Financial Management

FINA 2010, Semester II, 2020-2021

Assignment 3 (Solution)

25 January, 2021

1. Questions from Chapter 5 of the text book (Page 146, Questions and Problems)

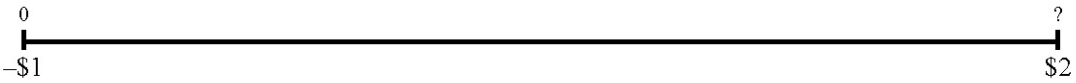
Q7: To find the length of time for money to double, triple, etc., the present value and future value are irrelevant as long as the future value is twice the present value for doubling, three times as large for tripling, etc. To answer this question, we can use either the FV or the PV formula. Both will 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 t, we get:

$$t = \ln(FV/PV)/\ln(1 + r)$$

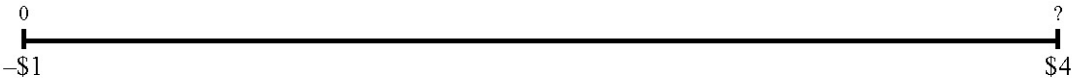
The length of time to double your money is:



$$FV = \$2 = \$1(1.061)^t$$

$$t = \ln 2/\ln 1.061 = 11.71 \text{ years}$$

The length of time to quadruple your money is:

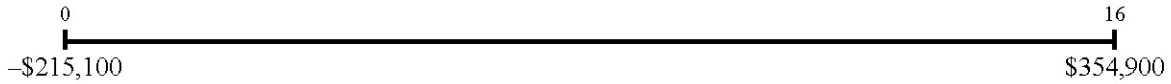


$$FV = \$4 = \$1(1.061)^t$$

$$t = \ln 4/\ln 1.061 = 23.41 \text{ years}$$

Notice that the length of time to quadruple your money is twice as long as the time needed to double your money (the slight difference in these answers is due to rounding). This is an important concept of time value of money.

Q8: The time line is:



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:

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

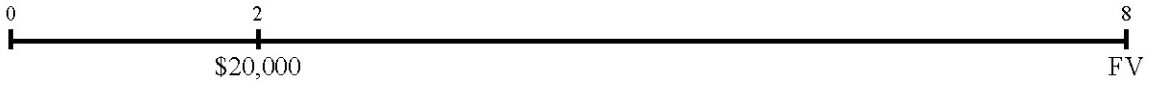
Solving for r, we get:

$$r = (FV/PV)^{1/t} - 1$$

$r = (\$354{,}900/\$215{,}100)^{1/16} - 1$

$r = .0318$, or 3.18%

Q19: The time line is:



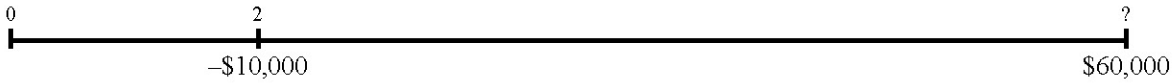
We need to find the FV of a lump sum. However, the money will only be invested for six years, so the number of periods is six.

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

$FV = \$20{,}000(1.068)^6$

$FV = \$29{,}679.56$

Q20: The time line is:



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 t, we get:

$t = \ln(FV/PV)/\ln(1 + r)$

$t = \ln(\$60{,}000/\$10{,}000)/\ln(1.09)$

$t = 20.79$

So, the money must be invested for 20.79 years. However, you will not receive the money for another two years. From now, you'll wait:

2 years + 20.79 years = 22.79 years

2. Questions from Chapter 6 of the text book (Page 182, Concepts Review and Critical Thinking Questions)

Q7: Yes, they should be changed. 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.

Q10: In general, viatical settlements are ethical. In the case of a viatical settlement, it is an exchange of cash today for payment in the future, although the payment depends on the death of the seller. The purchaser of the life insurance policy is bearing the risk that the insured individual will live longer than expected. Although viatical settlements are ethical, they may not be the best choice for an individual. In a *Businessweek* article (October 31, 2005), options were examined for a 72-year-old male with a life expectancy of eight years and a $1 million dollar life insurance policy with an annual premium of $37,000. The four options were: (1) Cash the policy today for $100,000. (2) Sell the policy in a viatical settlement for $275,000. (3) Reduce the death benefit to $375,000, which would keep the policy in force for 12 years without premium payments. (4) Stop paying premiums and don't reduce the death benefit. This will run the cash value of the policy to zero in five years, but the viatical settlement would be worth $475,000 at that time. If he died within five years, the beneficiaries would receive $1 million. Ultimately, the decision rests with the individual on what he perceives as best for himself. The terms that will affect the value of the viatical settlement are the discount rate, the face value of the policy, and the health of the individual selling the policy.

