CHAPTER 9
NET PRESENT VALUE AND OTHER INVESTMENT CRITERIA

Answers to Concepts Review and Critical Thinking Questions

1. 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.

2. If a project has a positive NPV for a certain discount rate, then it will also have a positive NPV for a zero discount rate; thus, the payback period must be less than the project life. Since discounted payback is calculated at the same discount rate as is NPV, if NPV is positive, the discounted payback period must be less than the project's life. If NPV is positive, then the present value of future cash inflows is greater than the initial investment cost; thus PI must be greater than 1. If NPV is positive for a certain discount rate R, then it will be zero for some larger discount rate R*; thus the IRR must be greater than the required return.

3. *a.* Payback period is simply the accounting break-even point of a series of cash flows. To actually compute the payback period, it is assumed that any cash flow occurring during a given period is realized continuously throughout the period, and not at a single point in time. The payback is then the point in time for the series of cash flows when the initial cash outlays are fully recovered. Given some predetermined cutoff for the payback period, the decision rule is to accept projects that payback before this cutoff, and reject projects that take longer to payback.

b. The worst problem associated with payback period is that it ignores the time value of money. In addition, the selection of a hurdle point for payback period is an arbitrary exercise that lacks any steadfast rule or method. The payback period is biased towards short-term projects; it fully ignores any cash flows that occur after the cutoff point.

c. Despite its shortcomings, payback is often used because (1) the analysis is straightforward and simple and (2) accounting numbers and estimates are readily available. Materiality considerations often warrant a payback analysis as sufficient; maintenance projects are another example where the detailed analysis of other methods is often not needed. Since payback is biased towards liquidity, it may be a useful and appropriate analysis method for short-term projects where cash management is most important.

4. *a.* The discounted payback is calculated the same as is regular payback, with the exception that each cash flow in the series is first converted to its present value. Thus discounted payback provides a measure of financial/economic break-even because of this discounting, just as regular payback provides a measure of accounting break-even because it does not discount the cash flows. Given some predetermined cutoff for the discounted payback period, the decision rule is to accept projects that whose discounted cash flows payback before this cutoff period, and to reject all other projects.

b. The primary disadvantage to using the discounted payback method is that it ignores all cash flows that occur after the cutoff date, thus biasing this criterion towards short-term projects. As a result, the method may reject projects that in fact have positive NPVs, or it may accept projects with large future cash outlays resulting in negative NPVs. In addition, the selection of a cutoff point is again an arbitrary exercise.

c. Discounted payback is an improvement on regular payback because it takes into account the time value of money. For conventional cash flows and strictly positive discount rates, the discounted payback will always be greater than the regular payback period.

5. *a.* The average accounting return is interpreted as an average measure of the accounting performance of a project over time, computed as some average profit measure attributable to the project divided by some average balance sheet value for the project. This text computes AAR as average net income with respect to average (total) book value. Given some predetermined cutoff for AAR, the decision rule is to accept projects with an AAR in excess of the target measure, and reject all other projects.

b. AAR is not a measure of cash flows and market value, but a measure of financial statement accounts that often bear little resemblance to the relevant value of a project. In addition, the selection of a cutoff is arbitrary, and the time value of money is ignored. For a financial manager, both the reliance on accounting numbers rather than relevant market data and the exclusion of time value of money considerations are troubling. Despite these problems, AAR continues to be used in practice because (1) the accounting information is usually available, (2) analysts often use accounting ratios to analyze firm performance, and (3) managerial compensation is often tied to the attainment of certain target accounting ratio goals.

6. *a.* NPV is simply the present value of a project's cash flows. NPV specifically measures, after considering the time value of money, the net increase or decrease in firm wealth due to the project. The decision rule is to accept projects that have a positive NPV, and reject projects with a negative NPV.

b. NPV is superior to the other methods of analysis presented in the text because it has no serious flaws. The method unambiguously ranks mutually exclusive projects, and can differentiate between projects of different scale and time horizon. The only drawback to NPV is that it relies on cash flow and discount rate values that are often estimates and not certain, but this is a problem shared by the other performance criteria as well. A project with NPV = $2,500 implies that the total shareholder wealth of the firm will increase by $2,500 if the project is accepted.

