STUDENTS OFFERING SUPPORT
Wilfrid Laurier University

BU111
Final Exam-AID
Review Package

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The Straight Market Order

Steps to Success:

1. **Calculate the purchase price**
   = #shares x (market price per share at the time of purchase)
2. **Calculate the "commission in"**
   = 2% of the purchase price
3. **Calculate the total cost**
   = purchase price + "commission in"
4. **Calculate the return on the sale**
   = #shares x (market price per share at the time of sale)
5. **Calculate the "commission out"**
   = you 2% of the return on the sale
6. **Calculate the total return**
   = return on the sale – "commission out"
7. **Calculate the capital gain (if this # is negative it is a capital loss)**
   = total return – total cost
8. **Calculate the yield**
   = capital gain ÷ purchase price

Problem 1

On January 1 2011 you purchase 200 shares of WOW Company at $5.30 per share. It is now December 2011 and the current market value of one WOW share has increased by $0.50 since January. Assume the brokerage commissions are 2% in, 2% out.

(a) How much would you receive if you decided to sell your holdings?
(b) How much would it cost you to purchase an additional 100 shares?

Problem 2

You purchased 500 shares of GOO Company last week for $2.50 per share.

(a) The current market value of one share today is $3.00. If you sold your holdings today, how much would you gain or lose after commission? What is the yield on this investment?
(b) The current market value of one share today is $2.00. If you sold your holdings today, how much would you gain or lose after commission? What is the yield on this investment?

Selling Short

Steps to Success:

1. **Calculate proceeds from the short sale**
   = #shares x (market price per share at the time of purchase)
2. **Calculate the "commission out"**
   = 2% of the proceeds from the short sale
3. **Calculate additional deposit in short account**
   = 50% of the proceeds from the short sale[1]
4. **Calculate total amount in short account**
   = proceeds from the short sale + additional deposit
5. **Calculate the cost of covering the short position**
   = # shares x (market price per share at the time it is covered)
6. **Calculate the "commission in"**
   = 2% of the cost of covering the short the position
7. **Calculate the capital gain (if this # is negative it is a capital loss)**
   = proceeds from the short sale – commission in - cost of covering the short position – commission out

Problem 3

Stock	Price Jan 1	Price Nov 1
JAM	$20	$20
PEA	$30	$15
NUT	$10	$15

(a) Sell short 1,000,000 shares of JAM on Jan 1. Cover Nov 1. How much would you gain or lose after commissions?
(b) Sell short 500 shares of PEA on Jan 1. Cover Nov 1. How much would you gain or lose after commissions if the stock was valued at $35 on March 1 and you received a short call from your broker at that time? What would be the amount of the short call?
(c) Sell short 200 shares of NUT on Jan 1. Cover Nov 1. How much would you gain or lose after commissions? What is the yield on this investment?

[1] The investor must always have at least 150% of the current market value of the stock in their short account. 100% of this comes from the proceeds of the short sale (which are deposited directly into the short account at the time of sale) and the other 50% is deposited out of investor's pocket at the time of sale. The investor will receive a short call if the amount of money in the short account is less than 150% of the current market value of the stock.

Bonds

Important Terminology:
New Bond = a bond that is issued today
Old Bond = a bond that was issued before today
Face Value = **Par** = price of the bond when it was issued = the fixed amount the holder of the bond will receive at expiry = $1000
Premium = price the investor pays for a bond (this will change over the life of a bond, the premium = the face value when the bond is first issued)
Coupon Rate = fixed rate of interest the bond hold receives once a year
Approximate Yield to Maturity = How much return the investment produced expressed as a % of its current purchase price

Determining the price of an Old Bond today:

Steps to Success:

1. **Equate the yield of New Bond to the yield of the Old Bond** [2]
   Yield of the old bond = Yield of the new bond
2. **Plug in the all variables in the yield formula that you know**
   - Coupon Rate
   - Face Value
   - # years to maturity
   - Yield of the new bond (which is equal to the prevailing interest rate)
3. **Solve for the price of the Old Bond**

Problem 4

(a) How much would a rational investor pay today for a BIEBS 9 of December 4, 2021 if bonds of similar risk issued today are carrying a coupon rate of 11%?
(b) What if bonds of similar risk issued today are carrying a coupon rate of 7%?
(c) What if bonds of similar risk issued today are carrying a coupon rate of 9%?