Q12: The ethical issues surrounding payday loans are more complex than they might first appear. On the one hand, the interest rates are astronomical, and the people paying those rates are typically among the worst off financially to begin with. On the other hand, and unfortunately, payday lenders are essentially the lenders of last resort for some. And the fact is that paying $15 for a two-week loan of $100 might be a bargain compared to the alternatives such as having utilities disconnected or paying bank overdraft fees. Restricting or banning payday lending also has the effect of encouraging loan sharking, where rates are even higher and collection practices much less consumer friendly (no payday loan company has ever demanded a pound of flesh nearest the heart as did Shylock in *The Merchant of Venice*). As a final note, such loans are by definition extremely risky, with a higher likelihood of default. As we will discuss later, higher-risk investments necessarily demand a higher return.

3. Questions from Chapter 6 of the text book (Page 183, Questions and Problems)

Q31: 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:

$FV = \$8{,}000[1 + (.0125/12)]^6$

$FV = \$8{,}050.13$

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

$FV = \$8{,}050.13[1 + (.178/12)]^6$

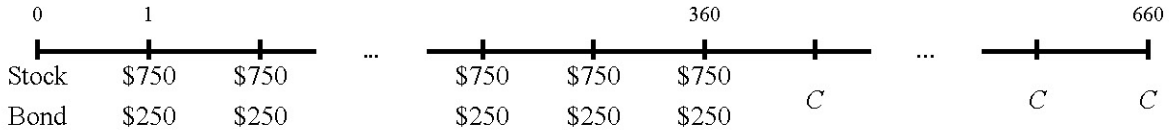
$FV = \$8{,}793.69$

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

Interest = $8,793.69 – 8,000

Interest = $793.69

Q32: Although the stock and bond accounts have different interest rates, we can draw one time line, but we need to remember to apply different interest rates. The time line is:



We need to find the annuity payment in retirement. Our retirement savings ends and the retirement withdrawals begin, so the PV of the retirement withdrawals will be the FV of the retirement savings. So, we find the FV of the stock account and the FV of the bond account and add the two FVs.

Stock account:

FVA = $750[{[1 + (.10/12)]^{360} – 1}/(.10/12)]

FVA = $1,695,365.94

Bond account:

FVA = $250[{[1 + (.06/12)]^{360} – 1}/(.06/12)]

FVA = $251,128.76

So, the total amount saved at retirement is:

$1,695,365.94 + 251,128.76 = $1,946,494.70

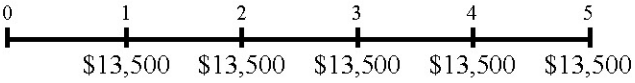
Solving for the withdrawal amount in retirement using the PVA equation gives us:

PVA = $1,946,494.70 = $*C*[1 – {1/[1 + (.05/12)]^{300}}/(.05/12)]

C = $1,946,494.70/171.0600

C = $11,379.01 withdrawal per month

Q53: *a.* If the payments are in the form of an ordinary annuity, the present value will be:

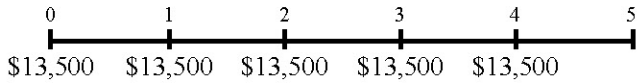


PVA = $C(\{1 - [1/(1 + r)^t]\}/r))$

PVA = $13,500[{1 – [1/(1 + .068)^5]}/ .068]

PVA = $55,650.35

If the payments are an annuity due, the present value will be:



$PVA_{due} = (1 + r)PVA$

PVA_{due} = (1 + .068)$55,650.35

PVA_{due} = $59,434.57

b. We can find the future value of the ordinary annuity as:

$FVA = C\{[(1 + r)^t - 1]/r\}$

$FVA = \$13{,}500\{[(1 + .068)^5 - 1]/.068\}$

$FVA = \$77{,}325.75$

If the payments are an annuity due, the future value will be:

$FVA_{due} = (1 + r)\,FVA$

$FVA_{due} = (1 + .068)\$77{,}325.75$

$FVA_{due} = \$82{,}583.90$

c. Assuming a positive interest rate, the present value of an annuity due will always be larger than the present value of an ordinary annuity. Each cash flow in an annuity due is received one period earlier, which means there is one period less to discount each cash flow. Assuming a positive interest rate, the future value of an annuity due will always be higher than the future value of an ordinary annuity. Since each cash flow is made one period sooner, each cash flow receives one extra period of compounding.

