario (c) invest in the project?
4.What is the average income earned by the project in scenario (d)?

2 NET PRESENT VALUE

Each of the following scenarios is independent. Assume that all cash flows are after-tax cash flows.

a. Harrison Manufacturing is considering the purchase of a new welding system. The cash benefits will be $360,000 per year. The system costs $2,040,000 and will last 10 years.
b. Kylie Hepworth is interested in investing in a women's specialty shop. The cost of the investment is $120,000. She estimates that the return from owning her own shop will be $36,000 per year. She estimates that the shop will have a useful life of six years.
c. Larsen Company calculated the NPV of a project and found it to be $7,100. The project's life was estimated to be eight years. The required rate of return used for the NPV calculation was 10 percent. The project was expected to produce annual after-tax cash flows of $15,000.

Required:

1. Compute the NPV for Harrison Manufacturing, assuming a discount rate of 12 percent. Should the company buy the new welding system?
2. Assuming a required rate of return of 8 percent, calculate the NPV for Kylie Hepworth's investment. Should she invest?
3. What was the required investment for Larsen Company's project?

3 INTERNAL RATE OF RETURN

Each of the following scenarios is independent. Assume that all cash flows are after-tax cash flows.

a. Manchester Company is considering the purchase of new equipment that will speed up the process for producing flash drives. The equipment will cost $6,254,000 and have a life of five years with no expected salvage value. The expected cash flows associated with the project follow:

Year	Cash Revenues	Cash Expenses
1	$6,000,000	$4,000,000
2	6,000,000	4,000,000
3	6,000,000	4,000,000
4	6,000,000	4,000,000
5	6,000,000	4,000,000

b. Kathleen Briggs is evaluating an investment in an information system that will save $160,000 per year. She estimates that the system will last 10 years. The system will cost $834,560. Her company's cost of capital is 10 percent.
c. Castle Dale Enterprises just announced that a new plant would be built in Price, Utah. Castle Dale told its shareholders that the plant has an expected life of 15 years and an expected IRR equal to 25 percent. The cost of building the plant is expected to be $2,880,000.

Required:

1. Calculate the IRR for Manchester Company. The company's cost of capital is 16 percent. Should the new equipment be purchased?
2. Calculate Kathleen Brigg's IRR. Should she acquire the new system?
3. What should be Castle Dale Enterprises' expected annual cash flow from the plant?

4 NET PRESENT VALUE AND COMPETING PROJECTS

Perry Hospital is investigating the possibility of investing in new dialysis equipment. Two local manufacturers of this equipment are being considered as sources of the equipment. After-tax cash inflows for the two competing projects are as follows:

Year	Limpio Equipment	Salman Equipment
1	$300,000	$ 50,000
2	250,000	50,000
3	200,000	300,000
4	100,000	400,000
5	50,000	450,000

Both projects require an initial investment of $500,000. In both cases, assume that the equipment has a life of five years with no salvage value.

Required:

1. Assuming a discount rate of 12 percent, compute the net present value of each piece of equipment.
2. A third option has surfaced for equipment purchased from an out-of-state supplier. The cost is also $500,000, but this equipment will produce even cash flows over its five-year life. What must the annual cash flow be for this equipment to be selected over the other two? Assume a 12 percent discount rate.

5 PAYBACK, ACCOUNTING RATE OF RETURN, PRESENT VALUE, NET PRESENT VALUE, INTERNAL RATE OF RETURN

All four parts are independent of all other parts. Assume that all cash flows are after-tax cash flows.

a. Randy Willis is considering investing in one of the following two projects. Either project will require an investment of $10,000. The expected cash flows for the two projects follow. Assume that each project is depreciable.

Year	Project A	Project
1	$ 3,000	$3,000
2	4,000	4,000
3	5,000	6,000
4	10,000	3,000
5	10,000	3,000

b. Wilma Golding is retiring and has the option to take her retirement as a lump sum of $225,000 or to receive $24,000 per year for 20 years. Wilma's required rate of return is 8 percent.

c. David Booth is interested in investing in some tools and equipment so that he can do independent drywalling. The cost of the tools and equipment is $20,000. He estimates that the return from owning his own equipment will be $6,000 per year. The tools and equipment will last six years.

d. Patsy Folson is evaluating what appears to be an attractive opportunity. She is currently the owner of a small manufacturing company and has the opportunity to acquire another small company's equipment that would provide production of a part currently purchased externally. She estimates that the savings from internal production will be $25,000 per year. She estimates that the equipment will last 10 years. The owner is asking $130,400 for the equipment. Her company's cost of capital is 10 percent.

Required:

1. What is the payback period for each of Randy Willis's projects? If rapid payback is important, which project should be chosen? Which would you choose?
2. Which of Randy's projects should be chosen based on the ARR?
3. Assuming that Wilma Golding will live for another 20 years, should she take the lump sum or the annuity?
4. Assuming a required rate of return of 8 percent for David Booth, calculate the NPV of the investment. Should David invest?
5. Calculate the IRR for Patsy Folson's project. Should Patsy acquire the equipment?

6 SOLVING FOR UNKNOWNS

Each of the following cases is independent. Assume that all cash flows are after-tax cash flows.

a. Thomas Company is investing $120,000 in a project that will yield a uniform series of cash inflows over the next four years.
b. Video Repair has decided to invest in some new electronic equipment. The equipment will have a three-year life and will produce a uniform series of cash savings. The NPV of the equipment is $1,750, using a discount rate of 8 percent. The IRR is 12 percent.
c. A new lathe costing $60,096 will produce savings of $12,000 per year.
d. The NPV of a project is $3,927. The project has a life of four years and produces the following cash flows:

Year 1	$10,000	Year 3	$15,000
Year 2	$12,000	Year 4	?

The cost of the project is two times the cash flow produced in year 4. The discount rate is 10 percent.

Required:

1. If the internal rate of return is 14 percent for Thomas Company, how much cash inflow per year can be expected?
2. Determine the investment and the amount of cash savings realized each year for Video Repair.
3. For scenario (c), how many years must the lathe last if an IRR of 18 percent is realized?
4. For scenario (d), find the cost of the project and the cash flow for year 4.

7 NET PRESENT VALUE VERSUS INTERNAL RATE OF RETURN

A company is thinking about two different modifications to its current manufacturing process. The after-tax cash flows associated with the two investments follow:

Year	Project I	Project II
0	$(100,000)	$(100,000)
1	—	63,857
2	134,560	63,857

The company's cost of capital is 10 percent.

