Financial Management

FINA 2010, Semester II, 2020-2021

Assignment 4 (Solution)

1 February, 2021

1. Questions from Chapter 9 of the text book (Page 303, Concepts Review and Critical Thinking Questions)

Q1: A payback period less than the project's life means that the NPV is positive for a zero discount rate, but nothing more definitive can be said. For discount rates greater than zero, the payback period will still be less than the project's life, but the NPV may be positive, zero, or negative, depending on whether the discount rate is less than, equal to, or greater than the IRR. The discounted payback includes the effect of the relevant discount rate. If a project's discounted payback period is less than the project's life, it must be the case that NPV is positive.

Q9: For a project with future cash flows that are an annuity:

Payback = I/C

And the IRR is:

0 = – I + C/IRR

Solving the IRR equation for IRR, we get:

IRR = C/I

Notice this is just the reciprocal of the payback. So:

IRR = 1/PB

For long-lived projects with relatively constant cash flows, the sooner the project pays back, the greater is the IRR.

Q14: The statement is incorrect. It is true that if you calculate the future value of all intermediate cash flows to the end of the project at the required return, then calculate the NPV of this future value and the initial investment, you will get the same NPV. However, NPV says nothing about reinvestment of intermediate cash flows. The NPV is the present value of the project cash flows. What is actually done with those cash flows once they are generated is irrelevant. Put differently, the value of a project depends on the cash flows generated by the project, not on the future value of those cash flows. The fact that the reinvestment "works" only if you use the required return as the reinvestment rate is also irrelevant because reinvestment is irrelevant in the first place to the value of the project.

One caveat: Our discussion here assumes that the cash flows are truly available once they are generated, meaning that it is up to firm management to decide what to do with the cash flows. In certain cases, there may be a requirement that the cash flows be reinvested. For example, in international investing, a

company may be required to reinvest the cash flows in the country in which they are generated and not "repatriate" the money. Such funds are said to be "blocked" and reinvestment becomes relevant because the cash flows are not truly available.

2. Questions from Chapter 9 of the text book (Page 305, Questions and Problems)

Q5: $R = 0\%$: 3 + ($2,900/$4,700) = 3.62 years

Discounted payback = Regular payback = 3.62 years

$R = 5\%$: $\$4,700/1.05 + \$4,700/1.05^2 + \$4,700/1.05^3 + \$4,700/1.05^4 = \$16,665.97$

$\$4,700/1.05^5 = \$3,682.57$

Discounted payback = 4 + ($17,000 – 16,665.97)/$3,682.57

Discounted payback = 4.09 years

$R = 19\%$: $\$4,700(PVIFA_{19\%,6}) = \$16,025.95$

The project never pays back.

Q6: Our definition of AAR is the average net income divided by the average book value. The average net income for this project is:

Average net income = ($1,570,000 + 1,684,200 + 1,716,300 + 1,097,400)/4

Average net income = $1,516,975

And the average book value is:

Average book value = ($13,500,000 + 0)/2

Average book value = $6,750,000

So, the AAR for this project is:

AAR = Average net income/Average book value

AAR = $1,516,975/$6,750,000

AAR = .2247, or 22.47%

Q15: The profitability index is defined as the PV of the future cash flows divided by the initial investment. The equation for the profitability index at a required return of 10 percent is:

$PI = [\$9,700/1.1 + \$7,800/1.1^2 + \$4,300/1.1^3]/\$16,700$

PI = 1.107

The equation for the profitability index at a required return of 15 percent is:

PI = [$9,700/1.15 + $7,800/1.15^2 + $4,300/1.15^3]/$16,700

PI = 1.028

The equation for the profitability index at a required return of 22 percent is:

PI = [$9,700/1.22 + $7,800/1.22^2 + $4,300/1.22^3]/$16,700

PI = .932

We would accept the project if the required return were 10 percent or 15 percent since the PI is greater than one. We would reject the project if the required return were 22 percent since the PI is less than one.

