Winter 2011 **ADM 2350 SECTIONS M, N & P** **Prof. Wm. F. Rentz**

FINANCIAL MANAGEMENT

Assignment #1 Solutions

GENERAL INSTRUCTIONS: Your assignment must be **sent electronically** in **doc, docx,** or **pdf** format **to the TUTOR for your section**. Your **tutor must RECEIVE** your assignment by **no later than noon on Thursday, January 27, 2011**. Late assignments will **NOT** be accepted. To ensure that your tutor receives the assignment on time, **it is STRONGLY recommended that you electronically submit your assignment before midnight on the evening of Wednesday, January 26, 2011 at the latest.** Unless there are system problems with doc-depot, the professors' solution set will be posted on doc-depot by no later than 6 PM of the due date. This assignment counts 5% of your course grade. You are encouraged to work on this assignment in teams of up to 5 students **from the same section of this course**. *However,* you may turn in an individual assignment if you prefer. Each assignment must be typed and contain the student name(s) and student number(s) on each page. A scanned statement of integrity must be electronically attached to each assignment (See pages 10-11 of the course syllabus). Each individual whose name appears on the assignment must sign the statement of integrity.

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1. (20 marks) Claudette is a fourth-year business student who wants to go on a graduation celebration/vacation in Costa Rica, but she has no money to pay for the trip. After the vacation, Claudette will start her career. Her job will require moving to a new town and buying professional clothes. She asked her parents to lend her $8,000, which she figures she will be able to pay back in four years. Her parents agree to lend her the money, but they will charge 4 percent interest per year.

   a. (5 marks) What amount will Claudette need to pay back at the end of four years?

Scientific Calculator Approach

$$FV_n = PV_0(1+k)^n$$

$$FV_3 = \$8{,}000 \times 1.04^4 = \$9{,}358.87$$

Scientific Calculator Marking Scheme

1 mark for correct expression
1 mark for entering correct PV
1 mark for entering correct interest rate
1 mark for entering correct n
1 mark for correctly calculating FV

Excel or Financial Calculator Approach

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N	4		
Rate, i	4.00%		
PV	$8,000.00		
PMT			
FV		1	-$9,358.87
Type			

Excel or Financial Calculator Marking Scheme

1 mark EACH for correct inputs for N, i, PV, and PMT (total 4 marks)
1 mark for correct FV

NB. The PMT cell can be left blank in the Excel template as this is interpreted as being $0.00. 0 need not be entered in the PMT register of the BAII+ so long as one remembers to use the keystrokes [2nd][CLR TVM] before entering data. One also needs to set P/Y = C/Y = 1 instead of the BAII+ factory default value of 12.

b. (5 marks) How much interest will Claudette pay at the end of four years?

This is an example of a bullet loan. A single payment is made at maturity that includes repayment of the original borrowed amount plus compound interest. This single maturity payment is the future value calculated in part a.

Compound Interest = Single Maturity Payment – Original Amount Borrowed

$9,358.87 - $8,000 = $1,358.87

Marking Scheme

2 marks for correct expression for compound interest
1 mark for your previously calculated future value entered into the expression
1 mark for correct original amount borrowed entered into the expression
1 mark for correct value of compound interest given previous results

c. (5 marks) Claudette's parents want to give her an incentive to pay off the loan as quickly as possible. They structure the loan so that they charge 4 percent interest the first year and increase the rate 2 percentage points each year until the loan is paid off. Now what will be the amount that Claudette needs to pay back at the end of four years?