7. *a.* The IRR is the discount rate that causes the NPV of a series of cash flows to be identically zero. IRR can thus be interpreted as a financial break-even rate of return; at the IRR discount rate, the net value of the project is zero. The IRR decision rule is to accept projects with IRRs greater than the discount rate, and to reject projects with IRRs less than the discount rate.

b. IRR is the interest rate that causes NPV for a series of cash flows to be zero. NPV is preferred in all situations to IRR; IRR can lead to ambiguous results if there are non-conventional cash flows, and also ambiguously ranks some mutually exclusive projects. However, for stand-alone projects with conventional cash flows, IRR and NPV are interchangeable techniques.

c. IRR is frequently used because it is easier for many financial managers and analysts to rate performance in relative terms, such as "12%", than in absolute terms, such as "$46,000." IRR may be a preferred method to NPV in situations where an appropriate discount rate is unknown are uncertain; in this situation, IRR would provide more information about the project than would NPV.

8. *a.* The profitability index is the present value of cash inflows relative to the project cost. As such, it is a benefit/cost ratio, providing a measure of the relative profitability of a project. The profitability index decision rule is to accept projects with a PI greater than one, and to reject projects with a PI less than one.

b. PI = (NPV + cost)/cost = 1 + (NPV/cost). If a firm has a basket of positive NPV projects and is subject to capital rationing, PI may provide a good ranking measure of the projects, indicating the "bang for the buck" of each particular project.

9. PB = I / C ; – I + C / r = NPV, 0 = – I + C / IRR so IRR = C / I ; thus IRR = 1 / PB
For long-lived projects with relatively constant cash flows, the sooner the project pays back, the greater is the IRR.

10. There are a number of reasons. Two of the most important have to do with transportation costs and exchange rates. Manufacturing in the U.S. places the finished product much closer to the point of sale, resulting in significant savings in transportation costs. It also reduces inventories because goods spend less time in transit. Higher labor costs tend to offset these savings to some degree, at least compared to other possible manufacturing locations. Of great importance is the fact that manufacturing in the U.S. means that a much higher proportion of the costs are paid in dollars. Since sales are in dollars, the net effect is to immunize profits to a large extent against fluctuations in exchange rates. This issue is discussed in greater detail in the chapter on international finance.

11. The single biggest difficulty, by far, is coming up with reliable cash flow estimates. Determining an appropriate discount rate is also not a simple task. These issues are discussed in greater depth in the next several chapters. The payback approach is probably the simplest, followed by the AAR, but even these require revenue and cost projections. The discounted cash flow measures (discounted payback, NPV, IRR, and profitability index) are really only slightly more difficult in practice.

12. Yes, they are. Such entities generally need to allocate available capital efficiently, just as for-profits do. However, it is frequently the case that the "revenues" from not-for-profit ventures are not tangible. For example, charitable giving has real opportunity costs, but the benefits are generally hard to measure. To the extent that benefits are measurable, the question of an appropriate required return remains. Payback rules are commonly used in such cases. Finally, realistic cost/benefit analysis along the lines indicated should definitely be used by the U.S. government and would go a long way toward balancing the budget!

Solutions to Questions and Problems

<u>*Basic*</u>

1. Payback = 2 + ($1,000 / $3,800) = 2.26 years

2. Payback = 3($780) + ($660 / $780) = 3.85 years
= 6($780) + ($320 / $780) = 6.41 years
8($780) = $6,240; project never pays back if cost is $7,000

3. A: Payback = 2 + ($5,000 / $10,000) = 2.50 years
B: Payback = 3 + ($2,000 / $425,000) = 3.005 years
Using the payback criterion and a cutoff of 3 years, accept project A and reject project B.

