Chapter 5

5-1

Year	Beginning BV	Dep	Ending BV	Average BV	Revenues	COGS	EBIT	EBIT (1-t)
1	25	3	22	23.5	$ 20.00	$ 10.00	$ 7.00	$ 4.20
2	22	3	19	20.5	$ 22.00	$ 11.00	$ 8.00	$ 4.80
3	19	3	16	17.5	$ 24.20	$ 12.10	$ 9.10	$ 5.46
4	16	3	13	14.5	$ 26.62	$ 13.31	$10.31	$ 6.19
5	13	3	10	11.5	$ 29.28	$ 14.64	$11.64	$ 6.98

a. Pre-tax Return on Capital

Year	Average BV	EBIT	Pre-tax ROC
1	23.5	$ 7.00	29.79%
2	20.5	$ 8.00	39.02%
3	17.5	$ 9.10	52.00%
4	14.5	$10.31	71.10%
5	11.5	$11.64	101.23%
Average			58.63%

b.

Year	Average BV	EBIT (1-t)	After-tax ROC
1	23.5	$ 4.20	17.87%
2	20.5	$ 4.80	23.41%
3	17.5	$ 5.46	31.20%
4	14.5	$ 6.19	42.66%
5	11.5	$ 6.98	60.74%
Average			35.18%

c. Since the return on capital is greater than the cost of capital, I would accept the project.

5-2

Year	Beginning BV	Depr	Ending BV	Average BV	Revenues	COGS	EBIT	EBIT (1-t)
1	$ 25.00	$ 6.00	$ 19.00	$ 22.00	$ 20.00	$ 10.00	$ 4.00	$ 2.40
2	$ 19.00	$ 3.60	$ 15.40	$ 17.20	$ 22.00	$ 11.00	$ 7.40	$ 4.44
3	$ 15.40	$ 2.16	$ 13.24	$ 14.32	$ 24.20	$ 12.10	$ 9.94	$ 5.96
4	$ 13.24	$ 2.00	$ 11.25	$ 12.24	$ 26.62	$ 13.31	$ 11.32	$ 6.79
5	$ 11.25	$ 2.00	$ 9.25	$ 10.25	$ 29.28	$ 14.64	$ 12.65	$ 7.59

a. Pre-tax Return on Capital

Year	Average BV	EBIT	Pre-tax ROC
1	$ 22.00	$ 4.00	18.18%

2	$ 17.20	$ 7.40	43.02%
3	$ 14.32	$ 9.94	69.41%
4	$ 12.24	$11.32	92.42%
5	$ 10.25	$12.65	123.41%
Average			69.29%

b.			
Year	Average BV	EBIT (1-t)	After-tax ROC
1	$ 22.00	$ 2.40	10.91%
2	$ 17.20	$ 4.44	25.81%
3	$ 14.32	$ 5.96	41.65%
4	$ 12.24	$ 6.79	55.45%
5	$ 10.25	$ 7.59	74.04%
Average			41.57%

c. Since the return on capital is greater than the cost of capital, I would accept the project.

5-3

Year	Beg BV Equity	Depr	End BV Equity	Avg BV Equity	Revenues	COGS	Int Exp	Taxable Inc.	Net Income
1	$ 15.00	$ 3.00	$ 12.00	$13.50	$ 20.00	$ 10.00	$ 1.00	$ 6.00	$ 3.60
2	$ 12.00	$ 3.00	$ 9.00	$10.50	$ 22.00	$ 11.00	$ 1.00	$ 7.00	$ 4.20
3	$ 9.00	$ 3.00	$ 6.00	$ 7.50	$ 24.20	$ 12.10	$ 1.00	$ 8.10	$ 4.86
4	$ 6.00	$ 3.00	$ 3.00	$ 4.50	$ 26.62	$ 13.31	$ 1.00	$ 9.31	$ 5.59
5	$ 3.00	$ 3.00	$ -	$ 1.50	$ 29.28	$ 14.64	$ 1.00	$10.64	$ 6.38

a.

Year	Avge BV Equity	Net Income	ROE
1	13.5	$ 3.60	26.67%
2	10.5	$ 4.20	40.00%
3	7.5	$ 4.86	64.80%
4	4.5	$ 5.59	124.13%
5	1.5	$ 6.38	425.64%
Average			136.25%

b. Since the return on equity is greater than the cost of equity, I would accept the project.