Scientific Calculator Approach

$$FV_n = PV_0\left(1+k_1\right)\left(1+k_2\right)\cdots\left(1+k_n\right)$$

$$FV_4 = \$8{,}000 \times 1.04 \times 1.06 \times 1.08 \times 1.10 = \$10{,}477.21$$

Marking Scheme

1 mark for correct interest rate for first year
1 mark for correct interest rate for second year
1 mark for correct interest rate for third year
1 mark for correct interest rate for fourth year
1 mark for correctly calculating FV

d. (5 marks) Claudette's parents realize that perhaps she may need 5 years to pay off the loan. So, they give Claudette the option to take 5 years. Nevertheless, they still want to encourage her to pay as early as possible. So, the interest rate on the loan will again increase by 2 percentage points each year so that it will reach 12 percent in year 5. Compared to your answer in Part c., how much more will the loan cost Claudette if she exercises the five-year option?

The cost of the loan will increase by the additional interest that must be paid in year 5.

Additional Cost = i_5 x FV_4 = 0.12 x \$10,477.21 = \$1,257.27

Marking Scheme

2 marks for correct expression for additional cost
1 mark for correct value of interest entered into the expression
1 mark for entering future value from part c.
1 mark for correct value of additional interest given previous results

2. (5 marks) Jay's Plumbing Supply sales were \$10,629,366 for fiscal 2010. Sales were \$6 million six years earlier in fiscal 2004. To the nearest percentage point, what is the compounded annual growth rate of Jay's sales?

Scientific Calculator Approach

$$\$10,629,366 = \$6,000,000 \times (1+g)^6 \Rightarrow (1+g)^6 = \frac{\$10,629,366}{\$6,000,000} = 1.771561$$

$$1+g = 1.771561^{1/6} \Rightarrow g = 1.10 - 1 = 0.10 \text{ or } 10\%$$

Scientific Calculator Marking Scheme

1 mark for correct "future value" expression
1 mark for entering correct number of periods
1 mark for entering correct "future value"
1 mark for entering correct "present value"
1 mark for calculating correct growth rate

Excel or Financial Calculator Approach

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N	6		
Rate, i		1	10.00%
PV	-$6,000,000.00		
PMT			
FV	$10,629,366.00		
Type			

Excel or Financial Calculator Marking Scheme

1 mark EACH for correct inputs for N, PV, PMT, and FV (total 4 marks)
1 mark for correct growth rate

3. (5 marks) The Force Corporation buys a machine for $10,000,000 and expects it to generate cash flows of $2,013,028 at the end of each year for the next eight years. To the nearest percentage point, what compounded rate of return does Force expect on this investment?

Scientific Calculator Approach

$$PV_0 = PMT\left[\frac{1-\frac{1}{(1+k)^n}}{k}\right]$$

$$\$10,000,000 = \$2,013,028 \times \left[\frac{1-\frac{1}{(1+k)^8}}{k}\right]$$

Try k = 10%.

$$\$2{,}013{,}028 \times \left[\frac{1 - \frac{1}{(1.10)^8}}{0.10} \right] = \$10{,}739{,}355.81 > \$10{,}000{,}000$$

The discount rate is too small. Try k = 12%.

$$\$2{,}013{,}028 \times \left[\frac{1 - \frac{1}{(1.12)^8}}{0.12} \right] = \$9{,}999{,}997.945 \cong \$10{,}000{,}000$$

Scientific Calculator Marking Scheme

1 mark for correct annuity expression
1 mark for correct value for PV
1 mark for correct value for PMT
1 mark for correct value for n
1 mark for correct interest rate

Excel or Financial Calculator Approach

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N	8		
Rate, i		1	12.00%
PV	-$10,000,000.00		
PMT	$2,013,028.00		
FV			
Type			

Excel or Financial Calculator Marking Scheme

1 mark EACH for correct inputs for N, PV, PMT, and FV (total 4 marks)
1 mark for correct interest rate

4. (5 marks) Suppose that a marketing manager for the Shingle Retail Appliance Store proposes a sale. Customers can buy now but don't have to pay for their appliance purchases for two years. From a time value of money perspective, selling appliances at full price with payment in two years is equivalent to selling appliances at a sale, or discounted, price with immediate payment. Suppose that the interest rate is 10 percent per year. What is the equivalent sale price today of a $2,401.85 washer/dryer combo when the customer takes the full two years to pay for it?

