**Chapter 5 In Class Exercise Solution**

1. **Suppose you invest the $1,000 from the previous example for 5 years @ 5% interest rate. How much would you have at time 5?**

PV=1000, Nper=5, Rate=5%, PMT=0, FV=?

FV=abs(fv(5%, 5, 0, 1000)) = 1,276.28

1. **Suppose you had a relative deposit $10 at 5.5% 200 years ago. How much will you have today?**

PV=10, Nper=200, Rate=5.5%, PMT=0, FV=?

FV=abs(fv(5.5%, 200, 0, 10)) = 447,189.8

If simple interest rate, not compounding interest rate, then interest in each period is 10\*5.5%=0.55, equally. So total of 200 years’ interest would be:

0.55\*200= 110. So 200 years later, you have 10+110=$120, rather than 447,189,8 with the compounding interest rate system.

1. **Suppose your company expects to increase unit sales of widgets by 15% per year for the next 5 years. If you sell 3 million widgets in the current year, how many widgets do you expect to sell in the fifth year?**

PV=3million, Nper=5, Rate=15%, PMT=0, FV=?

FV=abs(fv(15%,5, 0, 3000000)) = 6,034,072

1. **Suppose you have $500 to invest and you believe that you can earn 8% per year over the next 15 years. How much would you have at the end of 15 years using compound interest?**

PV=500, Nper=15, Rate=8%, PMT=0, FV=?

 FV=abs(fv(8%,15, 0, 500)) = 1,586.09

1. **Suppose you need $10,000 in one year for the down payment on a new car. If you can earn 7% annually, how much do you need to invest today?**

 FV=10,000, Nper=1, Rate=7%, PMT=0, PV=?

PV=abs(pv(7%, 1, 0, 10000)) = 9,345.79

1. **You want to begin saving for your daughter’s college education and you estimate that she will need $150,000 in 17 years. If you feel confident that you can earn 8% per year, how much do you need to invest today?**

FV=150000, Nper=17, Rate=8%, PMT=0, PV=?

PV=abs(pv(8%, 17, 0, 150000)) = 40,540.34

1. **Your parents set up a trust fund for you 10 years ago that is now worth $19,671.51. If the fund earned 7% per year. How much is your initial investment?**

FV=19671.51, Nper=10, Rate=7%, PMT=0, PV=?

PV=abs(pv(7%, 10, 0, 19671.51)) =100,000

1. **What is the present value of $500 to be received in 5 years? 10 years? The discount rate is 10%**

FV=500, Nper=5, Rate=10%, PMT=0, PV=?

PV=abs(pv(10%, 5, 0, 500)) =310.46

FV=500, Nper=10, Rate=10%, PMT=0, PV=?

PV=abs(pv(10%, 10, 0, 500)) =192.77

When discount rate (interest rate) is increasing, PV decreases.

1. **Suppose you need $15,000 in 3 years. If you can earn 6% annually, how much do you need to invest today? If you could invest the money at 8%, would you have to invest more or less than at 6%? How much?**

FV=15000, Nper=3, Rate=6%, PMT=0, PV=?

PV=abs(pv(6%, 3, 0, 15000)) = 12,594.29

FV=15000, Nper=3, Rate=8%, PMT=0, PV=?

PV=abs(pv(8%, 3, 0, 15000)) = 11,907.48

1. **You are looking at an investment that will pay $1,200 in 5 years if you invest $1,000 today. What is the implied rate of interest?**

FV=1200, PV=1000, Nper=5, PMT=0, rate=?

Rate = rate(5, 0, 1000, -1200) = 3.71% or

Rate = rate(5, 0, -1000, 1200)

1. **Suppose you are offered an investment that will allow you to double your money in 6 years. You have $10,000 to invest. What is the implied rate of interest?**

FV=20000, PV=10000, Nper=6, PMT=0, rate=?

Rate = rate(6, 0, 10000, -20000) = 12.25%

Rule of 72: When calculating the doubling questions, you can use 72/# of years to estimate rate of return. In this example, 72/6=12, so the interest rate is 12% roughly.

 If interest rate is given, can use 72/(interest rate \*100) = # years.

