

FIN5FMA – FINANCIAL MANAGEMENT

Tutorial 1 - Solutions

1. a. Explain the following investment appraisal techniques and discuss their decision criteria.

- Net Present Value
- Payback Period
- Internal rate of return

b. Discuss advantages and disadvantages associated with the above techniques.

Technique	Definition	Criteria for acceptance
NPV	Net present value is the difference between the sum of the present values of project's future cash flows and the initial cost of the project.	Accept a project if the NPV is greater than zero.
Payback Period	The time to recover the initial investment	Accept if the payback period is less than the cut off /prescribed time.
Internal Rate of Return	The discount rate that makes the NPV equal to zero.	Accept the project if the IRR is greater than the project's cost of capital for independent projects

Technique	Advantages	Disadvantages/problems
NPV	• Accepting positive NPV projects benefits shareholders • The value of the firm rises by the NPV of the project • Time value of cash flows is taken into consideration.	
Payback Period	• Easy to calculate and understand • Adjust for uncertainty of later cash flows	• Ignores the time value of money • Requires an arbitrary cut off point • Ignores cash flows beyond the cut-off date • Biased against long-term projects, such as research and development
IRR	• Consider the time value of money • All cash flows are taken into consideration	• Problem to calculate manually • Does not distinguish between investing and financing • Multiple IRR • no IRR is possible • Problem specific to mutually exclusive projects.

2.

Mario Brothers, a game manufacturer, has a new idea for an adventure game. It can market the game either as a traditional board game or as an interactive DVD, but not both. Consider the following cash flows of the two mutually exclusive projects for Mario Brothers. Assume the discount rate for Mario Brothers is 10 percent.

Year	Board Game	DVD
0	-\$750	-\$1,800
1	600	1,300
2	450	850
3	120	350

- Based on the payback period rule, which project should be chosen?
- Based on the NPV, which project should be chosen?
- Based on the IRR, which project should be chosen?
- Based on the incremental IRR, which project should be chosen?

a. Payback period

Board Game: - 1.33 years

DVD:- 1.59 Years

Accept board game as it pays back sooner.

b. NPV Board game:
$$-750 + \frac{600}{(1.1)} + \frac{450}{(1.1)^2} + \frac{120}{(1.1)^3} = \$257.51$$

NPV DVD:
$$-1800 + \frac{1300}{(1.1)} + \frac{850}{(1.1)^2} + \frac{350}{(1.1)^3} = \$347.26$$

Accept DVD as it has higher NPV.

c. IRR : Board game = 33.79

(Using a financial calculator: Input CF0 = -750, CF1 = 600, CF2 = 450, CF3 = 120 and compute IRR)

IRR: DVD = 23.31

Choose Board game as it has the higher IRR.

Since the IRR of the board game is greater than the IRR of the DVD, IRR implies we choose the board game. Note that this is the choice when evaluating only the IRR of each project. The IRR decision rule is flawed because there is a scale problem. That is, the DVD has a greater initial investment than does the board game. This problem is corrected by calculating the IRR of the incremental cash flows, or by evaluating the NPV of each project.

d. To calculate the incremental IRR, we subtract the smaller project's cash flows from the larger project's cash flows. In this case, we subtract the board game cash flows from the DVD cash flows. The incremental IRR is the IRR of these incremental cash flows. So, the incremental cash flows of the DVD are:

Year		Incremental cash flow
0	-1800--750	-1050
1	1300-600	700
2	850-450	400
3	350-120	230

Setting the present value of these incremental cash flows equal to zero, we find that the incremental IRR is:

$$0 = C_0 + C_1 / (1 + \text{IRR}) + C_2 / (1 + \text{IRR})^2 + C_3 / (1 + \text{IRR})^3$$

$$0 = -\$1,050 + \$700 / (1 + \text{IRR}) + \$400 / (1 + \text{IRR})^2 + \$230 / (1 + \text{IRR})^3$$

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

$$\text{IRR} = 15.86$$

Accept the larger project when the incremental IRR is greater than the discount rate. Since the incremental IRR, 15.86%, is greater than the required rate of return of 10 percent, choose the DVD project.

3.

Hanmi Group, a consumer electronics conglomerate, is reviewing its annual budget in wireless technology. It is considering investments in three different technologies to develop wireless communication devices. Consider the following cash flows of the three independent projects for Hanmi. Assume the discount rate for Hanmi is 10 percent. Further, Hanmi Group has only \$20 million to invest in new projects this year.

Project	CDMA	G4	Wi-Fi
Year 0	\$(8,000,000)	\$(12,000,000)	\$(20,000,000)
1	11,000,000	10,000,000	18,000,000
2	7,500,000	25,000,000	32,000,000
3	2,500,000	20,000,000	20,000,000

- Based on the profitability index decision rule, rank these investments.
- Based on the NPV, rank these investments.
- Based on your findings in (a) and (b), what would you recommend to the CEO of Hanmi Group and why?

Profitability Index = PV of future cash flows/ Initial investment

CDMA:

$$\text{PV of cash flows} = \frac{11,000,000}{(1.1)} + \frac{7,500,000}{(1.1)^2} + \frac{2,500,000}{(1.1)^3} = 18,076,640$$

$$\text{Profitability index: } 18,076,640 / 8,000,000 = 2.26$$

G4:

$$\text{PV of cash flows} = \frac{10,000,000}{(1.1)} + \frac{25,000,000}{(1.1)^2} + \frac{20,000,000}{(1.1)^3} = 44,778,362.13$$

$$\text{Profitability index: } 44,778,362.13 / 12,000,000 = 3.73$$

Wi-Fi:

$$\text{PV of cash flows} = \frac{18,000,000}{(1.1)} + \frac{32,000,000}{(1.1)^2} + \frac{20,000,000}{(1.1)^3} = 57,836,213.37$$

$$\text{Profitability index: } 57,836,213.37 / 20,000,000 = 2.89$$

Ranking: G4 has the highest profitability index; 2nd highest Wi-Fi; Last CDMA.

NPV:

$$\text{CDMA} = -8,000,000 + \frac{11,000,000}{(1.1)} + \frac{7,500,000}{(1.1)^2} + \frac{2,500,000}{(1.1)^3} = \$ 10,076,634.11$$

$$\text{G4} = -12,000,000 + \frac{10,000,000}{(1.1)} + \frac{25,000,000}{(1.1)^2} + \frac{20,000,000}{(1.1)^3} = \$ 32,778,362.13$$

$$\text{Wi-Fi} = -20,000,000 + \frac{18,000,000}{(1.1)} + \frac{32,000,000}{(1.1)^2} + \frac{20,000,000}{(1.1)^3} = \$ 37,836,213.37$$

Wi-Fi has the highest NPV. 2nd highest G4, 3rd CDMA.

Capital Rationing

However, when you have limited amount of money for investment, in this case you have 20M to invest, you can choose either Wi-Fi or both G4 and CDMA. Which one you will choose?

Choosing G4 & CDMA - combined NPV is \$42.8M

Choosing Wi-Fi - NPV is \$37.8M

Given the constraints on the amount of capital available choose G4 & CDMA