Q55: 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:

$PVA = \$71{,}500 = C\{[1 - 1/(1 + .07)^5]/.07\}$

$C = \$17{,}438.18$

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:

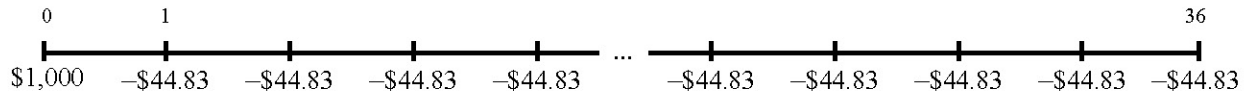
Year	Beginning Balance	Total Payment	Interest Payment	Principal Payment	Ending Balance
1	$71,500.00	$17,438.18	$5,005.00	$12,433.18	$59,066.82
2	59,066.82	17,438.18	4,134.68	13,303.51	45,763.31
3	45,763.31	17,438.18	3,203.43	14,234.75	31,528.55
4	31,528.55	17,438.18	2,207.00	15,231.19	16,297.37
5	16,297.37	17,438.18	1,140.82	16,297.37	0.00

In the third year, $3,203.43 of interest is paid.

Total interest over life of the loan = $5,005 + 4,134.68 + 3,203.43 + 2,207.00 + 1,140.82

Total interest over life of the loan = $15,690.92

Q67: The time line is:



Be careful of interest rate quotations. The actual interest rate of a loan is determined by the cash flows. Here, we are told that the PV of the loan is $1,000, and the payments are $44.83 per month for three years, so the interest rate on the loan is:

PVA = $1,000 = $44.83[{1 – [1/(1 + r)^{36}]}/r]

Solving for r with a spreadsheet, on a financial calculator, or by trial and error, gives:

r = 2.86% per month

APR = 12(2.86%)

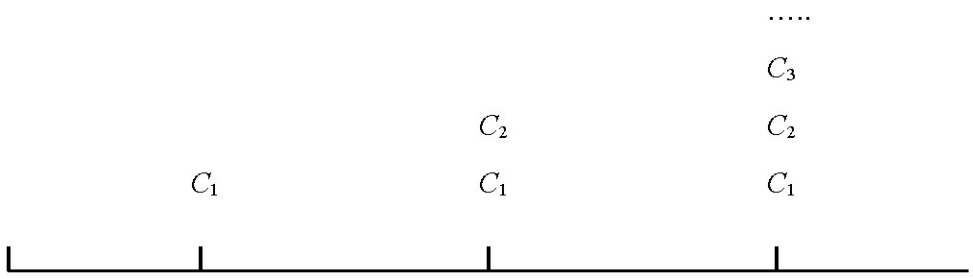
APR = 34.28%

EAR = $(1 + .0286)^{12} - 1$

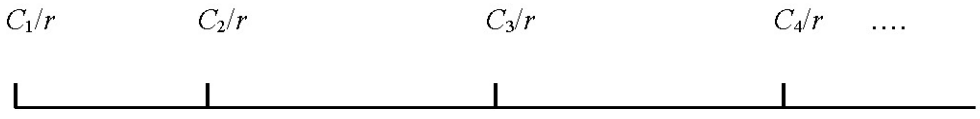
EAR = 40.21%

It's called add-on interest because the interest amount of the loan is added to the principal amount of the loan before the loan payments are calculated.

Q78: To answer this, we need to diagram the perpetuity cash flows, which are: (Note, the subscripts are only to differentiate when the cash flows begin. The cash flows are all the same amount.)



Thus, each of the increased cash flows is a perpetuity in itself. So, we can write the cash flows stream as:



So, we can write the cash flows as the present value of a perpetuity, and a perpetuity of:

C_2/r C_3/r C_4/r ….

The present value of this perpetuity is:

PV = $(C/r)/r = C/r^2$

So, the present value equation of a perpetuity that increases by C each period is:

PV = $C/r + C/r^2$

4. Tracy invested $1,000 five years ago and earns 4 percent interest on her investment. By leaving her interest earnings in her account, she increases the amount of interest she earns each year. The way she is handling her interest income is referred to as which one of the following?
A. simplifying
B. compounding
C. aggregation
D. accumulation
E. discounting

5. Terry is calculating the present value of a bonus he will receive next year. The process he is using is called:
A. growth analysis.
B. discounting.
C. accumulating.
D. compounding.
E. reducing.