Required:

1. Compute the NPV and the IRR for each investment.

2. Explain why the project with the larger NPV is the correct choice for the company.

8 NET PRESENT VALUE ANALYSIS

Uintah Communications Company is considering the production and marketing of a communications system that will increase the efficiency of messaging for small businesses or branch offices of large companies. Each unit hooked into the system is assigned a mailbox number, which can be matched to a telephone extension number, providing access to messages 24 hours a day. Up to 20 units can be hooked into the system, allowing the delivery of the same message to as many as 20 people. Personal codes can be used to make messages confidential. Furthermore, messages can be reviewed, recorded, cancelled, replied to, or deleted all during the same phone call. Indicators wired to the telephone blink whenever new messages are present.

To produce this product, a $1.1 million investment in new equipment is required. The equipment will last 10 years but will need major maintenance costing $100,000 at the end of its sixth year. The salvage value of the equipment at the end of 10 years is estimated to be $40,000. If this new system is produced, working capital must also be increased by $50,000. This capital will be restored at the end of the product's life cycle, which is estimated to be 10 years. Revenues from the sale of the product are estimated at $1.5 million per year; cash operating expenses are estimated at $1.26 million per year.

Required:

1. Prepare a schedule of cash flows for the proposed project. Assume that there are no income taxes.
2. Assuming that Uintah's cost of capital is 12 percent, compute the project's NPV. Should the product be produced?

9 BASIC INTERNAL RATE OF RETURN ANALYSIS

Lindsey Thompson, owner of Leshow Company, was approached by a local dealer of air-conditioning units. The dealer proposed replacing Leshow's old cooling system with a modern, more efficient system. The cost of the new system was quoted at $96,660, but it would save $20,000 per year in energy costs. The estimated life of the new system is 10 years, with no salvage value expected. Excited over the possibility of saving $20,000 per year and having a more reliable unit, Lindsey requested an analysis of the project's economic viability. All capital projects are required to earn at least the firm's cost of capital, which is 10 percent. There are no income taxes.

Required:

1. Calculate the project's IRR. Should the company acquire the new cooling system?
2. Suppose that energy savings are less than claimed. Calculate the minimum annual cash savings that must be realized for the project to earn a rate equal to the firm's cost of capital.
3. Suppose that the life of the new system is overestimated by two years. Repeat Requirements 1 and 2 under this assumption.
4. Explain the implications of the answers from Requirements 1, 2, and 3.

10 NET PRESENT VALUE, UNCERTAINTY

Eden Airlines is interested in acquiring a new aircraft to service a new route. The route will be from Dallas to El Paso. The aircraft will fly one round-trip daily except for scheduled maintenance days. There are 15 maintenance days scheduled each year. The seating capacity of the aircraft is 150. Flights are expected to be fully booked. The average revenue per passenger per flight (one-way) is $200. Annual operating costs of the aircraft follow:

Fuel	$1,400,000
Flight personnel	500,000
Food and beverages	100,000

Maintenance	400,000
Other	100,000
Total	$2,500,000

The aircraft will cost $100,000,000 and has an expected life of 20 years. The company requires a 14 percent return. Assume there are no income taxes.

Required:

1. Calculate the NPV for the aircraft. Should the company buy it?
2. In discussing the proposal, the marketing manager for the airline believes that the assumption of 100 percent booking is unrealistic. He believes that the booking rate will be somewhere between 70 and 90 percent, with the most likely rate being 80 percent. Recalculate the NPV by using an 80 percent seating capacity. Should the aircraft be purchased?
3. Calculate the average seating rate that would be needed so that NPV will equal zero.
4. Suppose that the price per passenger could be increased by 10 percent without any effect on demand. What is the average seating rate now needed to achieve a NPV equal to zero? What would you now recommend?

11 REVIEW OF BASIC CAPITAL BUDGETING PROCEDURES

Dr. Whitley Avard, a plastic surgeon, had just returned from a conference in which she learned of a new surgical procedure for removing wrinkles around eyes, reducing the time to perform the normal procedure by 50 percent. Given her patient-load pressures, Dr. Avard is excited to try out the new technique. By decreasing the time spent on eye treatments or procedures, she can increase her total revenues by performing more services within a work period. Unfortunately, in order to implement the new procedure, special equipment costing $74,000 is needed. The equipment has an expected life of four years, with a salvage value of $6,000. Dr. Avard estimates that her cash revenues will increase by the following amounts:

Year	Revenue Increases
1	$19,800
2	27,000
3	32,400
4	32,400

She also expects additional cash expenses amounting to $3,000 per year. The cost of capital is 12 percent. Assume that there are no income taxes.

Required:

1.Compute the payback period for the new equipment.

2.Compute the ARR.

3.Compute the NPV and IRR for the project. Should Dr. Avard purchase the new equipment? Should she be concerned about payback or the ARR in making this decision?

4.Before finalizing her decision, Dr. Avard decided to call two plastic surgeons who have been using the new procedure for the past six months. The conversations revealed a somewhat less glowing report than she received at the conference. The new procedure reduced the time required by about 25 percent rather than the advertised 50 percent. Dr. Avard estimated that the net operating cash flows of the procedure would be cut by one-third because of the extra time and cost involved (salvage value would be unaffected). Using this information, recompute the NPV of the project. What would you now recommend?

12 NET PRESENT VALUE AND COMPETING ALTERNATIVES

Stillwater Designs has been rebuilding Model 100, Model 120, and Model 150 Kicker subwoofers that were returned for warranty action. Customers returning the subwoofers receive a new replacement. The warranty returns are then rebuilt and resold (as seconds). Tent sales are often used to sell the rebuilt speakers. As part of the rebuilding process, the speakers are demagnetized so that metal pieces and shavings can be removed. A demagnetizing (demag) machine is used to achieve this objective. A product design change has made the most recent Model 150 speakers too tall for the demag machine. They no longer fit in the demag machine.
Stillwater Designs has two alternatives that it is currently considering. First, a new demag machine can be bought that has a different design, eliminating the fit problem. The cost of this machine is $600,000, and it will last five years. Second, Stillwater can keep the current machine and sell the 150 speakers for scrap, using the old demag machine for the Model 100 and 120 speakers only. A rebuilt speaker sells for $295 and costs $274.65 to rebuild (for materials, labor, and overhead cash outlays). The $274.65 outlay includes the annual operating cash effects of the new demag machine. If not rebuilt, the Model 150 speakers can be sold for $4 each as scrap. There are 10,000 Model 150 warranty returns per year. Assume that the required rate of return is 10 percent.