1. **Suppose you have a 1-year old son and you want to provide $75,000 in 17 years towards his college education. You currently have $5,000 to invest. What interest rate must you earn to have the $75,000 when you need it?**

FV=75000, PV=5000, Nper=17, PMT=0, rate=?

Rate = rate(17, 0, 5000, -75000) = 17.27%

1. **You are offered the following investments:**

**You can invest $500 today and receive $600 in 5 years. The investment is low risk.**

**You can invest the $500 in a bank account paying 4%.**

**What is the implied interest rate for the first choice, and which investment should you choose?**

FV=600, PV=500, Nper=5, PMT=0, rate=?

Rate = rate(5, 0, 500, -600) = 3.71 % < 4%, so you should invest in the bank paying 4%.

1. **You want to purchase a new car, and you are willing to pay $20,000. If you can invest at 10% per year and you currently have $15,000, how long will it be before you have enough money to pay cash for the car?**

FV=20000, PV=15000, rate=10%, PMT=0, Nper=?

Number of year = nper(10%, 0, 15000, -20000) = 3.02 years

1. **Suppose you want to buy a new house. You currently have $15,000, and you figure you need to have a 10% down payment plus an additional 5% of the loan amount for closing costs. Assume the type of house you want will cost about $150,000 and you can earn 7.5% per year. How long will it be before you have enough money for the down payment and closing costs?**

Down payment = 15,000

Loan amount = 135,000

Closing cost = 5%\*135000=6750

 We have 15,000, and we need (15000+6750 = 21,750) @ 7.5% interest rate, nper=?

 Nper = nper(7.5%, 0, 15000, -21750) = 5.14 years

1. **Suppose you want to buy some new furniture for your family room. You currently have $500, and the furniture you want costs $600. If you can earn 6%, how long will you have to wait if you don’t add any additional money?**

FV=600, PV=500, rate=6%, PMT=0, Nper=?

Number of year = nper(6%, 0, 500, -600) = 3.13 years

1. **You have $10,000 to invest for five years. How much additional interest will you earn if the investment provides a 5% annual return, when compared to a 4.5% annual return? How long will it take your $10,000 to double in value if it earns 5% annually? What annual rate has been earned if $1,000 grows into $4,000 in 20 years?**

At 5% rate, your FV = abs(fv(5%, 5, 0, 10000)) = 12,762.82

At 4.5% rate, your FV = abs(fv(4.5%, 5, 0, 10000)) = 12,461.82.

So additional interest = 12,762.82 – 12,461.82 = 301

To double, number of years = nper(5%, 0, 10000, -20000)=14.21 years

The annual rate = rate(20, 0, 1000, -4000) = 7.18%

**Chapter 6 In Class Exercise**

1. **Suppose you have $1,000 now in a savings account that is earning 6%. You want to add $500 one year from now and $700 two years from now. How much will you have two years from now in your savings account (after you make your $700 deposit)?**

With $1000, two years later would be = abs(fv(6%, 2, 0, 1000)) = 1,123.6

With $500, one years later would be = abs(fv(6%, 1, 0, 500)) = 530

700 is still 700. So two years from now, the saving account = 1123.6+530+700 = 2,353.6

If you do not make any additional deposits, how much in you saving accounting five years from now, assume 6% of interest rate?

Now two years from now, your saving account is 2,353.6. You let it grow @ 6% for three more years. Then by the end, you have= abs(fv(6%, 3, 0, 2353.6)) = 2,803.18

 ***Another approach:***

 CF0=1000, CF1=500, CF2=700. Rate=6%.

 NPV = npv(rate, CF1, CF2) = npv(6%, 500, 700) = 1,094.70

 Plus the current $1000, so total current value would be 1094.7+1000=2094.7.

 So think about investing 2,094.7 for two years, how much will you have?

 = fv(6%, 2, 0, 2094.7) = 2,353.6

 So think about investing 2,094.7 for five years, how much will you have?

 = fv(6%, 5, 0, 2094.7) = 2,803.18

1. **Consider receiving the following cash flows:**

**Year 1 CF = $200**

**Year 2 CF = $400**

**Year 3 CF = $600**

**Year 4 CF = $800**

**If the discount rate is 12%, what would this cash flow be worth today?**

Cash flow of today =npv(rate, CF in year 1, CF in year 2, CF in year 3, CF in year 4)

=npv(12%, 200, 400, 600, 800) = 1433 > 1400, should stick to the cash flow plan.