Problem 5

Fill in the blanks for each of the following inequalities with "<" , ">" or "=".

1. For bonds sold at premium: Yield ____ Coupon Rate
2. For bonds sold at par: Yield ____ Coupon Rate
3. For bonds sold at discount: Yield ____ Coupon Rate

[2] Note that a rationale investor would only consider purchasing both **new** and **old bonds** if their yields are the same. For example, if the yield of a **new bond** is higher than the yield of an **old bond**, a rationale investor will always invest in the **new bond** (higher yield = more money = happy investor). How can we make sure the **old bond** is still considered by the investor? Ah-ha! ... we can lower the price of the **old bond** to increase its yield! We must determine what the current market price of the **old bond** must be lowered to, in order for it to be equally attractive as the **new bond.**

Options

Important Terminology:
Writer = seller of an option contract
Holder = buyer of an option contract
1 Option Contract = 100 shares
PUT = a contract that gives the holder the option to sell shares at some point in the future, at some predetermined price
CALL = a contract that gives the holder the option to buy shares at some point in the future, at some predetermined price

Steps to Success:

1. **Calculate the Premium**
   = # of shares x (option cost per share)
2. **Calculate the commission on the premium**
   = 2% of the cost of purchasing the option
3. **Calculate the total cost in obtaining the option**
   = cost of purchasing the option + commission on the purchase of the option

   If the option is *not exercised*, than Step 3 is the total cost to the holder.
   If the option is *exercised*, proceed to Step 4.

4. **Calculate the proceeds from exercising the option**
   CALL Option = (# of shares x current market value per share) – (# of shares x strike price)
   PUT Option = (# of shares x strike price) – (# of shares x current market value per share)
5. **Calculate the commission incurred in exercising the option**
   CALL Option = 2% of (# of shares x current market value per share)
   PUT Option = 2% of (# of shares x strike price)
6. **Calculate the capital gain (if this # is negative it is a capital loss)**
   = proceeds from exercising the option – commission incurred in exercising – premium – commission on premium

Problem 6

Fill in each the blanks with “rise” or “fall”.

When you purchase a PUT option you want to price of the stock to _____ .
When you purchase a CALL option you want to price of the stock to _____ .

When you sell a PUT option you want to price of the stock to _____ .
When you sell a CALL option you want to price of the stock to _____ .

Problem 7

Stock	Price Jan 1	Price Nov 1
PEACE	$10	$35
LOVE	$30	$20
HAPP	$10	$12

(a) You purchase a 11 month PUT on 2,000 shares of HAPP on Jan 1 costing $0.10 per share, and exercise at a strike price of $10. How much would you have gained or lost on Nov. 1 if you allowed the PUT to expire?
(b) You purchase an 11 month CALL on 700 shares of PEACE on Jan 1 costing $2 per share, and exercise at a strike price of $25. You exercise the option on Nov 1. How much would you have gained or lost after all costs have been considered?

Buying on Margin

Steps to Success:

1. **Calculate the Broker Loan**
   = (investor's money ÷ minimum margin requirement) - investor's money
2. **Calculate the # of shares that can be purchased**
   = (investor's money + broker loan) ÷ (market price per share at the time of purchase)
3. **Calculate the purchase price**
   = # shares x (market price per share at the time of purchase)
   = investor's money investing + broker loan
4. **Calculate 'Commission In'**
   = 2% of the purchase price
5. **Calculate the return on the sale**
   = #shares x (market price per share at the time of sale)[3]
6. **Calculate 'Commission In'**
   = 2% of the return on the sale
7. **Calculate the capital gain (if this # is negative it is a capital loss)**
   = return on the sale - purchase price – commission in – commission out