4. $\$7{,}000/1.12 = \$6{,}250$; $\$7{,}500/1.12^2 = \$5{,}978.95$; $\$8{,}000/1.12^3 = \$5{,}694.24$;
$\$8{,}500/1.12^4 = \$5{,}401.90$
Cost = $8,000: Discounted payback = 1 + ($8,000 – 6,250)/$5,978.95 = 1.29 yrs
Cost = $13,000: Discounted payback = 2 + ($13,000 – 6,250 – 5,978.95)/$5,694.24 = 2.14 yrs
Cost = $18,000: 3 + ($18,000 – 6,250 – 5,978.95 – 5,694.24) / $5,401.90 = 3.01 yrs

5. R = 0%: 4($1,700) + ($1,200 / $1,700) = 4.71 yrs;
discounted payback = regular payback = 4.71 years
R = 5%: $\$1{,}700/1.05 + \$1{,}700/1.05^2 + \$1{,}700/1.05^3 + \$1{,}700/1.05^4 + \$1{,}700/1.05^5 = \$7{,}360.11$;
$\$1{,}700/1.05^6 = \$1{,}268.57$
discounted payback = 5 + ($8,000 – $7,360.11) / $1,268.57 = 5.50 years
R = 15%: $\$1{,}700/1.15 + \$1{,}700/1.15^2 + \$1{,}700/1.15^3 + \$1{,}700/1.15^4 + \$1{,}700/1.15^5 + \$1{,}700/1.15^6$
= $6,433.62 never pays back.

6. Average net income = ($1,416,000 + 1,032,000 + 1,562,000 + 985,000) / 4 = $1,248,750
Average book value = ($12M + 0) / 2 = $6M
AAR = average net income / average book value = 20.81%

7. $0 = -\$30{,}000 + \$19{,}000/(1+IRR) + \$9{,}000/(1+IRR)^2 + \$14{,}000/(1+IRR)^3$
IRR = 20.42% > *R* = 18%, so accept the project.

8. $NPV = -\$30{,}000 + \$19{,}000/1.11 + \$9{,}000/1.11^2 + \$14{,}000/1.11^3 = \$4{,}658.40$;
NPV > 0 so accept the project.
$NPV = -\$30{,}000 + \$19{,}000/1.21 + \$9{,}000/1.21^2 + \$14{,}000/1.21^3 = -\$247.76$;
NPV < 0 so reject the project.

9. $NPV = -\$6{,}000 + \$1{,}200(PVIFA_{8\%, 9}) = \$1{,}496.27$; accept the project if *R* = 8%
$NPV = -\$6{,}000 + \$1{,}200(PVIFA_{24\%, 9}) = -\$1{,}721.40$; reject the project if *R* = 24%
$\$6{,}000 = \$1{,}200(PVIFA_{IRR, 9})$; IRR = 13.70% ; indifferent about the project if *R* = 13.70%

10. $0 = -\$4{,}000 + \$1{,}500/(1+IRR) + \$2{,}100/(1+IRR)^2 + \$2{,}900/(1+IRR)^3$; IRR = 25.43%

11. NPV = – $4,000 + $1,500 + $2,100 + $2,900 = $2,500
$= -\$4{,}000 + \$1{,}500/1.1 + \$2{,}100/1.1^2 + \$2{,}900/1.1^3 = \$1{,}277.99$
$= -\$4{,}000 + \$1{,}500/1.2 + \$2{,}100/1.2^2 + \$2{,}900/1.2^3 = \$386.57$
$= -\$4{,}000 + \$1{,}500/1.3 + \$2{,}100/1.3^2 + \$2{,}900/1.3^3 = -\$283.57$

