

Chapter 9 - SOLUTIONS TO PROBLEMS ASSIGNED

(Note: This doc is both the check figures and the complete solution for Chapter 9 HW.)

Note to students: In problems involving the internal rate of return calculation, a financial calculator has been used.

ST 9-1 Solution is in the back of the textbook.

To illustrate, for part a, the payback period should be:

Project M:

$$= 2 + (\text{Amount yet needed} / \text{Next Year's Cash Flow})$$

$$= 2 + (8500 / 10000)$$

$$= \underline{2.85} \text{ years}$$

Project N:

$$= 2 + (\text{Amount yet needed} / \text{Next Year's Cash Flow})$$

$$= 2 + (6000 / 9000)$$

$$= \underline{2.67} \text{ years}$$

9-2 Payback Comparisons

Standard: 5 years.

a.

Project 1			Project 2		
Year	Cash Inflows	Investment Balance or Cumulative Cash Flows	Year	Cash Inflows	Investment Balance
0		—\$14,000	0		—\$21,000
1	\$3,000	\$3,000	1	\$4,000	4,000
2	\$3,000	\$6,000	2	\$4,000	8,000
3	\$3,000	\$9,000	3	\$4,000	12,000
4	\$3,000	\$12,000	4	\$4,000	16,000
5	\$3,000	\$15,000	5	\$4,000	20,000
6	\$3,000	\$18,000	6	\$4,000	24,000
7	\$3,000	\$21,000	7	\$4,000	28,000

Etc...out to 20 years.

Project 1 Payback occurs in Year 5. Exact payback period equals:

$$= 4 + (\text{Amount Yet Needed} / \text{Next Year's CF})$$

$$= 4 + (14,000—12,000) / 3,000$$

$$= 4 + 2,000/3,000$$

$$= \underline{4.67} \text{ years}$$

Since this is less than 5 years, this is an acceptable project. However, to make our final decision, we must recognize that this is a choice between two alternatives, so a mutually exclusive investment decision. After looking at Project 2's payback, we'll choose the best (if at least one is acceptable).

Project 2 Payback occurs in Year 6. Exact payback period equals:

$$\begin{aligned} &= 5 + (\text{Amount Yet Needed} / \text{Next Year's CF}) \\ &= 5 + (21,000 - 20,000) / 4,000 \\ &= 5 + 1,000/4,000 \\ &= \underline{5.25 \text{ years}} \end{aligned}$$

On its own merits, Project 2 is *not acceptable* since it does not pay back within 5 years.

b. If **independent** projects, that is, considered on their own merits, Project 1 is acceptable but Project 2 is not.

c. **The company should select PROJECT 1.** Yes, it is better than 2, but since 2 is unacceptable based on the payback standard, it is the only acceptable project.

d. Yes, Project 2's post-payback cash flows are significantly better than Project 1's. Also, on what basis was the 5 year standard selected by management? We have no way of knowing whether that coincides with shareholder wealth maximization (SWM), which is the primary financial goal of the firm.

9-4 NPV for Varying Cost of Capital (shows decreasing NPV as discount rate increases due to higher capital cost or due to higher perceived risk)

- a. Cost of capital = 10 % (I/YR) Calculator solution: \$2,674.63
Accept; positive NPV
- b. Cost of capital = 12 % Calculator solution: \$838.20
Accept; positive NPV
- c. Cost of capital = 14% Calculator solution: — \$805.68
Reject; negative NPV

9-5 NPV – Independent Projects (all with 14% cost of capital, enter as I/YR)

Project A NPV

Calculator solution: — \$5,135.54
Reject

Project B NPV

NPV = Calculator solution: \$53,887.93
Accept

Project C NPV

Calculator solution: — \$83,668.24
Reject

Project D NPV

Calculator solution: \$116,938.70

Accept

Project E NPV

Calculator solution: \$9,963.63

Accept

9-7 NPV–Mutually Exclusive Projects (cost of capital = 15%)

a. & b.

<u>Drill Press</u>	<u>NPV</u>
A	NPV = Calculator solution: —\$4,228.21 Reject IF it was an independent project.
B	NPV = Calculator solution: \$2,584.33 Accept IF it was an independent
C	NPV = Calculator solution: \$15,043.88 Accept IF it was an independent project.

Now, since these are actually **competing**, or **mutually exclusive**, projects, we have to do a second step in which we rank them from best to worst (and then select the best, assuming at least one is acceptable when considered as if it were an independent project).

c. **Ranking - using NPV as criterion**

<u>Rank</u>	<u>Press</u>	<u>NPV</u>
1	C	\$15,044
2	B	2,584
3	A	- 4,228

9-9 Internal Rate of Return

IRR is found by solving:

$$\$0 = \sum_{t=1}^n \left[\frac{CF_t}{(1 + IRR)^t} \right] - \text{Initial Investment}$$

It can be computed by using a financial calculator.