Problem 8

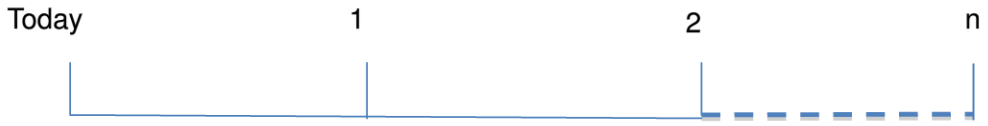
You purchased shares ABC common stock on margin at $25 on May 1. Assume the minimum margin requirement is 75% and you invested 45,000. O Nov 1 you decide to sell your shares at $23 per share, what is your capital gain (loss)?

[3] Here the investor is hoping for the price of the stock to increase

Time Value of Money

Steps to Success:

1. **Draw a Timeline**[4]



2. **Determine what kind of investment it is and if you need the future value or the present value – this will help you choose which formula(s) to use**
   - Single Payment
   - Annuity
   - Annuity Due
   - Perpetuity
3. **Determine the appropriate r**
4. **Plug all variables into the correct formula(s)**
5. **Write a therefore statement**

Problem 9

Which grows to a larger future value?

a) $4000 invested for 10 years at 5% or
b) $2000 invested for 10 years at 10%

Problem 10

Your grandparents bought their collection of one hundred silver dollars at face value in 1952. If they appreciate at a rate of 3% per year, how much are they worth today (2006)?

Problem 11

You have come across an investment opportunity that will give you $63,000 in 14 years if you put up $14,000 today. Calculate the annual return on this investment.

Problem 12

You currently have $48,000 in your bank account, which pays annual interest of 5% and you are saving up to buy a brand new $150,000 Jaguar convertible. In how many years will you have enough money to buy the car?

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[4] Although the timelines for each of the practice questions in this section are not given, you should always begin with one to guarantee full marks for the question. Please see the timelines in the corresponding slideshow to get an idea of how to develop them.

Problem 13

You have just won $50,000 on your Scratch and Win ticket, but you won't be awarded the money until your 40th birthday, 20 years from now. If the appropriate discount rate is 15%, what is the present value of your winnings?

Problem 14

Solve for **A, B, C, D, E, F, G** and **H** in the table below.

Stated Rate (APR)	Number of Times Compounded	Effective Annual Rate
7%	Daily	**A**
9%	Quarterly	**B**
C	Semi-annually	8%
23%	Continuous	**D**
E	Weekly	15%
F	Monthly	11%
G	Continuous	22%
10%	Monthly	**H**

Problem 15

Suzanne has identified a project with the following cash flows:

Year	Cash Flow
1	$2,000
2	$650
3	$375
4	$1,200

Calculate the present value of the cash flows if the discount rate is 9%.

Problem 16

You are 30 years old and you want to retire at age 60 with $1.5 million. You are going to make equal annual deposits into your savings account at the end of each year in order to save up this money. Your savings account pays 8% interest. What amount must you deposit each year?

Problem 17

You are saving for your child's university education. It is her 1st birthday today. She will start university just after her 18th birthday. You are going to save $2,000 per year each year (starting today and ending on her 18th birthday) in a Registered Education Savings Plan (RESP). If you expect to earn a real rate of 5% on the investment, how much will you have saved by her 18th birthday?

Problem 18

Jennifer has offered you an insurance policy that will pay you $1,250 per year forever. How much would you be willing to pay for this policy if the required rate of return is 10.5%?

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ANSWERS

Problem 1

On January 1 2011 you purchase 200 shares of WOW Company at $5.30 per share. It is now December 2011 and the current market value of one WOW share has increased by $0.50 since January. Assume the brokerage commissions are 2% in, 2% out.

(c) How much would you receive if you decided to sell your holdings?