12. *a.* A: $\$17,000 = \$8,000/(1+IRR) + \$7,000/(1+IRR)^2 + \$5,000/(1+IRR)^3 + \$3,000/(1+IRR)^4$
IRR = 15.86%
B: $\$17,000 = \$2,000/(1+IRR) + \$5,000/(1+IRR)^2 + \$9,000/(1+IRR)^3 + \$9,500/(1+IRR)^4$
IRR = 14.69%
$IRR_A > IRR_B$, so IRR decision rule implies accepting project A. This may not be a correct decision; however, because the IRR criterion has a ranking problem for mutually exclusive projects. To see if the IRR decision rule is correct or not, we need to evaluate the project NPVs.

b. A: $NPV = -\$17,000 + \$8,000/1.11 + \$7,000/1.11^2 + \$5,000/1.11^3 + \$3,000/1.11^4 = \$1,520.71$
B: $NPV = -\$17,000 + \$2,000/1.11 + \$5,000/1.11^2 + \$9,000/1.11^3 + \$9,500/1.11^4$
$= \$1,698.58$
$NPV_B > NPV_A$, so NPV decision rule implies accepting project B.

c. Crossover rate: $0 = \$6,000/(1+R) + \$2,000/(1+R)^2 - \$4,000/(1+R)^3 - \$6,500/(1+R)^4$
R = 12.18%
At discount rates above 12.18% choose project A; for discount rates below 12.18% choose project B; indifferent between A and B at a discount rate of 12.18%.

13. X: $\$4,000 = \$2,500/(1+IRR) + \$1,500/(1+IRR)^2 + \$1,800/(1+IRR)^3$; IRR = 22.85%
Y: $\$4,000 = \$1,500/(1+IRR) + \$2,000/(1+IRR)^2 + \$2,600/(1+IRR)^3$; IRR = 22.08%
Crossover rate: $0 = \$1,000/(1+R) - \$500/(1+R)^2 - \$800/(1+R)^3$; R = 17.87%

R%	$\$NPV_X$	$\$NPV_Y$
0	1,800.00	2,100.00
5	1,296.40	1,488.61
10	864.76	969.95
15	491.66	526.18
20	166.67	143.52
25	–118.40	–188.80

14. *a.* $NPV = -\$28M + \$53M/1.1 - \$8M/1.1^2 = \$13,570,247.93$; NPV > 0 so accept the project.

b. $\$28M = \$53M/(1+IRR) - \$8M/(1+IRR)^2$
IRR = 72.75%, –83.46%
When there are multiple IRRs, the IRR decision rule is ambiguous; in this case, if the correct IRR is 72.75%, then we would accept the project, but if the correct IRR is –83.46%, we would reject the project.

15. PI $= [\$1,200/1.1 + \$550/1.1^2 + \$310/1.1^3] / \$1,600 = 1.111$
$= [\$1,200/1.15 + \$550/1.15^2 + \$310/1.15^3] / \$1,600 = 1.039$
$= [\$1,200/1.22 + \$550/1.22^2 + \$310/1.22^3] / \$1,600 = 0.952$

16. *a.* $PI_I = \$10,000(PVIFA_{9\%,3}) / \$20,000 = 1.266$; $PI_{II} = \$2,500(PVIFA_{9\%,3}) / \$3,000 = 2.109$
The profitability index decision rule implies accept project II, since $PI_{II} > PI_I$

b. $NPV_I = -\$20,000 + \$10,000(PVIFA_{9\%,3}) = \$5,312.95$
$NPV_{II} = -\$3,000 + \$2,500(PVIFA_{9\%,3}) = \$3,328.24$
NPV decision rule implies accepting I, since $NPV_I > NPV_{II}$

c. Using the profitability index to compare mutually exclusive projects can be ambiguous when the magnitude of the cash flows for the two projects are of different scale. In this problem, project I is roughly 7 times as large as project II and produces a larger NPV, yet the profit-ability index criterion implies that project II is more acceptable.