Q25: *a.* Here the cash inflows of the project go on forever, which is a perpetuity. Unlike ordinary perpetuity cash flows, the cash flows here grow at a constant rate forever, which is a growing perpetuity. If you remember back to the chapter on stock valuation, we presented a formula for valuing a stock with constant growth in dividends. This formula is actually the formula for a growing perpetuity, so we can use it here. The PV of the future cash flows from the project is:

PV of cash inflows = $C_1/(R - g)$

PV of cash inflows = $145,000/(.11 – .04)

PV of cash inflows = $2,071,428.57

NPV is the PV of the inflows minus the PV of the outflows, so the NPV is:

NPV = –$1,900,000 + 2,071,428.57

NPV = $171,428.57

The NPV is positive, so we would accept the project.

b. Here we want to know the minimum growth rate in cash flows necessary to accept the project. The minimum growth rate is the growth rate at which we would have a zero NPV. The equation for a zero NPV, using the equation for the PV of a growing perpetuity, is:

0 = –$1,900,000 + $145,000/(.11 – g)

Solving for g, we get:

g = .0337, or 3.37%

Q26: The IRR of the project is:

$59,000 = $34,000/(1 + IRR) + $39,000/(1 + IRR)^2

Using a spreadsheet, financial calculator, or trial and error to find the root of the equation, we find that:

IRR = 15.07%

At an interest rate of 12 percent, the NPV is:

NPV = $59,000 – $34,000/1.12 – $39,000/1.12^2

NPV = –$2,447.70

At an interest rate of zero percent, we can add cash flows, so the NPV is:

NPV = $59,000 – $34,000 – $39,000

NPV = –$14,000

And at an interest rate of 24 percent, the NPV is:

NPV = $59,000 – $34,000/1.24 – $39,000/$1.24^2$

NPV = $6,216.44

The cash flows for the project are unconventional. Since the initial cash flow is positive and the remaining cash flows are negative, the decision rule for IRR is invalid in this case. The NPV profile is upward sloping, indicating that the project is more valuable when the interest rate increases.

3. Which one of the following methods of project analysis is defined as computing the value of a project based upon the present value of the project's anticipated cash flows?
A. constant dividend growth model
B. discounted cash flow valuation
C. average accounting return
D. expected earnings model
E. internal rate of return

4. The length of time a firm must wait to recoup the money it has invested in a project is called the:
A. internal return period.
B. payback period.
C. profitability period.
D. discounted cash period.
E. valuation period.

5. The length of time a firm must wait to recoup, in present value terms, the money it has in invested in a project is referred to as the:
A. net present value period.
B. internal return period.
C. payback period.
D. discounted profitability period.
E. discounted payback period.

6. There are two distinct discount rates at which a particular project will have a zero net present value. In this situation, the project is said to:
A. have two net present value profiles.
B. have operational ambiguity.
C. create a mutually exclusive investment decision.
D. produce multiple economies of scale.
E. have multiple rates of return.

7. If a firm accepts Project A it will not be feasible to also accept Project B because both projects would require the simultaneous and exclusive use of the same piece of machinery. These projects are considered to be:
A. independent.
B. interdependent.
C. mutually exclusive.
D. economically scaled.
E. operationally distinct.

8. Which one of the following will decrease the net present value of a project?
A. increasing the value of each of the project's discounted cash inflows
B. moving each of the cash inflows back to a later time period
C. decreasing the required discount rate
D. increasing the project's initial cost at time zero
E. increasing the amount of the final cash inflow

9. Rossiter Restaurants is analyzing a project that requires $180,000 of fixed assets. When the project ends, those assets are expected to have an aftertax salvage value of $45,000. How is the $45,000 salvage value handled when computing the net present value of the project?
A. reduction in the cash outflow at time zero
B. cash inflow in the final year of the project
C. cash inflow for the year following the final year of the project
D. cash inflow prorated over the life of the project
E. not included in the net present value