Return on the Sale = 200 x $5.80 = $1160
Commission Out = 0.02 x $1160 = $23.20
Total Return = $1160 – $23.30 = $1136.70

You would receive $1136.70 if you sold your holdings today

(d) How much would it cost you to purchase an additional 100 shares?

Purchase price = 100 x $5.80 = $580
Commission in = 0.02 x $580 = $11.60
Total Cost = $580 + $11.60 = $591.6

Problem 2

You purchased 500 shares of GOO Company last week for $2.50 per share.

(c) The current market value of one share today is $3.00. If you sold your holdings today, how much would you gain or lose after commission? What is the yield on this investment?

Purchase price = 500 x $2.50 = $1250
Commission In = 0.02 x $1250 = $25
Total Cost = $1250 + $25 = $1275
Return on the Sale = 500 x $3.00 = $1500
Commission Out = 0.02 x $1500 = $30
Total Return = $1500 – $30 = $1470
Capital Gain (Loss) = $1470 – $1275 = $195
Yield = $195 ÷ $1250 = 15.6%

You would gain $195 after commission. The yield on this investment is 15.6%.

(d) The current market value of one share today is $2.00. If you sold your holdings today, how much would you gain or lose after commission? What is the yield on this investment?

Purchase price = 500 x $2.50 = $1250
Commission In = 0.02 x $1250 = $25
Total Cost = $1250 + $25 = $1275
Return on the Sale = 500 x $2.00 = $1000
Commission Out = 0.02 x $1000 = $20
Total Return = $1000 – $20 = $980
Capital Gain (Loss) = $980 – $1250 = - $270
Yield = -$270 ÷ $1250 = -21.6%

You would lose $20 after commission. The yield on this investment is -21.6%.

Problem 3

Stock	Price Jan 1	Price Nov 1
JAM	$20	$20
PEA	$30	$15
NUT	$10	$15

(d) Sell short 1,000,000 shares of JAM on Jan 1. Cover Nov 1. How much would you gain or lose after commissions? What is the yield on this investment?

Proceeds from the Short Sale = 1,000,000 x $20 = $20,000,000
Commission Out = 0.02 x $20,000,000 = $400,000
Additional Deposit = 0.50 x $20,000,000 = $10,000,000
Total Amount in Short Account = $20,000,000 + $10,000,000 = $30,000,000
Cost of Covering the Short = 1,000,000 x $20 = $20,000,000
Commission In = 0.02 x $20,000,000 = $400,000
Capital Gain = $20,000,000 – $400,000 – $20,000,000 – $400,000 = -$ 800,000
Yield = -$800,000 ÷ 20,000,000 = -4%

You would lose $800,000 after commission. The yield on this investment is -4%.

(e) Sell short 500 shares of PEA on Jan 1. Cover Nov 1. How much would you gain or lose after commissions if the stock was valued at $35 on March 1 and you received a short call from your broker at that time? What would be the amount of the short call? What is the yield on this investment?

Proceeds from the Short Sale = 500 x $30 = $15,000
Commission Out = 0.02 x $15,000 = $300
Additional Deposit = 0.50 x $15,000 = $7,500
Total Amount in Short Account = $7,500 + $15,000= $22,500

March 1 stock rises to $35 x 500 share = $17,500
Total deposit required in short account = 150% of $17,500 = $26,250
Addition deposit required = amount of the short call = 26,250 – 22,500 = 3,750

Cost of Covering the Short = 500 x $15 = $7,500
Commission In = 0.02 x $7,500 = $150
Capital Gain = $15,000 – $300 – $7,500 – $150= $7,050
Yield = $7,050 ÷ $15,000 = 47%

The amount of the short call on March 1 is $3,750. You would gain $7,050 after commission. The yield on this investment is 47%.

(f) Sell short 200 shares of NUT on Jan 1. Cover Nov 1. How much would you gain or lose after commissions? What is the yield on this investment?