5-4

a. False. If you pay a higher interest rate on debt than you earn as a return on capital, your return on equity can be lower than your return on capital.
b. False. They can still both be higher than the cost of financing (capital, if you are using return on capital and equity, if you are using return on equity).
c. False. The first part of the statement is true, but the lower net income can be more than offset by a lower equity investment in the project, leading to a higher return on equity.
d. False. It will reduce earnings and returns at least in the near term. It will increasae cashflows.
e. True. Switching to accelerated depreciation will generally reduce the return on equity in the earlier periods but more than compensate by providing very high returns in the later years.

5-5. This will occur only if: 1) earnings are equal to cash flows to equity, i.e., there are no non-cash charges, working capital or cap ex., or 2) earnings are level over time.

5-6

Year	0	1	2	3	4	
Investment	15000		2000			
WC Investment	1000					
Salvage					7000	! Book value is salvaged
Revenues		$ 10,000	$11,000	$12,000	$13,000	
- COGS		$4,000	$ 4,400	$4,800	$ 5,200	
- Depreciation		$4,000	$ 3,000	$2,000	$ 1,000	
EBIT		$2,000	$ 3,600	$5,200	$ 6,800	
EBIT (1-t)		$1,200	$ 2,160	$3,120	$ 4,080	
+ Depreciation		$4,000	$ 3,000	$2,000	$ 1,000	
- Chg in WC		$ 100	$ 100	$ 100	$ (1,300)	
FCFF	$ (16,000)	$5,100	$ 3,060	$5,020	$13,380	

a. See above
b. Payback

Cumulated FCFF	$ (16,000)	$ (10,900)	$ (7,840)	$ (2,820)	$10,560

Payback is early in the fourth year.
c. NPV of Project at 12% cost of capital

PV of Cash flow	$ (16,000)	$4,554	$ 2,439	$3,573	$ 8,503
NPV of Project =		$ 3,069.35			
d. IRR of Project		19.26%			

5-7

Year	0	1	2	3	4
Investment	15000		2000		
WC Investment	1000				
- Debt Issued	6400		800		

+ Salvage					7000
Revenues		$ 10,000	$11,000	$12,000	$13,000
- COGS		$4,000	$ 4,400	$4,800	$ 5,200
- Depreciation		$4,000	$ 3,000	$2,000	$ 1,000
- Interest Exp.		$ 640	$ 644	$ 728	$ 732
Taxable Inc.		$1,360	$ 2,956	$4,472	$ 6,068
Net Income		$ 816	$ 1,774	$2,683	$ 3,641
+ Depreciation		$4,000	$ 3,000	$2,000	$ 1,000
- Chg in WC		$ 100	$ 100	$ 100	$ (1,300)
+ new Debt Issued		$ 40	$ 40	$ 40	
- Principal Repaid					$ 7,320
FCFE	$ (9,600)	$4,756	$ 3,514	$4,623	$ 5,621

a. See above
b. Payback

Cum. FCFE	$ (9,600)	$ (4,844)	$ (1,330)	$3,293	$ 8,914

Payback is shortly after the end of the second year
c. NPV

PV at 16%	$(9,600.0)	$ 4,100.00	$ 2,611.18	$ 2,961.89	$ 3,104.32

NPV = $3,177.38
d. The IRR is 31.26%; hence I would accept the project, since IRR > cost of equity of 16%.

5-8

Year	FCFF
0	$ (10,000,000)
1	$ 4,000,000
2	$ 5,000,000
3	$ 6,000,000

Discount Rate	NPV
2%	$4,381,347
4%	$3,802,913
6%	$3,261,283
8%	$2,753,391
10%	$2,276,484
12%	$1,828,079
14%	$1,405,939
16%	$1,008,036
18%	$632,538
20%	$277,778
22%	($57,758)
24%	($375,449)

26%	($676,553)
28%	($962,219)
30%	($1,233,500)

The internal rate of return of this project is about 21%. I would accept the project because its return is greater than the cost of capital. (The cost of equity does not apply)

5-9

Year	FCFE
0	-4750000
1	4000000
2	4000000
3	-3000000

Discount Rate	NPV
2%	$189,277
4%	$127,390
6%	$64,713
8%	$1,562
10%	($61,796)
12%	($125,137)
14%	($188,273)
16%	($251,046)
18%	($313,324)
20%	($375,000)
22%	($435,983)
24%	($496,199)
26%	($555,589)
28%	($614,105)
30%	($671,711)

The IRR for this project is roughly 9%. Hence I would not accept the project, since the IRR < cost of equity.