10. Which one of the following increases the net present value of a project?
A. an increase in the required rate of return
B. an increase in the initial capital requirement
C. a deferment of some cash inflows until a later year
D. an increase in the aftertax salvage value of the fixed assets
E. a reduction in the final cash inflow

11. Which of the following are advantages of the payback method of project analysis?
I. works well for research and development projects
II. liquidity bias
III. ease of use
IV. arbitrary cutoff point
A. I and II only
B. I and III only
C. II and III only
D. II and IV only
E. II, III, and IV only

12. Samuelson Electronics has a required payback period of three years for all of its projects. Currently, the firm is analyzing two independent projects. Project A has an expected payback period of 2.8 years and a net present value of $6,800. Project B has an expected payback period of 3.1 years with a net present value of $28,400. Which projects should be accepted based on the payback decision rule?
A. Project A only
B. Project B only
C. Both A and B
D. Neither A nor B
E. Answer cannot be determined based on the information given.

13. Which one of the following is an advantage of the average accounting return method of analysis?
A. easy availability of information needed for the computation
B. inclusion of time value of money considerations
C. the use of a cutoff rate as a benchmark
D. the use of pre-tax income in the computation
E. use of real, versus nominal, average income

14. Which one of the following statements related to the internal rate of return (IRR) is correct?
A. The IRR yields the same accept and reject decisions as the net present value method given mutually exclusive projects.
B. A project with an IRR equal to the required return would reduce the value of a firm if accepted.
C. The IRR is equal to the required return when the net present value is equal to zero.
D. Financing type projects should be accepted if the IRR exceeds the required return.
E. The average accounting return is a better method of analysis than the IRR from a financial point of view.

15. Tedder Mining has analyzed a proposed expansion project and determined that the internal rate of return is lower than the firm desires. Which one of the following changes to the project would be most expected to increase the project's internal rate of return?
A. decreasing the required discount rate
B. increasing the initial investment in fixed assets
C. condensing the firm's cash inflows into fewer years without lowering the total amount of those inflows
D. eliminating the salvage value
E. decreasing the amount of the final cash inflow

16. The profitability index is most closely related to which one of the following?
A. payback
B. discounted payback
C. average accounting return
D. net present value
E. modified internal rate of return

17. Which one of the following methods of analysis provides the best information on the cost-benefit aspects of a project?
A. net present value
B. payback
C. internal rate of return
D. average accounting return
E. profitability index

18. You are considering a project with conventional cash flows and the following characteristics:

Internal rate of return	11.63 percent
Profitability ratio	1.04
Net present value	$987
Payback period	2.98 years

Which of the following statements is correct given this information?
I. The discount rate used in computing the net present value was less than 11.63 percent.
II. The discounted payback period must be more than 2.98 years.
III. The discount rate used in the computation of the profitability ratio was 11.63 percent.
IV. This project should be accepted as the internal rate of return exceeds the required return.
A. I and II only
B. III and IV only
C. I, II, and IV only
D. II, III, and IV only
E. I, II, III, and IV

19. A project will produce cash inflows of $3,200 a year for 4 years with a final cash inflow of $5,700 in year 5. The project's initial cost is $9,500. What is the net present value of this project if the required rate of return is 16 percent?
A. -$311.02
B. $2,168.02
C. $4,650.11
D. $9,188.98
E. $21,168.02

$$NPV = -\$9,500 + \left\{\$3,200 \times \left[\frac{1 - \frac{1}{(1+0.16)^4}}{0.16}\right]\right\} + \frac{\$5,700}{(1+0.16)^5} = \$2,168.02$$

20. An investment has the following cash flows and a required return of 13 percent. Based on IRR, should this project be accepted? Why or why not?