1. **You are considering an investment that will pay you $1,000 in one year, $2,000 in two years and $3,000 in three years. If you want to earn 10% on your money, how much would you be willing to pay?**

CF1=1000, CF2=2000, CF3=3000.

Total current value =npv(10%, 1000, 2000, 3000) = 4,815.93

1. **Your broker calls you and tells you that he has this great investment opportunity. If you invest $100 today, you will receive $40 in one year and $75 in two years. If you require a 15% return on investments of this risk, should you take the investment?**

CF1=40, CF2=75

Net present value =Npv(15%, 40, 75) = 91 <100

1. **Suppose you are looking at the following possible cash flows: Year 1 CF = $100; Years 2 and 3 CFs = $200; Years 4 and 5 CFs = $300. The required discount rate is 7%. What is the value of the cash flows at year 5? What is the value of the cash flows today? What is the value of the cash flows at year 3?**

Value of cash flow today = npv(7%, 100, 200, 200, 300, 300) = 874.17

Value of cash flow at year 5 = abs(fv(7%, 5, 0, 874.17)) = 1226.07

Cash flow at year 3 = abs(fv(7%, 3-1, 0, 100)) + abs(fv(7%, 3-2, 0, 200))+ 200 = 528.49

1. **After carefully going over your budget, you have determined you can afford to pay $632 per month towards a new sports car. You call up your local bank and find out that the going rate is 1 percent per month for 48 months. How much can you borrow?**

PMT= 632, nper = 48, rate =1%. PV=? FV=0

How much to borrow =abs(pv(1%, 48, 632, 0)) = 23,999.54

The car is $15,000 @1% monthly rate for 48 months. How much is your monthly payment?

=abs(pmt(1%, 48, 15000, 0)) = 395.01

The car is $15,000 and your monthly payment is $400 for 48 months. How much is monthly interest rate?

=rate(48, 400, -15000,0) = 1.06%

1. **Suppose you win the Publishers Clearinghouse $10 million sweepstakes. The money is paid in equal annual end-of-year installments of $333,333.33 over 30 years. If the appropriate discount rate is 5%, how much is the sweepstakes actually worth today?**

PMT=333,333.33, NPER=30, rate=5%, FV=0, cpt for PV=?

PV=abs(5%, 30, 333333.33, 0) =512,4150

1. **You are offered the opportunity to put some money away for retirement. You will receive five annual payments of $25,000 each, beginning in 40 years. How much would you be willing to invest today if you desire an interest rate of 12%?**
2. Can use NPV function directly.

=NPV(12%, 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0 ,0,0,0,0,0, 0,0,0,0,0, 25000, 25000, 25000, 25000,25000) = 968.5

1. OR use PV function.

PV at year 39 = abs(pv(12%, 5, 25000, 0))= 90119.41

PV at year 0 = abs(pv(12%, 39, 0, 90119.41)) = 968.50

1. **You are ready to buy a house, and you have $20,000 for a down payment and closing costs. Closing costs are estimated to be 4% of the loan value. You have an annual salary of $36,000, and the bank is willing to allow your monthly mortgage payment to be equal to 28% of your monthly income. The interest rate on the loan is 6% per year with monthly compounding (.5% per month) for a 30-year fixed rate loan. How much money will the bank loan you? How much can you offer for the house?**

PMT monthly = 840 ( 3000\*28%)

NPER = 360 (30\*12)

Rate = 0.5% (6%/12)

FV=0, PV=abs(pv(6%/12, 360, 840,0)) = 140,105 --- loan

140105+(20000-140105\*4% )= 154500.8 ------ offer for the house

1. **You want to receive 5,000 per month in retirement. If you can earn 0.75% per month and you expect to need the income for 25 years, how much do you need to have in your account at retirement?**

PMT=5000, rate=0.75%, nper=25\*12, pv=0, cpt for fv=?

FV = abs(fv(0.75%, 25\*12, 5000, 0)) =560,5610

1. **Suppose you want to borrow $20,000 for a new car. You can borrow at 8% per year, compounded monthly (8/12 = .66667% per month). If you take a 4-year loan, what is your monthly payment?**

PV=20000, rate=8%/12, nper=4\*12, FV=0, cpt FOR PMT=?