17. *a*. $PB_A = 3 + (\$110K/\$380K) = 3.29$ years; $PB_B = 2 + (\$2K/\$10K) = 2.20$ years
Payback criterion implies accepting project B, because it pays back sooner than project A.

b. A: $\$10K/1.15 + \$25K/1.15^2 + \$25K/1.15^3 = \$44,037.15$; $\$380K/1.15^4 = \$217,266.23$
Discounted payback = $3 + (\$170,000 – 44,037.15)/\$217,266.23 = 3.58$ years

B: $\$10K/1.15 + \$6K/1.15^2 = \$13,232.51$; $\$10K/1.15^3 = \$6,575.16$
Discounted payback = $2 + (\$18,000 – 13,232.51)/\$6,575.16 = 2.73$ years
Discounted payback criterion implies accepting project B because it pays back sooner than A

c. A: $NPV = – \$170K + \$10K/1.15 + \$25K/1.15^2 + \$25K/1.15^3 + \$380K/1.15^4 = \$91,303.38$
B: $NPV = – \$18K + \$10K/1.15 + \$6K/1.15^2 + \$10K/1.15^3 + \$8K/1.15^4 = \$6,381.70$
NPV criterion implies accept project A because project A has a higher NPV than project B.

d. A: $\$170K = \$10K/(1+IRR) + \$25K/(1+IRR)^2 + \$25K/(1+IRR)^3 + \$380K/(1+IRR)^4$
IRR = 29.34%
B: $\$18K = \$10K/(1+IRR) + \$6K/(1+IRR)^2 + \$10K/(1+IRR)^3 + \$8K/(1+IRR)^4$; IRR = 32.01%
IRR decision rule implies accept project B because IRR for B is greater than IRR for A.

e. A: $PI = [\$10K/1.15 + \$25K/1.15^2 + \$25K/1.15^3 + \$380K/1.15^4] / \$170K = 1.537$
B: $PI = [\$10K/1.15 + \$6K/1.15^2 + \$10K/1.15^3 + \$8K/1.15^4] / \$18K = 1.355$
Profitability index criterion implies accept project A because its PI is greater than project B's.

f. In this instance, the NPV and PI criterion imply that you should accept project A, while payback period, discounted payback and IRR imply that you should accept project B. The final decision should be based on the NPV since it does not have the ranking problem associated with the other capital budgeting techniques. Therefore, you should accept project A.

18. NPV @ r = 0% = – \$412,670 + \$212,817 + \$153,408 + \$102,389 + \$72,308 = \$128,252
NPV @ r = ∞ = – \$412,670
$NPV = 0 = –\$412,670 + \$212,817/(1+IRR) + \$153,408/(1+IRR)^2 + \$102,389/(1+IRR)^3 + \$72,308/(1+IRR)^4$; IRR = 14.57%; NPV = 0

Intermediate

19. Since the NPV index has the cost subtracted in the numerator, NPV index = PI – 1.

20. *a*. To have a payback equal to the project's life, given C is a constant cash flow for N years, $C = I/N$.

b. To have a positive NPV, $I < C\,(PVIFA_{R\%,\,N})$. Thus, $C > I / (PVIFA_{R\%,\,N})$.

c. Benefits = $C\,(PVIFA_{R\%,\,N})$ = 2 costs = 2I
$C = 2I / (PVIFA_{R\%,\,N})$

Challenge

21. Given the seven year payback, the worst case is the payback occurs at the end of the seventh year. Thus, the worst-case NPV = $–\$320,000 + \$320,000/1.12^7 = –\$175,248.25$. The best case has infinite cash flows beyond the payback point. Thus, the best-case NPV is infinite.

22. From trial and error, IRRs of 25%, 33.33%, 42.86%, and 66.67% are found. Take the project when NPV > 0, for required returns between 25% and 33.33% or between 42.86% and 66.67%.

23. *a.* PV of cash inflows = $C_1/(r - g)$ = \$40,000/(.14 – .07) = \$571,428.57 > 0
NPV of the project = –\$650,000 + \$571,428.57 = –\$78,571.43 < 0 so don't start the cemetery business.

b. \$40,000/(.14 – g) = \$650,000; g = 7.85%

Calculator Solutions

7.

