Pts	IRR for simple flows or increments

10   7.14 An investor bought 100 shares of stock at a cost of $10 per share. He held the stock for 15 years and then sold it for a total of $4,000. For the first three years, he received no dividends. For each of the next seven years, he received total dividends of $50 per year. For the remaining period, he received total dividends of $100 a year. What rate of return did he make on the investment?

$PW(i) = -\$1000 + (\$50(F/A,i\%,12)+\$50(F/A,i\%,5)+\$4,000)]*(P/F,i\%,15)$
Set PW = 0, then solve for $\iota* = 12.08\%$, using EXCEL IRR function.

7.16 Consider the following projects

	Net Cash Flow			
n	A	B	C	D
0	-$1800	-$1900	-$2200	-$3000
1	$500	$800	$5600	$360
2	$100	$600	$4900	$4675
3	$100	$500	-$3000	$2288
4	$1000	$700	-$7000	
5			-$1400	
6			$2100	
7			$900	

5

    (a) Classify each project as either simple or nonsimple
       A, B, and D are simple (only one change in sign of cash flows), C is nonsimple.

20

    (b) Identify all positive i*s for each project by setting PW or FW or AEW = 0
       A: $-1800(F/P, i*,4)+500(F/P, i*,3)+100(F/P, i*,2)+100(F/P, i*,1)+1000=0$
       Project A: $\iota* = -1.9\%$
       B: $-1900(F/P, i*,4)+800(F/P, i*,3)+600(F/P, i*,2)+500(F/P, i*,1)+700=0$
       Project B: $\iota* = 14.4\%$
       For Project C, one approach is to use EXCEL IRR with different guesses for i:
       $=IRR(flow_0:flow_n$, guess for i*).
       Project C: $\iota* = 1.1\%, 201.\%$.
       D: $-3000(F/P, i*,3)+360(F/P, i*,2)+4675(F/P, i*, 1)+2288=0$
       Project D: $\iota* = 49.9\%$

20   7.39 A plant engineer is considering two types of solar water-heating systems:

Item	Model A	Model B
Initial Cost	$5,000	$7,000
Annual Savings	$700	$1,000
Annual Maintenance	$100	$50
Expected Life	20 years	20 years
Salvage Value	$400	$500

The firm's MARR is 10%. On the basis of the IRR criterion, decide which system is the better choice.

n	Cash flow for B-A	
0	-$2000	B:-7000-A:-5000
1-19	$350	B:950-A:600
20	$450	B:1450-A:1000

Set PW = -2000 + 350(P/A, i*, 19) + 450(P/F, i*, 20) = 0 and solve for i*
(i* = IRR for simple investments)
or use Excel IRR to find i* = IRR_{B-A} = 16.75% > MARR of 10%
So Model B is a better choice.

7.44 An electronic-circuit-board manufacturer is considering six mutually exclusive cost-reduction projects for its PC-board manufacturing plant. All have lives of 10 years and zero salvage values. The required investment, the estimated after-tax reduction in annual disbursements, and the gross rate of return are given for each alternative in the following table.

Proposed Aj	Req. Inv.	AT Savings	R. Return
A_1	$60,000	$22,000	34.8%
A_2	$100,000	$28,200	25.2%
A_3	$110,000	$32,600	26.9%
A_4	$120,000	$33,600	25.0%
A_5	$140,000	$38,400	24.3%
A_6	$150,000	$42,200	25.1%

The following rates of return are also given for some of the increments:
IRR $_{A2-A1}$ = 8.9%
IRR $_{A3-A2}$ = 42.7%
IRR $_{A4-A3}$ = 0.0%
IRR $_{A5-A4}$ = 20.2%
IRR $_{A6-A5}$ = 36.3%

25   Incremental analysis: As with B/C ratio, the projects can be considered in pairs in any order, although each increment must be an investment, not borrowing. The analysis below uses the given information first:

Increment of Investment	IRR	Decision
A2-A1	9% < 15%	Reject A2
A4-A3	0% < 15%	Reject A4
A6-A5	36% > 15%	Reject A5

We still have A1, A3 and A6 in the running, and the other given IRRs don't help us with these, so we must look at two more increments. The order is up to us, as long as we make sure the increment is an investment. The three remaining possible increments of investment to investigate are shown in the table below.

	A6-A3	A3-A1	A6-A1
Initial	-40000	-50000	-90000
Series	9600	10600	20200
	9600	10600	20200
	9600	10600	20200
	9600	10600	20200
	9600	10600	20200
	9600	10600	20200
	9600	10600	20200
	9600	10600	20200
	9600	10600	20200
	9600	10600	20200
IRR	20%	17%	18%

Continuing the incremental analysis (the following is only one possible way):

Increment of Investment	IRR	Decision
A3-A1	17% > 15%	Reject A1
A6-A3	20% > 15%	Reject A3 so choose A6

Choose A6!

80   (Total points)