Year	Cash Flow
0	-$42,000
1	16,500
2	28,400
3	7,500

A. No; The IRR exceeds the required return by about 0.06 percent.
B. No; The IRR is less than the required return by about 0.94 percent.
C. Yes; The IRR exceeds the required return by about 0.06 percent.
D. Yes; The IRR exceeds the required return by about 0.94 percent.
E. Yes; The IRR is less than the required return by about 0.06 percent.

$$0 = -\$42,000 + \frac{\$16,500}{1+IRR} + \frac{\$28,400}{(1+IRR)^2} + \frac{\$7,500}{(1+IRR)^3}$$

21. You are considering two independent projects with the following cash flows. The required return for both projects is 16 percent. Given this information, which one of the following statements is correct?

Year	Project A	Project B
0	-$125,000	-$135,000
1	46,000	50,000
2	79,000	30,000
3	51,000	110,000

A. You should accept Project A and reject Project B based on their respective NPVs.
B. You should accept Project B and reject Project A based on their respective NPVs.
C. You should accept Project A and reject Project B based on their respective IRRs.
D. You should accept Project B and reject Project A based on their respective IRRs.
E. You should accept both projects based on both the NPV and IRR decision rules.

$$NPV_A = -\$125,000 + \frac{\$46,000}{1.16} + \frac{\$79,000}{1.16^2} + \frac{\$51,000}{1.16^3} = \$6,038.58$$

$$NPV_B = -\$135,000 + \frac{\$50,000}{1.16} + \frac{\$30,000}{1.16^2} + \frac{\$110,000}{1.16^3} = \$870.68$$

$$IRR_A = 0 = -\$125,000 + \frac{\$46,000}{1+IRR} + \frac{\$79,000}{(1+IRR)^2} + \frac{\$51,000}{(1+IRR)^3}$$

$$IRR_B = 0 = -\$135,000 + \frac{\$50,000}{1+IRR} + \frac{\$30,000}{(1+IRR)^2} + \frac{\$110,000}{(1+IRR)^3}$$

22. Blue Water Systems is analyzing a project with the following cash flows. Should this project be accepted based on the discounting approach to the modified internal rate of return if the discount rate is 14 percent? Why or why not?

Year	Cash Flow
0	-$236,000
1	137,400
2	189,300
3	-25,000

A. Yes; The MIRR is 13.48 percent.
B. Yes; The MIRR is 17.85 percent.
C. Yes; The MIRR is 21.23 percent.
D. No; The MIRR is 5.73 percent.
E. No; The MIRR is 17.85 percent.

The modified cash flows will be:

Time	Cash flow
0	-$236,000 + (-$25,000/1.14^3) = -$252,874.29
1	137,400
2	189,300
3	0

$$IRR = 0 = -\$252,874.29 + \frac{\$137,400}{1+IRR} + \frac{\$189,300}{(1+IRR)^2}$$

23. What is the profitability index for an investment with the following cash flows given a 14.5 percent required return?

Year	Cash Flow
0	-$46,500
1	$12,200
2	$38,400
3	$11,300

A. 0.94
B. 0.98
C. 1.02
D. 1.06
E. 1.11

$$PV_{inflows} = \frac{\$12,200}{(1.145)^1} + \frac{\$38,400}{(1.145)^2} + \frac{\$11,300}{(1.145)^3} = \$47,472.78$$

PI =$47,472.78/$46,500 = 1.02

24. You are analyzing the following two mutually exclusive projects and have developed the following information. What is the crossover rate?

Year	Project A Cash Flow	Project B Cash Flow
0	-$75,000	-$75,000
1	$24,800	$22,000
2	$29,500	$27,500
3	$45,300	$51,300

A. 13.17 percent
B. 13.33 percent
C. 14.32 percent
D. 14.96 percent
E. 15.20 percent

Year	Project A Cash Flow	Project B Cash Flow	Difference
0	-$75,000	-$75,000	$0
1	$24,800	$22,000	$2,800
2	$29,500	$27,500	$2,000
3	$45,300	$51,300	-$6,000