CFo	–\$30,000
C01	\$19,000
F01	1
C02	\$9,000
F02	1
C03	\$14,000
F03	1

IRR CPT
20.42%

8.

CFo	–\$30,000	**CFo**	–\$30,000
C01	\$19,000	**C01**	\$19,000
F01	1	**F01**	1
C02	\$9,000	**C02**	\$9,000
F02	1	**F02**	1
C03	\$14,000	**C03**	\$14,000
F03	1	**F03**	1
I = 11%		I = 21%	
NPV CPT		NPV CPT	
\$4,658.40		–\$247.76	

9.

CFo	–\$6,000	**CFo**	–\$6,000	**CFo**	–\$6,000
C01	\$1,200	**C01**	\$1,200	**C01**	\$1,200
F01	9	**F01**	9	**F01**	9
I = 8%		I = 24%		IRR CPT	
NPV CPT		NPV CPT		13.70%	
\$1,496.27		–\$1,712.40			

10.

CFo	–$4,000
C01	$1,500
F01	1
C02	$2,100
F02	1
C03	$2,900
F03	1

IRR CPT
25.43%

11.

CFo	–$4,000
C01	$1,500
F01	1
C02	$2,100
F02	1
C03	$2,900
F03	1

I = 0%
NPV CPT
$2,500

CFo	–$4,000
C01	$1,500
F01	1
C02	$2,100
F02	1
C03	$2,900
F03	1

I = 10%
NPV CPT
$1,277.99

CFo	–$4,000
C01	$1,500
F01	1
C02	$2,100
F02	1
C03	$2,900
F03	1

I = 20%
NPV CPT
$386.57

CFo	–$4,000
C01	$1,500
F01	1
C02	$2,100
F02	1
C03	$2,900
F03	1

I = 30%
NPV CPT
–$283.57

12. *Project A*

CFo	–$17,000	**CFo**	–$17,000
C01	$8,000	**C01**	$8,000
F01	1	**F01**	1
C02	$7,000	**C02**	$7,000
F02	1	**F02**	1
C03	$5,000	**C03**	$5,000
F03	1	**F03**	1
C04	$3,000	**C04**	$3,000
F04	1	**F04**	1
IRR CPT		I = 11%	
15.86%		NPV CPT	
		$1,520.71	

Project B

CFo	–$17,000	**CFo**	–$17,000
C01	$2,000	**C01**	$2,000
F01	1	**F01**	1
C02	$5,000	**C02**	$5,000
F02	1	**F02**	1
C03	$9,000	**C03**	$9,000
F03	1	**F03**	1
C04	$9,500	**C04**	$9,500
F04	1	**F04**	1
IRR CPT		I = 11%	
14.69%		NPV CPT	
		$1,698.58	

Crossover rate

CFo	$0
C01	$6,000
F01	1
C02	$2,000
F02	1
C03	–$4,000
F03	1
C04	–$6,500
F04	1
IRR CPT	
12.18%	

13. *Project X*

CFo	–$4,000
C01	$2,500
F01	1
C02	$1,500
F02	1
C03	$1,800
F03	1

I = 0%
NPV CPT
$1,800

CFo	–$4,000
C01	$2,500
F01	1
C02	$1,500
F02	1
C03	$1,800
F03	1

I = 15%
NPV CPT
$491.66

CFo	–$4,000
C01	$2,500
F01	1
C02	$1,500
F02	1
C03	$1,800
F03	1

I = 25%
NPV CPT
–$118.40

Project Y

CFo	–$4,000
C01	$1,500
F01	1
C02	$2,000
F02	1
C03	$2,600
F03	1

I = 0%
NPV CPT
$2,100

CFo	–$4,000
C01	$1,500
F01	1
C02	$2,000
F02	1
C03	$2,600
F03	1

I = 15%
NPV CPT
$526.18

CFo	–$4,000
C01	$1,500
F01	1
C02	$2,000
F02	1
C03	$2,600
F03	1

I = 25%
NPV CPT
–$188.80

Crossover rate

CFo	$0
C01	$1,000
F01	1
C02	–$500
F02	1
C03	–$800
F03	1

IRR CPT
17.87%

14.