Required:

1. Determine which alternative is the best for Stillwater Designs by using NPV analysis.
2. Determine which alternative is best for Stillwater Designs by using an IRR analysis. Explain why NPV analysis is a better approach.

13 BASIC NET PRESENT VALUE ANALYSIS, COMPETING PROJECTS

Kildare Medical Center, a for-profit hospital, has three investment opportunities: (1) adding a wing for in-patient treatment of substance abuse, (2) adding a pathology laboratory, and (3) expanding the outpatient surgery wing. The initial investments and the net present value for the three alternatives are as follows:

	Substance	Abuse Laboratory	Outpatient Surgery
Investment	$1,500,000	$500,000	$1,000,000
NPV	150,000	140,000	135,000

Although the hospital would like to invest in all three alternatives, only $1.5 million is available.

Required:

1. Rank the projects on the basis of NPV, and allocate the funds in order of this ranking. What project or projects were selected? What is the total NPV realized by the medical center using this approach?
2. Assume that the size of the lot on which the hospital is located makes the substance abuse wing and the outpatient surgery wing mutually exclusive. With unlimited capital, which of those two projects would be chosen? With limited capital and the three projects being considered, which projects would be chosen?
3. Form a group with two to four other students, and discuss qualitative considerations that should be considered in capital budgeting evaluations. Identify three such considerations.

14 PAYBACK, NET PRESENT VALUE, INTERNAL RATE OF RETURN, INTANGIBLE BENEFITS, INFLATION ADJUSTMENT

Foster Company wants to buy a numerically controlled (NC) machine to be used in producing specially machined parts for manufacturers of trenching machines (to replace an existing manual system). The outlay required is $3,500,000. The NC equipment will last five years with no expected salvage value. The expected incremental after-tax cash flows (cash flows of the NC equipment less cash flows of the old equipment) associated with the project follow:

Year	Cash Benefits	Cash Expenses
1	$3,900,000	$3,000,000
2	3,900,000	3,000,000
3	3,900,000	3,000,000
4	3,900,000	3,000,000
5	3,900,000	3,000,000

Foster has a cost of capital equal to 10 percent. The above cash flows are expressed without any consideration of inflation.

Required:

1. Compute the payback period.
2. Calculate the NPVand IRR of the proposed project.
3. Inflation is expected to be 5 percent per year for the next five years. The discount rate of 10 percent is composed of two elements: the real rate and the inflationary element. Since the discount rate has an inflationary component, the projected cash flows should also be adjusted to account for inflation. Make this adjustment, and recalculate the NPV. Comment on the importance of adjusting cash flows for inflationary effects.

15 COST OF CAPITAL, NET PRESENT VALUE

Leakam Company's product engineering department has developed a new product that has a three-year life cycle. Production of the product requires development of a new process that requires a current $100,000 capital outlay. The $100,000 will be raised by issuing $60,000 of bonds and by selling new stock for $40,000. The $60,000 in bonds will have net (after-tax) interest payments of $3,000 at the end of each of the three years, with the principal being repaid at the end of year 3. The stock issue carries with it an expectation of a 17.5 percent return, expressed in the form of dividends at the end of each year ($7,000 in dividends is expected for each of the next three years). The sources of capital for this investment represent the same proportion and costs that the company typically has. Finally, the project will produce after-tax cash inflows of $50,000 per year for the next three years.

Required:

1. Compute the cost of capital for the project. (Hint: The cost of capital is a weighted average of the two sources of capital where the weights are the proportion of capital from each source.)
2. Compute the NPV for the project. Explain why it is not necessary to subtract the interest payments and the dividend payments and appreciation from the inflow of $50,000 in carrying out this computation.

16 CAPITAL INVESTMENT, ADVANCED MANUFACTURING ENVIRONMENT

''I know that it's the thing to do,'' insisted Pamela Kincaid, vice president of finance for Colgate Manufacturing. ''If we are going to be competitive, we need to build this completely automated plant.'' ''I'm not so sure,'' replied Bill Thomas, CEO of Colgate. ''The savings from labor reductions and increased productivity are only $4 million per year. The price tag for this factory—and it's a small one—is $45 million. That gives a payback period of more than 11 years. That's a long time to put the company's money at risk.'' ''Yeah, but you're overlooking the savings that we'll get from the increase in quality,'' interjected John Simpson, production manager. ''With this system, we can decrease our waste and our rework time significantly. Those savings are worth another million dollars per year.'' ''Another million will only cut the payback to about nine years,'' retorted Bill. ''Ron, you're the marketing manager—do you have any insights?'' ''Well, there are other factors to consider, such as service quality and market share. I think that increasing our product quality and improving our delivery service will make us a lot more competitive. I know for a fact that two of our competitors have decided against automation. That'll give us a shot at their customers, provided our product is of higher quality and we can deliver it faster. I estimate that it'll increase our net cash benefits by another $2.4 million.''''Wow! Now that's impressive,'' Bill exclaimed, nearly convinced. ''The payback is now getting down to a reasonable level.'' ''I agree,'' said Pamela, ''but we do need to be sure that it's a sound

investment. I know that estimates for construction of the facility have gone as high as $48 million. I also know that the expected residual value, after the 20 years of service we expect to get, is $5 million. I think I had better see if this project can cover our 14 percent cost of capital.'' ''Now wait a minute, Pamela,'' Bill demanded. ''You know that I usually insist on a 20 percent rate of return, especially for a project of this magnitude.''

Required:

1. Compute the NPV of the project by using the original savings and investment figures. Calculate by using discount rates of 14 percent and 20 percent. Include salvage value in the computation.
2. Compute the NPV of the project using the additional benefits noted by the production and marketing managers. Also, use the original cost estimate of $45 million. Again, calculate for both possible discount rates.
3. Compute the NPV of the project using all estimates of cash flows, including the possible initial outlay of $48 million. Calculate by using discount rates of 14 percent and 20 percent.
4. If you were making the decision, what would you do? Explain.