Proceeds from the Short Sale = 200 x $10 = $2,000
Commission Out = 0.02 x $2,000 = $40
Additional Deposit = 0.50 x $2,000 = $1,000
Total Amount in Short Account = $2,000 + $1,000= $3,000
Cost of Covering the Short = 200 x $15 = $3,000
Commission In = 0.02 x $3,000 = $60
Capital Gain = $2000 - $3000 - $40 - $60 = -$1100
Yield = -$1100 ÷ $1,000 = -110%

You would lose $1,100 after commission. The yield on this investment is -110% .

Problem 4

(d) How much would a rational investor pay today for a BIEBS 9 of December 4, 2021 if bonds of similar risk issued today are carrying a coupon rate of 11%?

Yield of the new bond = Yield of the old bond

$$11\% = (\text{coupon rate} \times \text{face value}) + \frac{[\,(\text{value at maturity} - \textbf{price})\,]}{(\#\text{ years to maturity})}}{\textbf{price}}$$

$$0.11 \times \textbf{price} = (0.09 \times 1000) + (1000 - \textbf{price}) \div 10$$

$$\textbf{price} = \$904.76^{5}$$

A rationale investor would pay $904.46 today for a BIEBS 9 of December, 2021.

(e) What if bonds of similar risk issued today are carrying a coupon rate of 7%?

Yield of the new bond = Yield of the old bond

$$7\% = (\text{coupon rate} \times \text{face value}) + \frac{[\,(\text{value at maturity} - \textbf{price})\,]}{(\#\text{ years to maturity})}}{\textbf{price}}$$

$$0.07 \times \textbf{price} = (0.09 \times 1000) + (1000 - \textbf{price}) \div 10$$

$$\textbf{price} = \$1{,}117.64^{6}$$

A rationale investor would pay $1117.64 today for a BIEBS 9 of December, 2021.

(f) What if bonds of similar risk issued today are carrying a coupon rate of 9%?

Yield of the new bond = Yield of the old bond

$$9\% = (\text{coupon rate} \times \text{face value}) + \frac{[\,(\text{value at maturity} - \textbf{price})\,]}{(\#\text{ years to maturity})}}{\textbf{price}}$$

$$0.09 \times \textbf{price} = (0.09 \times 1000) + (1000 - \textbf{price}) \div 10$$

$$\textbf{price} = \$1{,}000^{7}$$

A rationale investor would pay $1,000 today for a BIEBS 9 of December, 2021.

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[5] Note: The interest rate went up from 9% to 11%, thus the purchase price of old bonds went down. Old bonds are now selling at a **discount,** creating a **capital gain** for the investor.

[6] Note: The interest rate went down from 9% to 7%, thus the purchase price of old bonds went up. Old bonds are now selling at a **premium,** creating a **capital loss** for the investor.

[7] Note: The interest rate did not changes (is it still 9%), thus the purchase price of old bonds stayed the same. Old bonds are now selling at a **par,** no capital gain or loss is created for the investor.

Problem 5

Fill in the blanks for each of the following inequalities with "<" , ">" or "=".

4. For bonds sold at premium: Yield **<** Coupon Rate
5. For bonds sold at par: Yield **=** Coupon Rate
6. For bonds sold at discount: Yield **>** Coupon Rate

Problem 6

Fill in each the blanks with "rise" or "fall".

When you purchase a PUT option you want to price of the stock to **fall.**
When you purchase a CALL option you want to price of the stock to **rise.**

When you write a PUT option you want to price of the stock to **rise.**
When you write a CALL option you want to price of the stock to **fall.**

Problem 7

Stock	Price Jan 1	Price Nov 1
PEACE	$10	$35
LOVE	$30	$20
HAPP	$10	$12

(c) You purchase a 6 month PUT on 2,000 shares of HAPP on Jan 1 costing $0.10 per share, and exercise at a strike price of $10. How much would you have gained or lost on Nov. 1 if you allowed the PUT to expire?

Premium = 2,000 x $0.10 = $200
Commission on the premium = 0.02 x $200 = $4
Total Cost of the PUT = $200 + $4 = $204

You would have lost $204 on Nov 1. if you allowed the PUT to expire.

