CHAPTER 4

INTRODUCTION TO VALUATION: THE TIME VALUE OF MONEY

Answers to Concepts Review and Critical Thinking Questions

1. Compounding refers to the growth of a dollar amount through time via reinvestment of interest earned. It is also the process of determining the future value of an investment. Discounting is the process of determining the value today of an amount to be received in the future.

2. Future values grow (assuming a positive rate of return); present values shrink.

3. The future value rises (assuming a positive rate of return); the present value falls.

4. It depends. The large deposit will have a larger future value for some period, but after time, the smaller deposit with the larger interest rate will eventually become larger. The length of time for the smaller deposit to overtake the larger deposit depends on the amount deposited in each account and the interest rates.

5. It would appear to be both deceptive and unethical to run such an ad without a disclaimer or explanation.

6. It's a reflection of the time value of money. TMCC gets to use the $1,163. If TMCC uses it wisely, it will be worth more than $10,000 in thirty years.

7. This will probably make the security less desirable. TMCC will only repurchase the security prior to maturity if it to its advantage, i.e. interest rates decline. Given the drop in interest rates needed to make this viable for TMCC, it is unlikely the company will repurchase the security. This is an example of a "call" feature. Such features are discussed at length in a later chapter.

8. The key considerations would be: (1) Is the rate of return implicit in the offer attractive relative to other, similar risk investments? and (2) How risky is the investment; i.e., how certain are we that we will actually get the $10,000? Thus, our answer does depend on who is making the promise to repay.

9. The Treasury security would have a somewhat higher price because the Treasury is the strongest of all borrowers.

10. The price would be higher because, as time passes, the price of the security will tend to rise toward $10,000. This rise is just a reflection of the time value of money. As time passes, the time until receipt of the $10,000 grows shorter, and the present value rises. In 2015, the price will probably be higher for the same reason. We cannot be sure, however, because interest rates could be much higher, or TMCC's financial position could deteriorate. Either event would tend to depress the security's price.

Solutions to Questions and Problems

NOTE: All end-of-chapter problems were solved using a spreadsheet. Many problems require multiple steps. Due to space and readability constraints, when these intermediate steps are included in this solutions manual, rounding may appear to have occurred. However, the final answer for each problem is found without rounding during any step in the problem.

Basic

13. To answer this question, we can use either the FV or the PV formula. Both will give the same answer since they are the inverse of each other. We will use the FV formula, that is:

$FV = PV(1 + r)^t$

Solving for r, we get:

$r = (FV / PV)^{1/t} – 1$
$r = (\$1,225,000 / \$150)^{1/111} – 1$
$r = 0.0845$ or 8.45%

To find what the check will be in 2040, we use the FV of a lump sum, so:

$FV = PV(1 + r)^t$
$FV = \$1,225,000(1.0845)^{34}$
FV = \$19,338,380.03

16. *a.* To answer this question, we can use either the FV or the PV formula. Both will give the same answer since they are the inverse of each other. We will use the FV formula, that is:

$FV = PV(1 + r)^t$

Solving for r, we get:

$r = (FV / PV)^{1/t} – 1$
$r = (\$10,000 / \$1,163)^{1/30} – 1$
$r = 0.0744$ or 7.44%

b. Using the FV formula and solving for the interest rate, we get:

$r = (FV / PV)^{1/t} – 1$

$r = (\$2{,}500 / \$1{,}163)^{1/9} – 1$
$r = 0.0888$ or 8.88%

c. Using the FV formula and solving for the interest rate, we get:

$r = (\text{FV} / \text{PV})^{1/t} – 1$
$r = (\$10{,}000 / \$2{,}500)^{1/21} – 1$
$r = 0.0682$ or 6.82%

19. Even though we need to calculate the value in eight years, we will only have the money for six years, so we need to use six years as the number of periods. To find the FV of a lump sum, we use:

$\text{FV} = \text{PV}(1 + r)^t$
$\text{FV} = \$15{,}000(1.08)^6$
$\text{FV} = \$23{,}803.11$

20. To answer this question, we can use either the FV or the PV formula. Both will give the same answer since they are the inverse of each other. We will use the FV formula, that is:

$\text{FV} = \text{PV}(1 + r)^t$
$\$160{,}000 = \$30{,}000(1.09)^t$
$t = \ln(\$160{,}000 / \$30{,}000) / \ln 1.09$
$t = 19.42$ years