17 DISCOUNT RATES, AUTOMATED MANUFACTURING, COMPETING INVESTMENTS

A company is considering two competing investments. The first is for a standard piece of production equipment; the second is for computer-aided manufacturing (CAM) equipment. The investment and after-tax operating cash flows follow:

Year	Standard Equipment	CAM Equipment
0	$(500,000)	$(2,000,000)
1	300,000	100,000
2	200,000	200,000
3	100,000	300,000
4	100,000	400,000
5	100,000	400,000
6	100,000	400,000
7	100,000	500,000
8	100,000	1,000,000
9	100,000	1,000,000
10	100,000	1,000,000

The company uses a discount rate of 18 percent for all of its investments. The company's cost of capital is 10 percent.

Required:

1. Calculate the NPV for each investment by using a discount rate of 18 percent.
2. Calculate the NPV for each investment by using a discount rate of 10 percent.
3. Which rate should the company use to compute the NPV? Explain.

18 QUALITY, MARKET SHARE, AUTOMATED MANUFACTURING ENVIRONMENT

A company is considering two competing investments. The first is for a standard piece of production equipment; the second is for computer-aided manufacturing (CAM) equipment. The investment and after-tax operating cash flows follow:

Year	Standard Equipment	CAM Equipment
0	$(500,000)	$(2,000,000)

1	300,000	100,000
2	200,000	200,000
3	100,000	300,000
4	100,000	400,000
5	100,000	400,000
6	100,000	400,000
7	100,000	500,000
8	100,000	1,000,000
9	100,000	1,000,000
10	100,000	1,000,000

Assume that the company's cost of capital is 14 percent.

Required:

1. Calculate the NPV of each alternative by using the 14 percent rate.
2. Now assume that if the standard equipment is purchased, the competitive position of the firm will deteriorate because of lower quality (relative to competitors who did automate). Marketing estimates that the loss in market share will decrease the projected net cash inflows by 50 percent for years 3 through 10. Recalculate the NPV of the standard equipment given this outcome. What is the decision now? Discuss the importance of assessing the effect of intangible benefits

19 CAPITAL INVESTMENT AND ETHICAL BEHAVIOR

Manny Carson, certified management accountant and controller of Wakeman Enterprises, had been given permission to acquire a new computer and software for the company's accounting system. The capital investment analysis showed an NPV of $100,000; however, the initial estimates of acquisition and installation costs were made on the basis of tentative costs without any formal bids. Manny now has two formal bids, one that would allow the firm to meet or beat the original projected NPV and one that would reduce the projected NPV by $50,000. The second bid involves a system that would increase both the initial cost and the operating cost.

Normally, Manny would take the first bid without hesitation. However, Todd Downing, the owner of the firm presenting the second bid, was a close friend. Manny had called Todd and explained the situation, offering Todd an opportunity to alter his bid and win the job. Todd thanked Manny and then made a counteroffer.

Todd: Listen, Manny, this job at the original price is the key to a successful year for me. The revenues will help me gain approval for the loan I need for renovation and expansion. If I don't get that loan, I see hard times ahead. The financial stats for loan approval are so marginal that reducing the bid price may blow my chances.

Manny: Losing the bid altogether would be even worse, don't you think?

Todd: True. However, I have a suggestion. If you grant me the job, I will have the capability of adding personnel. I know that your son is looking for a job, and I can offer him a good salary and a promising future. Additionally, I'll be able to take you and your wife on that vacation to Hawaii that we have been talking about.

Manny: Well, you have a point. My son is having an awful time finding a job, and he has a wife and three kids to support. My wife is tired of having them live with us. She and I could use a vacation. I doubt that the other bidder would make any fuss if we turned it down. Its offices are out of state, after all.

Todd: Out of state? All the more reason to turn it down. Given the state's economy, it seems almost criminal to take business outside. Those are the kind of business decisions that cause problems for people like your son.

Required:

Evaluate the ethical behavior of Manny. Should Manny have called Todd in the first place? What if Todd had agreed to meet the lower bid price—would there have been any problems? Identify the standards of ethical conduct listed in the Institute of Management Accountants ''Statement of Ethical Professional

Practice'' found at https:// www.imanet.org/about_ethics_statement.asp that Manny may be violating, if any

20 PAYBACK, NET PRESENT VALUE, INTERNAL RATE OF RETURN, EFFECTS OF DIFFERENCES IN SALES ON PROJECT VIABILITY

Shaftel Ready Mix is a processor and supplier of concrete, aggregate, and rock products. The company operates in the intermountain western United States. Currently, Shaftel has 14 cement-processing plants and a labor force of more than 375 employees. With the exception of cement powder, all materials (e.g., aggregates and sand) are produced internally by the company. The demand for concrete and aggregates has been growing steadily nationally, and in the West, the growth rate has been above the national average. Because of this growth, Shaftel has more than tripled its gross revenues over the past 10 years.

Of the intermountain states, Arizona has been experiencing the most growth. Processing plants have been added over the past several years, and the company is considering the addition of yet another plant to be located in Scottsdale. A major advantage of another plant in Arizona is the ability to operate year round, a feature not found in states such as Utah and Wyoming. In setting up the new plant, land would have to be purchased and a small building constructed. Equipment and furniture would not need to be purchased; these items would be transferred from a plant that opened in Wyoming during the oil boom period and closed a few years after the end of that boom. However, the equipment needs some repair and modifications before it can be used. It has a book value of $200,000, and the furniture has a book value of $30,000. Neither has any outside market value. Other costs, such as the installation of a silo, well, electrical hookups, and so on, will be incurred. No salvage value is expected. The summary of the initial investment costs by category is as follows:

Land	$ 20,000
Building	135,000
Equipment:	
Book value	200,000
Modifications	20,000
Furniture (book value)	30,000
Silo	20,000
Well	80,000
Electrical hookups	27,000
General setup	50,000
Total	$582,000

Estimates		
Life of plant and equipment		10 years
Expected annual	35,000	
Selling price (per cubic yard of cement)		$45.00
Variable costs (per cubic yard of		
Cement		$12.94
Sand/gravel		6.42
Fly ash		1.13
Admixture		1.53
Driver labor		3.24
Mechanics		1.43
Plant operations (batching and		1.39
Loader operator		0.50
Truck parts		1.75
Fuel		1.48
Other		3.27
Total variable costs		$35.08

Fixed costs (annual):	
Salaries	$135,000
Insurance	75,000
Telephone	5,000
Depreciation	58,200
Utilities	25,000
Total fixed costs	$298,200

* Straight-line depreciation is calculated by using all initial investment costs over a 10-year period assuming no salvage value.