(d) You purchase an 11 month CALL on 700 shares of PEACE on Jan 1 costing $2 per share, and exercise at a strike price of $25. You exercise the option on Nov 1. How much would you have gained or lost after all costs have been considered?

Premium = 700 x $2 = $1,400
Commission on the premium = 0.02 x $1,400 = $28
Total Cost of the CALL = $1,400 + $28 = $1428

Proceeds from exercising the option = (700 x $35) – (700 x $25) = $7,000
Commission incurred from exercising = 0.02 x $7,000 = $140

Capital Gain (Loss) = $7,000 – $140 – $1,428 = $5,432

You would have gained $5,432 if you exercised on Nov 1., considering all costs.

Problem 8

You purchased shares ABC common stock on margin at $25 on May 1. Assume the minimum margin requirement is 75% and you invested 45,000. O Nov 1 you decide to sell your shares at $23 per share, what is your capital gain (loss)?

Broker Loan = ($45,000 ÷ 0.75)[8] – $45,000 = $60,000 – $45,000 = $15,000
# of shares purchased on May 1 = ($45,000 + $15,000) ÷ $25 = 2,400 shares
Purchase Price on May 1 = 2,400 x $25 = $60,000
Commission In = 0.02 x $60,000 = $1,200
Return on the sale on Nov 1= 2,400 x $23 = $55,200
Commission Out = 0.02 x $55,200 = $1,104
Capital Gain (Loss) = $55,200 –$ 60,000 – $1,200 – $1,104 = (7,104)

Your capital loss in this investment would be $7,104.

[8] Note 45,000 ÷ 0.75 = 60,000. This is the maximum investment (it includes the investor's money and the maximum broker loan)

Problem 9

Which grows to a larger future value?

c) $4,000 invested for 10 years at 5% or

$$FV_{\text{singleamount}} = \$4000(1+0.05)^{10} = \$6{,}515.58$$

d) $2,000 invested for 10 years at 10%

$$FV_{\text{singleamount}} = \$2000(1+0.10)^{10} = \$5{,}187.4$$

Therefore $4,000 invested for 10 years at 5% grows to a larger future value.

Problem 10

Your grandparents bought their collection of one hundred silver dollars at face value in 1952. If they appreciate at a rate of 3% per year, how much are they worth today (2006)?

$$FV_{\text{singleamount}} = \$100(1+0.03)^{54} = \$493.41$$

Therefore the one hundred silver dollars are worth $493.41 today.

Problem 11

You have come across an investment opportunity that will give you $63,000 in 14 years if you put up $14,000 today. Calculate the annual return on this investment.

$$FV_{\text{singleamount}} = PMT(1+r)^{n}$$
$$\$63{,}000 = \$14{,}000(1+r)^{14}$$
$$4.5 = (1+r)^{14}$$
$$r = 4.5^{1/14} - 1$$
$$r = 11.34\%$$

Therefore the annual return on this investment is 11.34%

Problem 12

You currently have $48,000 in your bank account, which pays annual interest of 5% and you are saving up to buy a brand new $150,000 Jaguar convertible. In how many years will you have enough money to buy the car?

$$FV_{\text{singleamount}} = PMT(1+r)^n$$
$$\$150{,}000 = \$48{,}000(1+0.05)^n$$
$$3.125 = (1.05)^n$$
$$\log 3.125 = t \log 1.05$$
$$t = 23.4\,years$$

Therefore it will take 23.4 years before you have enough money to buy the car.

Problem 13

You have just won $50,000 on your Scratch and Win ticket, but you won't be awarded the money until your 40th birthday, 20 years from now. If the appropriate discount rate is 15%, what is the present value of your winnings?

$$PV_{\text{singleamount}} = \frac{PMT}{(1+r)} = \frac{\$50{,}000}{(1+0.15)^{20}} = \$3{,}055.01$$

Therefore, the present value of your winnings is $3,055.01

Problem 14

Solve for **A, B, C, E, F** and **H** in the table below.