From now, you'll wait 2 + 19.42 = 21.42 years

22. To find the length of time for money to double, triple, etc., the present value and future value are irrelevant as long as the future value is twice the present value for doubling, three times as large for tripling, etc. We also need to be careful about the number of periods. Since the length of the compounding is three months and we have 24 months, there are eight compounding periods. To answer this question, we can use either the FV or the PV formula. Both will give the same answer since they are the inverse of each other. We will use the FV formula, that is:

$\text{FV} = \text{PV}(1 + r)^t$

Solving for *r*, we get:

$r = (\text{FV} / \text{PV})^{1/t} – 1$
$r = (\$3 / \$1)^{1/8} – 1$
$r = 0.1472$ or 14.72%

25. To find the PV of a lump sum, we use:

$PV = FV / (1 + r)^t$

So, if you can earn 11 percent, you will need to invest:

$PV = \$1{,}000{,}000 / (1.12)^{45}$
$PV = \$6{,}098.02$

And if you can earn 5 percent, you will need to invest:

$PV = \$1{,}000{,}000 / (1.06)^{45}$
$PV = \$72{,}650.07$

CHAPTER 5
DISCOUNTED CASH FLOW VALUATION

Answers to Concepts Review and Critical Thinking Questions

1. Assuming positive cash flows and a positive interest rate, both the present and the future value will rise.

2. Assuming positive cash flows and a positive interest rate, the present value will fall, and the future value will rise.

3. It's deceptive, but very common. The deception is particularly irritating given that such lotteries are usually government sponsored!

4. The most important consideration is the interest rate the lottery uses to calculate the lump sum option. If you can earn an interest rate that is higher than you are being offered, you can create larger annuity payments. Of course, taxes are also a consideration, as well as how badly you really need $5 million today.

5. If the total money is fixed, you want as much as possible as soon as possible. The team (or, more accurately, the team owner) wants just the opposite.

6. The better deal is the one with equal installments.

7. Yes, they should. APRs generally don't provide the relevant rate. The only advantage is that they are easier to compute, but, with modern computing equipment, that advantage is not very important.

8. A freshman does. The reason is that the freshman gets to use the money for much longer before interest starts to accrue.

9. The subsidy is the present value (on the day the loan is made) of the interest that would have accrued up until the time it actually begins to accrue.

10. The problem is that the subsidy makes it easier to repay the loan, not obtain it. However, the ability to repay the loan depends on future employment, not current need. For example, consider a student who is currently needy, but is preparing for a career in a high-paying area (such as corporate finance!). Should this student receive the subsidy? How about a student who is currently not needy, but is preparing for a relatively low-paying job (such as becoming a college professor)?

Solutions to Questions and Problems

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14. For discrete compounding, to find the EAR, we use the equation:

$$\text{EAR} = [1 + (\text{APR} / m)]^m - 1$$

So, for each bank, the EAR is:

First National: $\text{EAR} = [1 + (.124 / 12)]^{12} - 1 = .1313$ or 13.13%

First United: $\text{EAR} = [1 + (.127 / 2)]^{2} - 1 = .1310$ or 13.10%

For a borrower, First United would be preferred since the EAR of the loan is lower. Notice that the higher APR does not necessarily mean the higher EAR. The number of compounding periods within a year will also affect the EAR.

15. The reported rate is the APR, so we need to convert the EAR to an APR as follows:

$$\text{EAR} = [1 + (\text{APR} / m)]^m - 1$$

$$\text{APR} = m[(1 + \text{EAR})^{1/m} - 1]$$
$$\text{APR} = 365[(1.18)^{1/365} - 1] = .1656 \text{ or } 16.56\%$$

This is deceptive because the borrower is actually paying annualized interest of 18% per year, not the 16.56% reported on the loan contract.