After reviewing these data, Karl Flemming, vice president of operations, argued against the proposed plant. Karl was concerned because the plant would earn significantly less than the normal 8.3 percent return on sales. All other plants in the company were earning between 7.5 and 8.5 percent on sales. Karl also noted that it would take more than five years to recover the total initial outlay of $582,000. In the past, the company had always insisted that payback be no more than four years. The company's cost of capital is 10 percent. Assume that there are no income taxes.

Required:

1. Prepare a variable-costing income statement for the proposed plant. Compute the ratio of net income to sales. Is Karl correct that the return on sales is significantly lower than the company average?
2. Compute the payback period for the proposed plant. Is Karl right that the payback period is greater than four years? Explain. Suppose you were told that the equipment being transferred from Wyoming could be sold for its book value. Would this affect your answer?
3. Compute the NPV and the IRR for the proposed plant. Would your answer be affected if you were told that the furniture and equipment could be sold for their book values? If so, repeat the analysis with this effect considered.
4. Compute the cubic yards of cement that must be sold for the new plant to break even. Using this break-even volume, compute the NPV and the IRR. Would the investment be acceptable? If so, explain why an investment that promises to do nothing more than break even can be viewed as acceptable.
5. Compute the volume of cement that must be sold for the IRR to equal the firm's cost of capital. Using this volume, compute the firm's expected annual income. Explain this result.

SOLUZIONI

Esercizio 1

1. Initial investment (Average depreciation = $480,000):

   Accounting rate of return=

   =

   = 13.3%

2. Accounting rate of return (ARR):

   Project A: ARR = = 44%

   Project B: ARR = = 18%

Project A should be chosen.

3. ARR =

   0. 40 =

   Initial investment =

   = $400,000

4. ARR =

   0.25 =

   Average net income = 0.25 × $100,000
   = $25,000

Esercizio 2

1. NPV = *P* – *I*
   = (5.65022 × $360,000) – $2,040,000
   = $(5,921)

   The system should not be purchased.

2. NPV = *P* – *I*
   = (4.62288 × $36,000) – $120,000 = $46,424

   Yes, she should make the investment.

3. NPV = *P* – *I*
   I = *P* – NPV
   I = (5.33493 × $15,000) – $7,100
   = $72,924

Esercizio 3

1. *P* = *CF(df)* = *I* for the IRR, thus,

   df =

   =

   = 3.127

   For five years and a discount factor of 3.127, the IRR is very close to 18%. Thus, the equipment should be purchased.

2. *P* = *CF(df)* = *I* for the IRR, thus,

   df =

   = 5.216

   For 10 years and a discount factor of 5.216, the IRR is very close to 14%. Yes, the investment should be made.

3. $CF(df) = I$ for the IRR, thus,

   $CF = \quad = \quad =$ $746,257.

Esercizio 4

1. Limpio equipment:

Year	Cash Flow	Discount Factor	Present Value
0	$(500,000)	1.00000	$(500,000)
1	300,000	0.89286	267,858
2	250,000	0.79719	199,298
3	200,000	0.71178	142,356
4	100,000	0.63552	63,552
5	50,000	0.56743	28,372
NPV			$ 201,436

Salman equipment:

Year	Cash Flow	Discount Factor	Present Value
0	$(500,000)	1.00000	$(500,000)
1	50,000	0.89286	44,643
2	50,000	0.79719	39,860
3	300,000	0.71178	213,534
4	400,000	0.63552	254,208
5	450,000	0.56743	255,344
NPV			$ 307,589

2. $$\begin{aligned} CF(df) - I &= \text{NPV} \\ CF(3.60478) - \$500{,}000 &= \$307{,}589 \\ (3.60478)CF &= \$807{,}589 \\ CF &= \\ CF &= \$224{,}033 \text{ per year} \end{aligned}$$

   Thus, the annual cash flow must exceed $224,036 to be selected.

Esercizio 5

1. Payback period:

   Project A:

$	3,000	1.00 year
	4,000	1.00 year
	3,000	0.60 year
	$10,000	2.60 years

   Project B:

$	3,000	1.00 year
	4,000	1.00 year
	3,000	0.50 year
	$10,000	2.50 years

Both projects have about the same payback so the most profitable should be chosen (Project A).

2. Accounting rate of return (ARR):

   Project A: ARR = = 44%

   Project B: ARR = = 18%

   Project A should be chosen.

3. $P = 9.81815 \times \$24{,}000 = \$235{,}636$

   Wilma should take the annuity.

4. NPV $= P - I$

   $= (4.62288 \times \$6{,}000) - \$20{,}000 = \$7{,}737$

   Yes, he should make the investment.

5. $df =$ = 5.216

   IRR is very close to 14%

   Yes, the investment should be made.

Esercizio 6

1. $P = I = df \times CF$

   $2.91371^* \times CF = \$120{,}000$

   $CF = \$41{,}185$

   *From Exhibit 14B-2, 14% for 4 years.

2. For IRR (discount factors from Exhibit 14B-2):

   $I = df \times CF$

   $= 2.40183 \times CF$ (1)

   For NPV:

   NPV $= df \times CF - I$

   $= 2.57710 \times CF - I$ (2)

   Substituting equation (1) into equation (2):

   NPV $= (2.57710 \times CF) - (2.40183 \times CF)$

   $\$1{,}750 = 0.17527 \times CF$

   $CF =$

   = $9,985 in savings each year

   Substituting CF = $9,985 into equation (1):

   $I = 2.40183 \times \$9{,}985$

   = $23,982 original investment

3. For IRR:

   $I = df \times CF$

   $\$60{,}096 = df \times \$12{,}000$

df =

= 5.008

From Exhibit 14B-2, 18% column, the year corresponding to df = 5.008 is 14. Thus, the lathe must last 14 years.