CFo	–$28,000,000
C01	$53,000,000
F01	1
C02	–$8,000,000
F02	1

I = 10%
NPV CPT
$13,570,247.93

CFo	–$28,000,000
C01	$53,000,000
F01	1
C02	–$8,000,000
F02	1

IRR CPT
74.75%

Financial calculators will only give you one IRR, even if there are multiple IRRs. Using a root solving calculator, the other IRR is –83.46%.

15.

CFo	$0
C01	$1,200
F01	1
C02	$550
F02	1
C03	$310
F03	1

I = 10%
NPV CPT
$1,778.36

CFo	$0
C01	$1,200
F01	1
C02	$550
F02	1
C03	$310
F03	1

I = 15%
NPV CPT
$1,663.19

CFo	$0
C01	$1,200
F01	1
C02	$550
F02	1
C03	$310
F03	1

I = 22%
NPV CPT
$1,523.85

@10%: PI = $1,778.36 / $1,600 = 1.111
@15%: PI = $1,663.19 / $1,600 = 1.039
@22%: PI = $1,523.85 / $1,600 = 0.952

16. *Project I*

CFo	$0
C01	$10,000
F01	3

I = 9%
NPV CPT
$25,312.95

CFo	–$20,000
C01	$10,000
F01	3

I = 9%
NPV CPT
$5,312.95

PI = $25,312.95 / $20,000 = 1.266

Project II

CFo	$0
C01	$2,500
F01	3

I = 9%
NPV CPT
$6,328.24

CFo	–$3,000
C01	$2,500
F01	3

I = 9%
NPV CPT
$3,328.24

PI = $6,328.24 / $3,000 = 2.109

17.

CF(A)

c.

Cfo	–$170,000
C01	$10,000
F01	1
C02	$25,000
F02	2
C03	$380,000
F03	1

I = 15%
NPV CPT
$91,303.38

PI = $261,303.38 / $170,000 = 1.537

d.

CFo	–$170,000
C01	$10,000
F01	1
C02	$25,000
F02	2
C03	$380,000
F03	1

IRR CPT
29.34%

e.

CFo	$0
C01	$10,000
F01	1
C02	$25,000
F02	2
C03	$380,000
F03	1

I = 15%
NPV CPT
$261,303.38

CF(B)

c.

CFo	–$18,000
C01	$10,000
F01	1
C02	$6,000
F02	1
C03	$10,000
F03	1
C04	$8,000
F04	1

I = 15%
NPV CPT
$6,381.70

PI = $24,381.70 / $18,000 = 1.355

d.

CFo	–$18,000
C01	$10,000
F01	1
C02	$6,000
F02	1
C03	$10,000
F03	1
C04	$8,000
F04	1

IRR CPT
32.01%

e.

CFo	$0
C01	$10,000
F01	1
C02	$6,000
F02	1
C03	$10,000
F03	1
C04	$8,000
F04	1

I = 15%
NPV CPT
$24,381.70

f. In this instance, the NPV and PI criterion imply that you should accept project A, while payback period, discounted payback and IRR imply that you should accept project B. The final decision should be based on the NPV since it does not have the ranking problem associated with the other capital budgeting techniques. Therefore, you should accept project A.

18.

CFo	–$412,670
C01	$212,817
F01	1
C02	$153,408
F02	1
C03	$102,389
F03	1
C04	$72,308
F04	1

I = 0%
NPV CPT
$128,252

CFo	–$412,670
C01	$212,817
F01	1
C02	$153,408
F02	1
C03	$102,389
F03	1
C04	$72,308
F04	1

IRR CPT
14.57%