Scientific Approach

$$PV_0 = \frac{FV_n}{(1+k)^n} = \frac{\$2,401.85}{1.10^2} = \$1,985.00$$

The cost of the appliances would be $1.985 today.

Scientific Calculator Marking Scheme

1 mark for correct PV expression
1 mark for entering correct FV
1 mark for entering correct interest rate
1 mark for entering correct n
1 mark for calculating correct PV

Excel or Financial Calculator Approach

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N	2		
Rate, i	10.00%		
PV		1	$1,985.00
PMT			
FV	-$2,401.85		
Type			

Excel or Financial Calculator Marking Scheme

1 mark EACH for correct inputs for N, i, PMT, and FV (total 4 marks)
1 mark for correct PV

5. (5 marks) Suppose that we expect interest rates to increase over the next few years, from 2 percent this year, to 3 percent next year, to 4 percent in year 3, and to 5 percent in year 4. In this environment, what is the present value of a future $11,472,552 cash flow received at the end of four years?

$$PV_0 = \frac{FV_n}{(1+k_1)(1+k_2)\cdots(1+k_n)} = \frac{\$11,472,552}{1.02\times1.03\times1.04\times1.05} = \$10,000,000$$

6. (10 marks) Your predecessor, Ima Spiller, at Dynamic Software (DS) calculated the net present value (NPV) of a new software game as **$276,360.39**. This calculation was based on an initial $600,000 development cost that generated net cash flows of $300,000 for years one and two, $200,000 for year three, and an unknown amount for year 4 because Ima spilled coffee on the computer printout. Ima discounted the cash flows using an interest rate of 6 percent. (Hint: NPV = PV of future cash flows – initial cost.)

a. (5 marks) What is the missing cash flow for year four?

$$NPV = \$276,360.39 = -\$600,000 + \frac{\$300,000}{1.06} + \frac{\$300,000}{1.06^2} + \frac{\$200,000}{1.06^3} + \frac{CF_4}{1.06^4}$$

$$\frac{CF_4}{1.06^4} = \$276,360.39 + \$600,000 - \$283,018.87 - \$266,998.93 - \$167,923.86 = \$158,418.73$$

$$CF_4 = \$158,418.73 \times 1.06^4 = \$200,000.00$$

Scientific Calculator Marking Scheme

3 marks for correct NPV expression
1 mark for correct value of PV of CF_4
1 mark for correct value of CF_4

b. (5 marks) Your boss, Ty Rex, feels that because of the current softness of the economy, net cash flows for each year will be only 75% of what Ima previously estimated. The development cost, however, remains at $600,000. Further, because of nervousness among investors, Ty feels that cash flows from this software game must now be discounted using an interest rate of 9 percent. Rex requests that you recalculate the NPV for this software game under his revised assumptions. Based on your calculation what is your recommendation to Ty for this software game?

$$NPV = -\$600,000 + \frac{0.75 \times \$300,000}{1.09} + \frac{0.75 \times \$300,000}{1.09^2} + \frac{0.75 \times \$200,000}{1.09^3} + \frac{0.75 \times \$200,000}{1.09^4}$$

$$NPV = -\$600,000 + \$206,422.02 + \$189.378.00 + \$115,827.52 + \$106,263.78 = \$17,891.32$$

Since the NPV is still somewhat positive, DS should still consider investing in developing the software game. One probably should do sensitivity analyses to see how much further revenues may fall below the original estimates or how much the discount rate must rise before break-even NPV is reached. We will do these analyses after presenting the Financial Calculator Approach to solving for the NPV. At this point in the course, these analyses were NOT expected from students in order to receive full credit for the problem.