4. X = Cash flow in year 4

Investment = 2X

Year	Cash Flow	Discount Factor	Present Value
0	$ (2X)	1.00000	$ (2X)
1	10,000	0.90909	9,091
2	12,000	0.82645	9,917
3	15,000	0.75131	11,270
4	X	0.68301	0.68301X
NPV			$ 3,927

$$-2X + \$9,091 + \$9,917 + \$11,270 + 0.68301X = \$3,927$$
$$-1.31699X + \$30,278 = \$3,927$$
$$-1.31699X = \$(26,351)$$
$$X = \$20,009$$

Cash flow in year 4 = X = $20,000

Cost of project = 2X = $40,000

Esercizio 7

1. NPV:

Project I

Year	Cash Flow	Discount Factor	Present Value
0	$(100,000)	1.00000	$(100,000)
1	—	—	—
2	134,560	0.82645	111,207
NPV			$ 11,207

Esercizio 8

1. Schedule of cash flows:

Year	Item	Cash Flow
0	Equipment	$(1,100,000)
	Working capital	(50,000)
	Total	$(1,150,000)
1–5	Revenues	$ 1,500,000
	Operating expenses	(1,260,000)
	Total	$ 240,000
6	Revenues	$ 1,500,000
	Operating expenses	(1,260,000)

	Major maintenance	(100,000)
	Total	$ 140,000
7–9	Revenues	$ 1,500,000
	Operating expenses	(1,260,000)
	Total	$ 240,000
10	Revenues	$ 1,500,000
	Operating expenses	(1,260,000)
	Salvage	40,000
	Recovery of working capital	50,000
	Total	$ 330,000

2.

Year	Cash Flow	Discount Factor	Present Value
0	$(1,150,000)	1.00000	$(1,150,000)
1–5	240,000	3.60478	865,147
6	140,000	0.50663	70,928
7	240,000	0.45235	108,564
8	240,000	0.40388	96,931
9	240,000	0.36061	86,546
10	330,000	0.32197	106,250
NPV			$ 184,366

The new process should be accepted.

Esercizio 9

1. df =
   =
   = 4.833

   The IRR is essentially 16%. The company should acquire the new system.

2. Since $I = P$ for the IRR:

   $I = df \times CF$
   $96,660= 6.14457* \times CF$
   $6.14457 \times CF= \$96,660$
   $CF = \$15,731$

   *Discount factor at 10% (cost of capital) for 10 years.

3. For a life of 8 years:

   df =
   =
   = 4.833

   The IRR is between 12% and 14%—greater than the 10% cost of capital. The company should still acquire the new system.

   Minimum cash flow at 10% for 8 years:

   $I = df \times CF$
   $96,660= 5.33493 \times CF$
   $5.33493 \times CF= \$96,660$
   $CF = \$18,118$

4. Requirement 2 reveals that the estimates for cash savings can be off by as much as $4,269 (over 20%) without affecting the viability of the new system. Requirement 3 reveals that the life of the new system can be two years less than expected and the project is still viable. In the latter case, the cash flows can also decrease by almost 10% as well without changing the outcome. Thus, the sensitivity analysis should strengthen the case for buying the new system.

Esercizio 10

1. First, calculate the expected cash flows:

   Days of operation each year: 365 – 15 = 350
   Revenue per day: $200 × 2 × 150 = $60,000
   Annual revenue: $60,000 × 350 = $21,000,000

   Annual cash flow = Revenues – Operating costs
   = $21,000,000 – $2,500,000
   = $18,500,000

   NPV = $P - I$
   = (6.62313 × $18,500,000) – $100,000,000
   = $122,527,905 – $100,000,000
   = $22,527,905

   Yes, the aircraft should be purchased.

2. Revised cash flow = (0.80 × $21,000,000) – $2,500,000
   = $14,300,000

   NPV = $P - I$
   = (6.62313 × $14,300,000) – $100,000,000
   = $(5,289,241)

   No, the aircraft should not be purchased.

3. NPV= $(6.62313)CF - \$100,000,000 = 0$

   CF =

   = $15,098,601

   Annual revenue = $15,098,601 + $2,500,000
   = $17,598,601

   Daily revenue =

   = $50,282

   Seats to be sold =
   = 126 seats (each way)

   Seating rate needed = = 84%

4. Seats to be sold = = 115 (rounded up)

   Seating rate = = 77%

   This seating rate is less than the most likely and above the least likely rate of 70%. There is some risk, since it is possible that the actual rate could be below 77%. However, the interval is 20% (70% to 90%), and the 77% rate is only 35% of the way into the interval, suggesting a high probability of a positive NPV.

Esercizio 11

1.

1.00 year	$16,800
1.00 year	24,000
1.00 year	29,400
0.13 year*	3,800
3.13 years	$74,000

   *

   Note: Cash flow = Increased revenue less cash expenses of $3,000.

2. Accounting rate of return:

   Average cash revenue =
   = $27,900

   Average cash expenses = $3,000 per year

   Average depreciation = = $17,000

   Accounting rate of return =
   =
   = 10.68%

3.

Year	Cash Flow	Discount Factor	Present Value
0	$(74,000)	1.00000	$(74,000)
1	16,800	0.89286	15,000
2	24,000	0.79719	19,133
3	29,400	0.71178	20,926
4	35,400*	0.63552	22,497
NPV			$ 3,556

   *Includes $6,000 salvage.

   IRR (by trial and error):

   Using 14% as the first guess:

Year	Cash Flow	Discount Factor	Present Value
0	$(74,000)	1.00000	$(74,000)
1	16,800	0.87719	14,737
2	24,000	0.76947	18,467
3	29,400	0.67497	19,844
4	35,400	0.59208	20,960
NPV			$ 8

The IRR is about 14%.

The equipment should be purchased (the NPV is positive and the IRR is larger than the cost of capital). Dr. Avard should not be concerned about the accounting rate of return in making this decision. The payback, however, may be of some interest, particularly if cash flow is of concern to Dr. Avard.

4.

Year	Cash Flow	Discount Factor	Present Value
0	$(74,000)	1.00000	$(74,000)
1	11,200	0.89286	10,000
2	16,000	0.79719	12,755
3	19,600	0.71178	13,951
4	25,600	0.63552	16,269
NPV			$(21,025)

For years 1–4, the cash flows are 2/3 of the original cash flow increases. Year 4 also includes $6,000 salvage.

Given the new information, Dr. Avard should not buy the equipment.

Esercizio 12

1. Annual *CF* (rebuild alternative) = ($295 – $274.65)10,000 = $203,500
   NPV = (*CF* × *df*) – *I* = ($203,500 × 3.79079) – $600,000 = $171,426

   Annual *CF* (scrap alternative) = $4 × 10,000 = $40,000
   NPV = (*CF* × *df*) – *I* = ($40,000 × 3.79079) – $0 = $151,632

   The NPV of the rebuild alternative is greater and so the new demag machine should be purchased.