Pmt=abs(pmt(8%/12, 48, 20000,0)) = 488.26

1. **You ran a little short on your spring break vacation, so you put $1,000 on your credit card. You can only afford to make the minimum payment of $20 per month. The interest rate on the credit card is 1.5 percent per month. How long will you need to pay off the $1,000?**

PV=1000, pmt=-20, rate=1.5%, fv=0, cpt for nper=?

Number of months = nper(1.5%, -20, 1000, 0) = 93.11 months

1. **Suppose you borrow $2,000 at 5%, and you are going to make annual payments of $734.42. How long before you pay off the loan?**

PV=2000, pmt=-734.42, rate=5%, fv=0, cpt for nper=?

Nper = nper(5%，-734.42， 2000， 0) = 3.00

1. **Suppose you borrow $25,000 from your parents to buy a car. You agree to pay $507.58 per month for 60 months. What is the monthly interest rate?**

PV=25000, pmt=-507.58, nper=60, fv=0, cpt for rate=?

 Monthly rate = rate(60, -507.58, 25000, 0) = 0.671%

1. **You want to receive $5,000 per month for the next 5 years. How much would you need to deposit today if you can earn 0.75% per month? What monthly rate would you need to earn if you only have $200,000 to deposit?**

Rate=0.75%, pmt=5000, nper=60, fv=0, cpt for pv=?

The amount to deposit = abs(pv(0.75%, 60, 5000, 0)) = 240866.87

pmt=5000, nper=60, PV=-200000, fv=0, cpt for rate=?

Rate = rate(60, 5000, -200000, 0) = 1.44%

1. **Suppose you have $200,000 to deposit and can earn 0.75% per month. How many months could you receive the $5,000 payment? How much could you receive every month for 5 years?**
2. PV=200000, rate=0.75%, fv=0, pmt=-5000, cpt for nper=?

Number of months = nper(0.75%, -5000, 200000, 0) = 47.73

1. PV=200000, rate=0.75%, fv=0, nper=60, cpt for pmt=?

Monthly payment= abs(pmt(0.75%, 60, 200000, 0)) = 4151.67

1. **Suppose you begin saving for your retirement by depositing $2,000 per year in an IRA. If the interest rate is 7.5%, how much will you have in 40 years?**

Pmt=2000, rate=7.5%, nper=40, pv=0, cpt for fv=?

Fv = abs(fv(7.5%, 40, 2000, 0)) =454,513.04

1. **You are saving for a new house and you need 20% down to get a loan. You put $10,000 per year in an account paying 8%. The first payment is made today. How much will you have at the end of 3 years (you make a total of three $10,000 payments)?**

PMT=10000, rate=8%, nper=3, type=1 (this is annuity due), pv=0, cpt for fv=?

Fv = abs(fv(8%, 3, 10000, 0, 1)) = 35061.12

1. **~~Suppose the Fellini Company wants to sell preferred stock at $100 per share. A similar issue of preferred stock already outstanding has a price of $40 per share and offers a dividend of $1 every quarter. What dividend will Fellini have to offer if the preferred stock is going to sell?~~**
2. **You want to have $1 million to use for retirement in 35 years. If you can earn 1% per month, how much do you need to deposit on a monthly basis if the first payment is made in one month? What if the first payment is made today?**
3. Nper=35\*12, fv=1000000, rate=1%, pv=0, cpt for pmt=?

Monthly deposit = abs(pmt(1%, 35\*12, 0,1000000)) = 155.50

1. Nper=35\*12, fv=1000000, rate=1%, pv=0, type =1 , cpt for pmt=?

Monthly deposit = abs(pmt(1%, 35\*12,0, 1000000, 1)) = 153.96

1. **~~You are considering preferred stock that pays a quarterly dividend of $1.50. If your desired return is 3% per quarter, how much would you be willing to pay?~~**
2. **What is the APR if the monthly rate is .5%?**

**What is the APR if the semiannual rate is .5%?**

**What is the monthly rate if the APR is 12% with monthly compounding?**

1. Apr = 0.5%\*12 = 6%
2. APR = 0.5%\*2=1%
3. Effective rate = EAR = effect(12%, 12) = 12.68%
4. **Suppose you can earn 1% per month on $1 invested today. What is the APR? How much are you effectively earning?**

APR = quoted rate = 1% \* 12 = 12%. (1+1%)^12-1 =12.68% ---- EAR

Effective rate = EAR = effect(12%, 12) = 12.68%,

So one dollar deposited will be $1.1268 by the end of the first year.