[] C ALL

1 [] P/YR

Enter II as a negative (do +/-) then press [CF_j] key

Enter each following year's OCI with its correct sign (normally positive), then press [CF_j] key.

For the last year, you *may* have to add Terminal Value to OCI to get the summed cash flow before pressing [CF_j].

Press [] IRR to get the IRR.

Project A

Calculator solution: 17.43%

The firm's maximum cost of capital for project acceptability would be 17.43%.

Project B

Calculator solution: IRR = 8.62%

The firm's maximum cost of capital for project acceptability would be 8.62%.

Project C

Calculator solution: IRR = 25.41%

The firm's maximum cost of capital for project acceptability would be 25.41%.

Project D

Calculator solution: IRR = 21.16%

The firm's maximum cost of capital for project acceptability would be 21.16%.

P9-10 IRR—Mutually Exclusive Projects

- X IRR = 15.67% so 16% rounded to nearest integer.
Y IRR = 17.29% so 17% rounded to nearest integer.
- X and Y both acceptable based on IRRs.
- Y higher, so Y is preferred. We would implement **only Y** since these (X and Y) are **competing**, or **mutually exclusive** projects.

P9-12 NPV and IRR

- NPV = \$1,223.68
- IRR = 12.01%
- Accept (both because NPV ≥ 0 and IRR ≥ 10% cost of capital)

P9-17 Integrative – Complete Investment Decision

(a) Initial investment:

Installed cost of new press =		
Cost of new press		\$2,200,000
– After-tax proceeds from sale of old asset		
Proceeds from sale of existing press	1,200,000	
– Taxes on sale of existing press *	<u>480,000</u>	
Total after-tax proceeds from sale		<u>(720,000)</u>
Initial investment		<u>\$1,480,000</u>

* Book value = \$0
 (SP – BV) = \$1,200,000 – \$0 = \$1,200,000 income from sale of existing press
 Tax Owed = 0.40 × \$1,200,000 = \$480,000

(b)

Calculation of Operating Cash Flows

Year	Revenues	Expenses	Depreciation	Net Profits Before Taxes	Taxes	Net Profits After Taxes	Cash Flow
1	\$1,600,000	\$800,000	\$440,000	\$360,000	\$144,000	\$216,000	\$656,000
2	1,600,000	800,000	704,000	96,000	38,400	57,600	761,600
3	1,600,000	800,000	418,000	382,000	152,800	229,200	647,200
4	1,600,000	800,000	264,000	536,000	214,400	321,600	585,600
5	1,600,000	800,000	264,000	536,000	214,400	321,600	585,600
6	0	0	110,000	–110,000	–44,000	–66,000	44,000

(c) Payback period = 2 years + (\$62,400 / \$647,200) = 2.1 years

(d) PV of cash inflows:

Year	CF	PVIF _{11%,n}	PV
1	\$656,000	0.901	\$591,056
2	761,600	0.812	618,419
3	647,200	0.731	473,103
4	585,600	0.659	385,910
5	585,600	0.593	347,261
6	44,000	0.535	<u>23,540</u>
			<u>\$2,439,289</u>

Continued on next page.

HP 10-BII Calculator keystrokes:

[] C ALL
1 [] P/YR
1480000 [+/-] [CFj]
656000 [CFj]
761600 [CFj]
647200 [CFj]
585600 [CFj]
585600 [CFj]
44000 [CFj]
11 [I/YR]
Press [] NPV => \$959,151.85
Press [] IRR => 35.04%

[Note: Below you can see how to do this if you would not have a financial calculator. The numbers are off slightly due to rounding]

NPV = PV of cash inflows – Initial investment

$$\text{NPV} = \$2,439,289 - \$1,480,000$$

$$\text{NPV} = \$959,289$$

As compared to the

Calculator solution: \$959,151.85

How would you calculate IRR if you did not have a financial calculator?

$$\$0 = \frac{\$656,000}{(1 + \text{IRR})^1} + \frac{\$761,600}{(1 + \text{IRR})^2} + \frac{\$647,200}{(1 + \text{IRR})^3} + \frac{\$585,600}{(1 + \text{IRR})^4} + \frac{\$585,600}{(1 + \text{IRR})^5} + \frac{\$44,000}{(1 + \text{IRR})^6} - \$1,480,000$$

IRR = 35%, roughly

As compared to the

Calculator solution: 35.04%

- (e) The NPV is a positive \$959,152 and the IRR of 35% is well above the cost of capital of 11%. Based on both decision criteria, the project should be accepted.