2. For the rebuild alternative, *df* = = 2.94840. The IRR is 14%. For the scrap alternative, *df* × *CF* = 0 implies that the IRR is infinite (*CF* is $40,000 and so *df* = 0 is required, which can occur only if the discount rate approaches infinity). This means that the scrap alternative is better under the IRR criterion. However, this doesn't make sense because an infinite IRR is required even if the annual cash flow is $1 per year! Clearly, the NPV approach is better as it measures the absolute improvement in dollars.

Esercizio 13

1.

Project	Investment	Allocation
(1) Substance abuse wing	$1,500,000	$1,500,000
(2) Laborator	500,000	0
(3) Outpatient surgery wing	1,000,000	0

Total net present value realized = $150,000

2. With unlimited capital, the substance abuse wing and the laboratory would be chosen. With limited capital the laboratory and outpatient surgery wing would be chosen.

3. Three qualitative considerations that should generally be considered in capital budgeting evaluations include:

   Quicker response to market changes and flexibility in production capacity.

Strategic fit and long-term competitive improvement from the project, or the negative impact to the company's competitiveness or image if it does not make the investment.

Risks inherent in the project, business, or country for the investment.

Esercizio 14

1. Payback period =

   =

   =

   = 3.89 years

2.

Year	Cash Flow	Discount Factor	Present Value
0	$(3,500,000)	1.00000	$(3,500,000)
1	900,000	0.90909	818,181
2	900,000	0.82645	743,805
3	900,000	0.75131	676,179
4	900,000	0.68301	614,709
5	900,000	0.62092	558,828
NPV			$ (88,298)

   $P = CF(df)$ = I for the IRR, thus,

   df =

   =

   = 3.88889

   For five years and a discount factor of 3.88889, the IRR is about 9%.

3.

Year	Cash Flow*	Discount Factor	Present Value
0	$(3,500,000)	1.00000	$(3,500,000)
1	945,000	0.90909	859,090
2	992,250	0.82645	820,045
3	1,041,863	0.75131	782,762
4	1,093,956	0.68301	747,183
5	1,148,654	0.62092	713,222
NPV			$ 422,302

   *$(1.05)^n \times \$900{,}000$, $n = 1, 2, \ldots, 5$. The asterisk is for years one through five.

   It is very important to adjust cash flows for inflationary effects. Since the required rate of return for capital budgeting analysis reflects an inflationary component at the time NPV analysis is performed, a correct analysis also requires that the predicted operating cash flows be adjusted to reflect inflationary effects. If the operating cash flows are not adjusted, then an erroneous decision may be the outcome. Notice, for example, that after adjusting for inflation, the new system is now favored—a totally different decision.

Esercizio 15

1. Bond cost = = 0.05

   Cost of capital = 0.05(0.6) + 0.175(0.4)
   = 0.03 + 0.07
   = 0.10

2.

Year	Cash Flow	Discount Factor	Present Value
0	$(100,000)	1.00000	$(100,000)
1	50,000	0.90909	45,455
2	50,000	0.82645	41,323
3	50,000	0.75131	37,566
NPV			$ 24,344

   It is not necessary to subtract the interest payments and the dividend payments because these are associated with the cost of capital and are included in the firm's cost of capital of 10%.

Esercizio 16

1. Original savings and investment:

   (14% rate):

Year	*CF*	*df*	Present Value
0	$(45,000,000)	1.00000	$(45,000,000)
1–20	4,000,000	6.62313	26,492,520
20	5,000,000	0.07276	363,800
NPV			$(18,143,680)

   (20% rate):

Year	CF	df	Present Value
0	$(45,000,000)	1.00000	$(45,000,000)
1–20	4,000,000	4.86958	19,478,320
20	5,000,000	0.02608	130,400
NPV			$(25,391,280)

2. Total benefits: ($4,000,000 + $1,000,000 + $2,400,000)

   (14% rate):

Year	CF	df	Present Value
0	$(45,000,000)	1.00000	$(45,000,000)
1–20	7,400,000	6.62313	49,011,162
20	5,000,000	0.07276	363,800
NPV			$ 4,374,962

   (20% rate):

Year	CF	df	Present Value
0	$(45,000,000)	1.00000	$(45,000,000)
1–20	7,400,000	4.86958	36,034,892
20	5,000,000	0.02608	130,400
NPV			$ (8,834,708)

3. Analysis with increased investment:

(14% rate):

Year	CF	df	Present Value
0	$(48,000,000)	1.00000	$(48,000,000)
1–20	7,400,000	6.62313	49,011,162
20	5,000,000	0.07276	363,800
NPV			$ 1,374,962

(20% rate):

Year	CF	df	Present Value
0	$(48,000,000)	1.00000	$(48,000,000)
1–20	7,400,000	4.86958	36,034,892
20	5,000,000	0.02608	130,400
NPV			$ 1,374,962

4. The automated plant is an attractive investment when the additional benefits are considered—it promises to return at least the cost of capital (even for the high-cost scenario). Using the hurdle rate of 20% is probably too conservative—especially given the robustness of the outcome using the cost of capital. The company should invest in the new system.

Esercizio 17

1. Standard equipment (Rate = 18%):

Year	Cash Flow	Discount Factor	Present Value
0	$(500,000)	1.00000	$(500,000)
1	300,000	0.84746	254,238
2	200,000	0.71818	143,636
3–10	100,000	2.92845	292,845
NPV			$ 190,719

CAM equipment (Rate = 18%):

Year	Cash Flow	Discount Factor	Present Value
0	$(2,000,000)	1.00000	$(2,000,000)
1	100,000	0.84746	84,746
2	200,000	0.71818	143,636
3	300,000	0.60863	182,589
4–6	400,000	1.32333	529,332
7	500,000	0.31393	156,965
8–10	1,000,000	0.68256	682,560
NPV			$ (220,172)

2. Standard equipment (Rate = 10%):

Year	Cash Flow	Discount Factor	Present Value
0	$(500,000)	1.00000	$(500,000)
1	300,000	0.90909	272,727
2	200,000	0.82645	165,290
3–10	100,000	4.40903	440,903
NPV			$ 378,920

CAM equipment (Rate = 10%):

Year	Cash Flow	Discount Factor	Present Value
0	$(2,000,000)	1.00000	$(2,000,000)
1	100,000	0.90909	90,909
2	200,000	0.82645	165,290
3	300,000	0.75131	225,393
4–6	400,000	1.86840	747,360
7	500,000	0.51316	256,580
8–10	1,000,000	1.27615	1,276,150
NPV			$ 761,682

3. Notice how the cash flows using a 10% rate in years 8–10 are weighted compared to the 18% rate. The difference in present value is significant. Using an excessive discount rate works against those projects that promise large cash flows later in their lives. The best course of action for a firm is to use its cost of capital as the discount rate. Otherwise, some very attractive and essential investments could be overlooked.