6. Steve just computed the present value of a $10,000 bonus he will receive in the future. The interest rate he used in this process is referred to as which one of the following?
A. current yield
B. effective rate
C. compound rate
D. simple rate
E. discount rate

7. Sue and Neal are twins. Sue invests $5,000 at 7 percent when she is 25 years old. Neal invests $5,000 at 7 percent when he is 30 years old. Both investments compound interest annually. Both Sue and Neal retire at age 60. Which one of the following statements is correct assuming that neither Sue nor Neal has withdrawn any money from their accounts?
A. Sue will have less money when she retires than Neal.
B. Neal will earn more interest on interest than Sue.
C. Neal will earn more compound interest than Sue.
D. If both Sue and Neal wait to age 70 to retire, then they will have equal amounts of savings.
E. Sue will have more money than Neal as long as they retire at the same time.

8. Which one of the following will produce the highest present value interest factor?
A. 6 percent interest for five years
B. 6 percent interest for eight years
C. 6 percent interest for ten years
D. 8 percent interest for five years
E. 8 percent interest for ten years

9. Gerold invested $6,200 in an account that pays 5 percent simple interest. How much money will he have at the end of ten years?
A. $8,710
B. $9,000
C. $9,300
D. $9,678
E. $10,099

Ending value = $6,200 + ($6,200 × .05 × 10) = $9,300

10. What is the future value of $7,189 invested for 23 years at 9.25 percent compounded annually?
A. $22,483.60
B. $27,890.87
C. $38,991.07
D. $51,009.13
E. $54,999.88

Future value = $7,189 × $(1 + .0925)^{23}$ = $54,999.88

11. Today, you earn a salary of $36,000. What will be your annual salary twelve years from now if you earn annual raises of 3.6 percent?
A. $55,032.54

B. $57,414.06
C. $58,235.24
D. $59,122.08
E. $59,360.45

Future value = $36,000 × (1 + .036)^{12} = $55,032.54

12. You just received $225,000 from an insurance settlement. You have decided to set this money aside and invest it for your retirement. Currently, your goal is to retire 25 years from today. How much more will you have in your account on the day you retire if you can earn an average return of 10.5 percent rather than just 8 percent?
A. $417,137
B. $689,509
C. $1,050,423
D. $1,189,576
E. $1,818,342

Future value = $225,000 × (1 + .105)^{25} = $2,730,483
Future value = $225,000 × (1 + .08)^{25} = $1,540,907
Difference = $2,730,483 - $1,540,907 = $1,189,576

13. A year ago, you deposited $30,000 into a retirement savings account at a fixed rate of 5.5 percent. Today, you could earn a fixed rate of 6.5 percent on a similar type account. However, your rate is fixed and cannot be adjusted. How much less could you have deposited last year if you could have earned a fixed rate of 6.5 percent and still have the same amount as you currently will when you retire 38 years from today?
A. $2,118.42 less
B. $3,333.33 less
C. $5,417.09 less
D. $7,274.12 less
E. $9,234.97 less

Future value = $30,000 × $(1 + .055)^{38+1}$ = $242,084.61
Present value = $242,084.61 × $[1/(1 + .065)^{38+1}]$ = $20,765.03
Difference = $30,000 - $20,765.03 = $9,234.97

14. One year ago, you invested $1,800. Today it is worth $1,924.62. What rate of interest did you earn?
A. 6.59 percent
B. 6.67 percent
C. 6.88 percent
D. 6.92 percent
E. 7.01 percent

$1,924.62 = $1,800 × $(1 + r)^1$; r = 6.92 percent

15. According to the Rule of 72, you can do which one of the following?
A. double your money in five years at 7.2 percent interest
B. double your money in 7.2 years at 8 percent interest
C. double your money in 8 years at 9 percent interest
D. triple your money in 7.2 years at 5 percent interest
E. triple your money at 10 percent interest in 7.2 years

Rule of 72 = 72/8 years = 9 percent interest

16. You expect to receive $9,000 at graduation in 2 years. You plan on investing this money at 10 percent until you have $60,000. How many years will it be until this occurs?
A. 18.78 years
B. 19.96 years
C. 21.90 years
D. 23.08 years
E. 25.00 years

$60,000 = $9,000 × (1 + .10)^t; t = 19.90 years
Total time = 2 + 19.90 = 21.90 years

17. Which one of the following terms is used to identify a British perpetuity?
A. ordinary annuity
B. amortized cash flow
C. annuity due
D. discounted loan
E. consol

18. A loan where the borrower receives money today and repays a single lump sum on a future date is called a(n) _____ loan.
A. amortized
B. continuous
C. balloon
D. pure discount
E. interest-only

19. Which one of the following statements related to annuities and perpetuities is correct?
A. An ordinary annuity is worth more than an annuity due given equal annual cash flows for ten years at 7 percent interest, compounded annually.
B. A perpetuity comprised of $100 monthly payments is worth more than an annuity comprised of $100 monthly payments, given an interest rate of 12 percent, compounded monthly.
C. Most loans are a form of a perpetuity.
D. The present value of a perpetuity cannot be computed, but the future value can.
E. Perpetuities are finite but annuities are not.