Stated Rate (APR)	Number of Times Compounded	Effective Annual Rate
7%	Daily	**A**
9%	Quarterly	**B**
C	Semi-annually	8%
E	Weekly	15%
F	Monthly	11%
10%	Monthly	**H**

A

$EAR = [1 + (r/m)]^m - 1$

$EAR = [1 + (0.07/365)]^{365} - 1$

$EAR = 0.0725 = \mathbf{7.25\%}$

B

$EAR = [1 + (r/m)]^m - 1$

$EAR = [1 + (0.09/4)]^4 - 1$

$EAR = 0.0931 = \mathbf{9.31\%}$

C

$EAR = [1 + (r/m)]^m - 1$

$0.08 = [1 + (r/2)]^2 - 1$

$r = (1.08^{1/2} - 1) * 2$

$r = 0.0785 = \mathbf{7.85\%}$

E

$EAR = [1 + (r/m)]^m - 1$

$0.15 = [1 + (r/52)]^{52} - 1$

$r = (1.15^{1/52} - 1) * 52$

$r = 0.1399 = \mathbf{13.99\%}$

F

$EAR = [1 + (r/m)]^m - 1$

$0.11 = [1 + (r/12)]^{12} - 1$

$r = (1.11^{1/12} - 1) * 12$

$r = 0.1048 =$ **10.48%**

H

$EAR = [1 + (r/m)]^m - 1$

$EAR = [1 + (0.10/12)]^{12} - 1$

$EAR = 0.1047 =$ **10.47%**

Problem 15

Suzanne has identified a project with the following cash flows:

Year	Cash Flow
1	$2,000
2	$650
3	$375
4	$1,200

Calculate the present value of the cash flows if the discount rate is 9%.

Present Value[9] = $\$2,000/(1.09) + \$650/(1.09)^2 + \$375/(1.09)^3 + \$1200/(1.09)^4 = \$3,521.63$

Therefore, the present value of these 4 year cash flows is $3,521.63

[9] Note: this calculation is just adding together the present value of four single payments

Problem 16

You are 30 years old and you want to retire at age 60 with $1.5 million. You are going to make equal annual deposits into your savings account at the end of each year in order to save up this money. Your savings account pays 8% interest. What amount must you deposit each year?

$$FV_{\text{ordinaryannuity}} = PMT\left[\frac{(1+r)^n - 1}{r}\right]$$

$$\$1{,}500{,}000 = PMT\left[\frac{(1+0.08)^{30} - 1}{0.08}\right]$$

$$PMT = \$13{,}214.15$$

Therefore, you must deposit $13,214.15 each year in order to receive $1.5 million when you retire

Problem 17

You are saving for your child's university education. It is her 1st birthday today. She will start university just after her 18th birthday. You are going to save $2,000 per year each year (starting today and ending on her 18th birthday) in a Registered Education Savings Plan (RESP). If you expect to earn a real rate of 5% on the investment, how much will you have saved by her 18th birthday?

The FVA-due formula will give you the value at the end of the last period, but the question asks for the value on the 18th birthday (after the last deposit). Therefore you need to discount the annuity back one more period.

$$FV_{\text{annuitydue}} = PMT\left[\frac{(1+r)^n - 1}{r}\right] \times (1+r) = \$2{,}000\left[\frac{(1+0.05)^{18} - 1}{0.05}\right] \times (1+0.05) = \$56{,}264.77$$

Therefore you will have saved $56,264.77 by her 18th birthday.

Problem 18

Jennifer has offered you an insurance policy that will pay you $1,250 per year forever. How much would you be willing to pay for this policy if the required rate of return is 10.5%?

$$PV_{perpetuity} = \frac{PMT}{r} = \frac{\$1{,}250}{0.105} = \$11{,}904.76$$

Therefore you would be willing to pay $11, 904.76 for this policy today.