Esercizio 18

1. Standard equipment (Rate = 14%):

Year	Cash Flow	Discount Factor	Present Value
0	$(500,000)	1.00000	$(500,000)
1	300,000	0.87719	263,157
2	200,000	0.76947	153,894
3–10	100,000	3.56946	356,946
NPV			$ 273,997

CAM equipment (Rate = 14%):

Year	Cash Flow	Discount Factor	Present Value
0	$(2,000,000)	1.00000	$(2,000,000)
1	100,000	0.87719	87,719
2	200,000	0.76947	153,894
3	300,000	0.67497	202,491
4–6	400,000	1.56704	626,816
7	500,000	0.39964	199,820
8–10	1,000,000	0.92781	927,810
NPV			$ (198,550)

2. Standard equipment (Rate = 14%):

Year	Cash Flow	Discount Factor	Present Value
0	$(500,000)	1.00000	$(500,000)
1	300,000	0.87719	263,157
2	200,000	0.76947	153,894
3–10	50,000	3.56946	178,473
NPV			$ 95,524

The decision reverses—the CAM system is now preferable. This reversal is attributable to the intangible benefit of maintaining market share. To remain competitive, managers must make good decisions, and this exercise emphasizes how intangible benefits can affect decisions.

Esercizio 19

The statement that Manny would normally have taken the first bid without hesitation implies that the bid met all of the formal requirements outlined by the company. If Manny's friend had met the bid as requested, then presumably Manny would have offered the business to his friend. The motive for this was friendship and possibly carried with it past experience in dealing with Todd's company. Perhaps there was some uncertainty in Manny's mind about the low bidder's ability to execute the requirements of the bid, especially since the winning bid was from out of state. If there was some legitimate concern about the winning bid and Manny was hopeful of eliminating this concern by dealing with a known quantity, then it could be argued that the call to Todd was justifiable. If, on the other hand, the only motive was friendship and Manny was confident that the winning bid could execute (as he appears to have been), then the call was improper. Confidentiality and integrity in carrying out the firm's bidding policies are essential.

The fact that Manny was tempted by Todd's enticements and appeared to be leaning toward accepting Todd's original offer compounds the difficulty of the issue. If Manny actually accepts Todd's offer and grants the business at the original price and accepts the gifts, then his behavior is unquestionably unethical. Some of the standards of ethical conduct that would be violated are listed below.

II. Confidentiality

1. Keep information confidential except when disclosure is authorized or legally required.
3. Refrain from using confidential information for unethical or illegal advantage.

III. Integrity

2. Refrain from engaging in any conduct that would prejudice carrying out duties ethically.

Esercizio 20

1.

Shaftel Ready Mix
Income Statement
For the Year Ended 20XX

Sales (35,000 × $45)		$1,575,000
Less: Variable expenses ($35.08 × 35,000)		1,227,800
Contribution margin	$ 347,200	
Less fixed expenses:		
Salaries	$135,000	
Insurance	75,000	
Telephone	5,000	
Depreciation	56,200*	
Utilities	25,000	296,200
Net income	$ 51,000	

*Reported depreciation erroneously included $2,000 for the land.

Ratio of net income to sales = = 3.24%

Karl is correct that the return on sales is significantly lower than the company average.

2. Payback period =

=

= 3.28 years

*Net income of $51,000 + depreciation of $56,200

Karl is not right. The book value of the equipment and the furniture should not be included in the amount of the original investment because there is no opportunity cost associated with them. Excluding the book value reduces the investment from $582,000 to $352,000. Karl's payback would be correct if the equipment and furniture could be sold for their book value because there would now be an opportunity cost associated with them and that cost should be included in the original investment.

3. NPV:

Year	Cash Flow	Discount Factor	Present Value
0	$(352,000)	1.00000	$(352,000)
1–10	107,200	6.14457	658,698
NPV			$ 306,698

IRR:

df =
=
= 3.28358

Thus, the IRR is between 25 percent and 30 percent.

If the furniture and equipment can be sold for book value:

NPV:

Year	Cash Flow	Discount Factor	Present Value
0	$(582,000)	1.00000	$(582,000)
1–10	107,200	6.14457	658,698
NPV			$ 76,698

IRR:

df =
= 5.42910

Thus, the IRR is between 12 percent and 14 percent.

4. Break even:

$45X = $35.08X + $296,200
$9.92X = $296,200
X = 29,859 cubic yards

NPV (using break-even amount):

Year	Cash Flow	Discount Factor	Present Value
0	$(352,000)	1.00000	$(352,000)
1–10	56,200	6.14457	345,325
NPV			$ (6,675)

IRR:

df =

= 6.2633

Thus, the IRR is between 9 percent and 10 percent.

The investment is not acceptable, although it came close. It is possible to have a positive NPV at the break-even point. Break-even is defined for accounting income, not for cash flow. Since there are noncash expenses deducted from revenues, accounting income understates cash income. Zero income does not mean zero cash inflows.

5. Cost of capital = 10 percent for 10 years, so $df = 6.14457$

$$df =$$

$$6.14457 =$$

$$6.14457 \times CF = \$352{,}000$$

$$CF = \$57{,}286$$

Cash flow	$57,286
Less: Depreciation	56,200
Net income	$ 1,086

$$\text{Net income} = \text{Sales} - \text{Variable expenses} - \text{Fixed expenses}$$

$$\$1{,}086 = \$45X - \$35.08X - \$296{,}200$$

$$\$1{,}086 = \$9.92X - \$296{,}200$$

$$\$297{,}286 = \$9.92X$$

$$X = 29{,}968 \text{ cubic yards}$$

Sales	$1,348,560
Less: Variable expenses	1,051,277
Contribution margin	$ 297,283
Less: Fixed expenses	296,200
Net income	$ 1,083*

*Difference due to rounding