5-10

FV of year 1 cash flow = 4000000* 1.10^2 = 4840000
FV of year 2 cash flow = 5000000* 1.10 = 5500000
FV of year 3 cash flow = 6000000
FV of years 1-3 cash flows = 16340000
Investment in year 0 = -1000000
Modified IRR = $(16340000/1000000)^{1/3} - 1 = 17.78\%$
I would still accept the project

5-11

Year	A	B

0	-4000000	-4000000	
1	2000000	1000000	
2	1500000	1500000	
3	1250000	1700000	
4	1000000	2400000	
a. NPV =	$680,008	$1,065,228	! Project B is better
b. IRR =	18.71%	20.19%	! Project B is still better

c. NPV assumes that you can reinvest at 10%; IRR assumes reinvestment at IRR.
d. Modified IRR Calculation

Year	A	FV of Cash Flow	B	FV of Cash Flow
0	$ (4,000,000)		$ (4,000,000)	
1	$ 2,000,000	$ 2,662,000	$ 1,000,000	$ 1,331,000
2	$ 1,500,000	$ 1,815,000	$ 1,500,000	$ 1,815,000
3	$ 1,250,000	$ 1,375,000	$ 1,700,000	$ 1,870,000
4	$ 1,000,000	$ 1,000,000	$ 2,400,000	$ 2,400,000
		6852000		7416000
MIRR		14.40%		16.69%

5-12
Generally not. Because you need a sign change (from negative to positive cash flows) for IRR to be estimated. It is possible that you could still get an operating cash flow that is negative in some year, but the IRR will be huge and meaningless.

5-13

Again, generally yes. The principle that all positive NPV projects should be taken does not apply if there are severe capital rationing constraints. In those cases, you want to get the highest return you can on your limited capital budget.

5-14

Year	A	B	C	
0	-10000	5000	-15000	
1	8000	5000	10000	
2	7000	-8000	10000	
a. NPV	$2,723.21	$3,086.73	$1,900.51	! B is the best project on a NPV basis
b. IRR	32.74%	-13.99%	21.53%	! A is the best project on an IRR basis

c. The reasons can be partially attributed to differences in scale, and difference in reinvestment rate assumptions. The strange pattern of cash flows on B also throws off the IRR rule. The IRR rule is devised with the idea that cash flows go from negative to positive, not the other way around.

5-15

a. NPV = -10 million + 2*1.05/(.10-.05) =$32
b. IRR of this project =
-10 + 2(1.05)/(r-.05) = 0
Solve for r,
r = 26%

5-16

a. FCFF each year = 3 (1-.4) + .5 = 2.30
NPV = $-20 - 5/1.125^{10} - 5/1.125^{20} + 2.3$ (PVA, 12.5%,30) $+ 15/1.125^{30} =$ -$3.71
b. IRR of this project

Discount Rate	NPV
5%	13.87328541
10%	-0.129403014
12.50%	-3.713174369
15%	-6.213125943

! IRR is close to 10%
The additional investments may create more than one sign change

5-17

Year	Cash Flow	Discount Rate		Cumulated Rate	
0	-15000	9.50%	$ (15,000)	1.00	! No
1	5000	10.50%	$ 4,525	1.105	!1.
2	5000	11.50%	$ 4,058	1.232075	! 1.
3	10000	12.50%	$ 7,215	1.386084375	! 1.

a. NPV = $ 798
b. IRR =13.94%
You would have to compare the IRR to the geometric average of the discount rates over the 3 periods. The geometric average is $1.38608^{1/3}-1 = 11.5\%$
Take the project

5-18

Yes. When the cash flow pattern is reversed, i.e., when cash flows are positive up front and negative later can be negative while the NPV is positive. (See problem 14)

5-19

a. NPV = $-50 + 5$ (PVA, 10%, 20 years) $- 20/1.1^{10} =$ -$15.14
b.

Discount Rate	NPV
2%	$ 15.35
4%	$ 4.44
6%	$ (3.82)
8%	$ (10.17)
10%	$ (15.14)

IRR is about 5%

12%	$ (19.09)
14%	$ (22.28)
16%	$ (24.89)
18%	$ (27.06)
20%	$ (28.88)

c. The IRR is about 5%. The fact that there are two sign changes may lead to two IRRS.

5-20

The average return on capital is overstated when accelerated depreciation is used because the book value o
drops quickly. The return on capital increases concurrently. The average return on capital is not time-weig
and overstates the true return on the project.

5-21

a. If cash flows are equal to accounting earnings
b. The earnings are level over time.