31. Here we need to find the FV of a lump sum, with a changing interest rate. We must do this problem in two parts. After the first six months, the balance will be:

$$\text{FV} = \$10{,}000\ [1 + (.015/12)]^6$$
$$\text{FV} = \$10{,}075.23$$

This is the balance in six months. The FV in another six months will be:

$$\text{FV} = \$10{,}075.23\ [1 + (.18/12)]^6$$
$$\text{FV} = \$11{,}016.70$$

The problem asks for the interest accrued, so, to find the interest, we subtract the beginning balance from the principal. The interest accrued is:

$$\text{Interest} = \$11{,}016.70 - 10{,}000.00$$

Interest = $1,016.70

32. We will calculate the time we must wait if we deposit in the bank that pays simple interest. The interest amount we will receive each year in this bank will be:

Interest = $89,000(.05)
Interest = $4,450 per year

The deposit will have to increase by the difference between the amount we need by the amount we originally deposit with divided by the interest earned per year, so the number of years it will take in the bank that pays simple interest is:

Years to wait = ($175,000 – 89,000) / $4,450
Years to wait = 19.33 years

To find the number of years it will take in the bank that pays compound interest, we can use the future value equation for a lump sum and solve for the periods. Doing so, we find:

$FV = PV(1 + r)^t$
$\$175,000 = \$89,000\,[1 + (.05/12)]^t$
t = 162.61 months or 13.55 years

44. Here, we have two cash flow streams that will be combined in the future. To find the withdrawal amount, we need to know the present value, as well as the interest rate and periods, which are given. The present value of the retirement account is the future value of the stock and bond account. We need to find the future value of each account and add the future values together. For the bond account the future value is the value of the current savings plus the value of the annual deposits. So, the future value of the bond account will be:

$FV = C\{[(1 + r)^t – 1] / r\} + PV(1 + r)^t$
$FV = \$9,000\{[(1 + .075)^{10} – 1] / .075\} + \$150,000(1 + .075)^{10}$
FV = $436,478.52

The total value of the stock account at retirement will be the future value of a lump sum, so:

$FV = PV(1 + r)^t$
$FV = \$450,000(1 + .115)^{10}$
FV = $1,336,476.07

The total value of the account at retirement will be:

Total value at retirement = $436,478.52 + 1,336,476.07

Total value at retirement = $1,772,954.59

This amount is the present value of the annual withdrawals. Now we can use the present value of an annuity equation to find the annuity amount. Doing so, we find the annual withdrawal will be:

PVA = $C(\{1 - [1/(1 + r)]^t \} / r)$
$\$1,772,954.59 = C[\{1 - [1 / (1 + .0675)]^{25}\}/ .0675]$
$C = \$148,727.69$

55. The payment for a loan repaid with equal payments is the annuity payment with the loan value as the PV of the annuity. So, the loan payment will be:

PVA = $C(\{1 - [1/(1 + r)]^t \} / r)$
$\$75,000 = C\{[1 - 1 / (1 + .09)^5] / .09\}$
$C = \$29,629.11$

The interest payment is the beginning balance times the interest rate for the period, and the principal payment is the total payment minus the interest payment. The ending balance is the beginning balance minus the principal payment. The ending balance for a period is the beginning balance for the next period. The amortization table for an equal payment is:

Year	Beginning Balance	Total Payment	Interest Payment	Principal Payment	Ending Balance
1	$75,000.00	$29,629.11	$6,750.00	$22,879.11	$52,120.89
2	52,120.89	29,629.11	4,690.88	24,938.23	27,182.67
3	27,182.67	29,629.11	2,446.44	27,182.67	0

In the third year, $2,446.44 of interest is paid.

Total interest over life of the loan = $6,750.00 + 4,690.88 + 2,446.44
Total interest over life of the loan = $13,887.32

56. This amortization table calls for equal principal payments of $15000 per year. The interest payment is the beginning balance times the interest rate for the period, and the total payment is the principal payment plus the interest payment. The ending balance for a period is the beginning balance for the next period. The amortization table for an equal principal reduction is:

Year	Beginning Balance	Total Payment	Interest Payment	Principal Payment	Ending Balance
1	$75,000.00	$31,750.00	$6,750.00	$25,000.00	$50,000.00
2	50,000.00	29,500.00	4,500.00	25,000.00	25,000.00
3	25,000.00	27,250.00	2,250.00	25,000.00	0

In the third year, $2,250 of interest is paid.

Total interest over life of the loan = $6,750 + 4,500 + 2,250
Total interest over life of the loan = $13,500

Notice that the total payments for the equal principal reduction loan are lower. This is because more principal is repaid early in the loan, which reduces the total interest expense over the life of the loan.