20. Which one of the following statements concerning interest rates is correct?
A. Savers would prefer annual compounding over monthly compounding.
B. The effective annual rate decreases as the number of compounding periods per year increases.
C. The effective annual rate equals the annual percentage rate when interest is compounded annually.
D. Borrowers would prefer monthly compounding over annual compounding.
E. For any positive rate of interest, the effective annual rate will always exceed the annual percentage rate.

21. Which one of the following statements correctly states a relationship?
A. Time and future values are inversely related, all else held constant.
B. Interest rates and time are positively related, all else held constant.
C. An increase in the discount rate increases the present value, given positive rates.
D. An increase in time increases the future value given a zero rate of interest.
E. Time and present value are inversely related, all else held constant.

22. An amortized loan:
A. requires the principal amount to be repaid in even increments over the life of the loan.
B. may have equal or increasing amounts applied to the principal from each loan payment.
C. requires that all interest be repaid on a monthly basis while the principal is repaid at the end of the loan term.
D. requires that all payments be equal in amount and include both principal and interest.
E. repays both the principal and the interest in one lump sum at the end of the loan term.

23. Trish receives $480 on the first of each month. Josh receives $480 on the last day of each month. Both Trish and Josh will receive payments for next three years. At a 9.5 percent discount rate, what is the difference in the present value of these two sets of payments?
A. $118.63
B. $121.06
C. $124.30
D. $129.08
E. $132.50

$$A_{due}PV = \$480 \times \left\{ \frac{1 - \left[1 / \left(1 + \frac{0.095}{12} \right)^{3 \times 12} \right]}{\frac{0.095}{12}} \right\} \times \left(1 + \frac{0.095}{12} \right) = \$15{,}103.20$$

Enter	3×12	9.5/12		480BGN	
	N	I/Y	PV	PMT	FV
Solve for			- 15,103.20		

$$APV = \$480 \times \left\{ \frac{1 - \left[1 / \left(1 + \frac{0.095}{12} \right)^{3 \times 12} \right]}{\frac{0.095}{12}} \right\} = \$14{,}984.57$$

Enter	3×12	9.5/12		480	
	N	I/Y	PV	PMT	FV
Solve for			- 14,984.57		

Difference = $15,103.20 – $14,984.57 = $118.63

Note: Difference $= \$14{,}984.57 \times \left(\frac{0.095}{12} \right) = \$118.63$

24. You are buying a previously owned car today at a price of $3,500. You are paying $300 down in cash and financing the balance for 36 months at 8.5 percent. What is the amount of each loan payment?

A. $101.02

B. $112.23

C. $118.47

D. $121.60

E. $124.40

Amount financed = $3,500 - $300 = $3,200

$$\$3{,}200 = C \times \left\{ \frac{1 - \left[1 / \left(1 + \frac{0.085}{12} \right)^{36} \right]}{\frac{0.085}{12}} \right\}; \; C = \$101.02$$

Enter	36	8.5/12	3,200		
	N	I/Y	PV	PMT	FV
Solve for				-101.02	

25. The Wine Press is considering a project which has an initial cash requirement of $187,400. The project will yield cash flows of $2,832 monthly for 84 months. What is the rate of return on this project?

A. 6.97 percent

B. 7.04 percent

C. 7.28 percent

D. 7.41 percent

E. 7.56 percent

$$\$187{,}400 = \$2{,}832 \times \left\{ \frac{1 - \left[1 / \left(1 + \frac{r}{12} \right)^{84} \right]}{\frac{r}{12}} \right\}$$; This cannot be solved directly, so it's easiest to just use the calculator method to get an answer. You can then use the calculator answer as the rate in the formula just to verify that your answer is correct.

Enter	84	/12	-187,400	2,832	
	N	I/Y	PV	PMT	FV
Solve for		7.04			

26. A preferred stock pays an annual dividend of $2.60. What is one share of this stock worth today if the rate of return is 11.75 percent?

A. $18.48

B. $20.00

C. $22.13

D. $28.80

E. $30.55

$$PV = \frac{\$2.60}{0.1175} = \$22.13$$