Abs(fv(1%, 12, 0,1) = 1.1268

ARP = 1%\*12 = 12%

EAR = EFFECT(12%, 12) = 12.68%, so 1.1268-1, so interest earned is 0.1268,

1. **Suppose you put it in another account and earn 3% per quarter. What is the APR? How much are you effectively earning?**

APR = quoted rate = 3% \*4=12%.

Effective rate = EAR = effect(12%, 4) = 12.55%

1. **You are looking at two savings accounts. One pays 5.25%, with daily compounding. The other pays 5.3% with semiannual compounding. Which account should you use? Which account should you choose and why? Let’s verify the choice. Suppose you invest $100 in each account. How much will you have in each account in one year?**

Compare the two accounts’ effective rates. The higher the better.

Daily compounding, effective rate = EAR = effect(5.25%, 365) = 5.39%

Semi compounding, effective rate = EAR = effect(5.3%, 2) = 5.37%

Daily compounding, abs(fv(5.25%/365, 365, 0, 100))=105.39

Semi annual abs(fv(5.3%/2, 2, 0, 100))=105.37

1. **Suppose you want to earn an effective rate of 12% and you are looking at an account that compounds on a monthly basis. What APR must they pay?**

Use nominal function.

APR =quoted rate = nominal(12%, 12) = 11.39%

EAR = (1+ APR/n)^n-1 🡺 APR = ((1+EAR)^(1/n)-1)\*n

1. **Suppose you want to buy a new computer system and the store is willing to allow you to make monthly payments. The entire computer system costs $3,500. The loan period is for 2 years, and the interest rate is 16.9% with monthly compounding. What is your monthly payment?**

PV=3500, nper=24, rate=16.9%/12, fv=0, cpt for pmt=?

Monthly payment = abs(pmt(16.9%/12, 24, 3500,0)) = 172.88

1. **Suppose you deposit $50 a month into an account that has an APR of 9%, based on monthly compounding. How much will you have in the account in 35 years?**

PMT=50, rate = 9%/12, nper=35\*12, pv=0, cpt for fv=?

Fv = abs(fv(9%/12, 35\*12, 50, 0)) =147,089.22

1. **You need $15,000 in 3 years for a new car. If you can deposit money into an account that pays an APR of 5.5% based on daily compounding, how much would you need to deposit?**

FV=15000, nper=3\*365, rate=5.5%/365, pmt=0, cpt for pv=?

 Deposit = abs(pv(5.5%/12, 3\*365, 0, 15000)) =12718.57

1. **If a T-bill promises to repay $10,000 in 12 months and the market interest rate is 7 percent, how much will the bill sell for in the market?**

FV=10000, rate=7%/12, nper=12, pmt=0, cpt for pv=?

Price = abs(pv(7%/12, 12, 0, 10000)) = 9,325.83

1. **~~Consider a $50,000, 10 year loan at 8% interest. The loan agreement requires the firm to pay $5,000 in principal each year plus interest for that year. Create amortization table.~~**
2. **An investment will provide you with $100 at the end of each year for the next 10 years. What is the present value of that annuity if the discount rate is 8% annually? What is the present value of the above if the payments are received at the beginning of each year?**
3. PMT=100, nper=10, rate=8%, fv=0, cpt for pv=?

Pv=abs(pv(8%, 10, 100, 0)) = 671.01

1. PMT=100, nper=10, rate=8%, fv=0, type=1, cpt for pv=?

Pv=abs(pv(8%, 10, 100, 0, 1)) = 724.69

1. **~~If you deposit those payments into an account earning 8%, what will the future value be in 10 years?~~**
2. **What will the future value be if you open the account with $1,000 today @ 8% for 5 years, and then make the $100 deposits at the end of each year?**

Pv=1000, pmt=100, rate =8%, nper=5, cpt for fv=?

Fv = abs(fv(8%, 5, 100,1000)) = 2,055.99