Scientific Calculator Marking Scheme

1 mark for remembering that future cash flows are only 75% of previous amounts
1 mark for correct NPV expression given previous results
1 mark for correct NPV value given previous results
1 mark for correct conclusion given previous results
1 mark bonus for everything correct to receive full credit of 5 marks for this part

Financial Calculator Approach

One can quickly calculate the NPV using the cash flow menu of the TI BAII+ taking advantage of two embedded annuities in the cash flows by setting F01 = 2 and F02 = 2.

Keystrokes	**Display**
[CF_0][2^{nd}][CLR WORK]	**0.00**
[6][0][0][0][0][0][+/-][ENTER]	**CF_0 = -600,000.00**
[downarrow][2][2][5][0][0][0][ENTER]	**C01 = 225,000.00**
[downarrow][2][ENTER]	**F01 = 2.00**
[downarrow][1][5][0][0][0][0][ENTER]	**C02 = 150,000.00**
[downarrow][2][ENTER]	**F02 = 2.00**
[NPV]	**I = 0.00**
[9][ENTER]	**I = 9.00**
[downarrow][CPT]	**NPV = 17,891.32**

Financial Calculator Marking Scheme

1 mark for correct input for CF_0 and I
1 mark for correct input of your CF_1 … CF_4 either separately or as embedded annuities
1 mark for correct NPV value given previous results
1 mark for correct conclusion given previous results
1 mark bonus for everything correct to receive full credit of 5 marks for this part

Now let's do a sensitivity analysis to see how much further the percentage decline in revenues must be before NPV falls to zero. Let α be the NPV break-even fraction of original revenues.

$$NPV = 0 = -\$600{,}000 + \alpha\left[\frac{\$300{,}000}{1.09} + \frac{\$300{,}000}{1.09^2} + \frac{\$200{,}000}{1.09^3} + \frac{\$200{,}000}{1.09^4}\right]$$

$$\$600{,}000 = \alpha\left[\$275{,}229.36 + \$252{,}504.00 + \$154{,}436.70 + \$141.685.04\right]$$

$$\alpha = \frac{\$600{,}000}{\$823{,}855.10} = 0.72.82834 \; or \; 72.83\%$$

Thus, if the decline in revenues is 100% - 72.83% = 27.17% instead of 25%, the NPV is zero.

Now let's do at sensitivity analysis on the discount rate. That is, what discount rate will give an NPV of zero? Such a discount rate is called the internal rate of return or IRR. This rate could be found by trial and error on a scientific calculator. However, it is far faster on the BAII+ financial calculator that still contains the data generating the NPV = 17,891,32. Simply first touch the key [IRR] and then [CPT]. The calculator then will display IRR = 10.47.

Thus, the NPV is quite sensitive to changes in the fraction α of original revenues but not as sensitive to changes in the discount rate. Whether the firm should invest in this software development ultimately depends not only on the probability that α falls below 72.83% but also how far it can fall below 72.83%.

7. (15 marks) Henry and Lesley Johnson want to send their daughter Abbey to university. Abbey is only 3 years old, but Henry and Lesley feel that they need to start saving soon. Suppose that Henry and Lesley plan to invest $18,295 on each of Abbey's birthdays until she is age 17. Abbey will need $50,000 for university expenses on her 18th, 19th, 20th, and 21st birthdays. The Johnson family expects each deposit that it makes in Abbey's savings account will earn 3 percent compounded annually.

   a. (5 marks) To the nearest dollar, how much does the Johnson family need to accumulate in Abbey's savings account by age 17 including the last deposit?

Scientific Calculator Approach

$$PV_{17} = PMT\left[\frac{1-\frac{1}{(1+k)^n}}{k}\right] = \$50{,}000 \times \left[\frac{1-\frac{1}{1.03^4}}{0.03}\right] = \$185{,}854.92$$

Scientific Calculator Marking Scheme

1 mark for correct expression
1 mark for entering correct PMT
1 mark for entering correct interest rate
1 mark for entering correct # of periods
1 mark for correct calculation of PV

Excel or Financial Calculator Approach

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N	4		
Rate, i	3.00%		
PV		1	$185,854.92
PMT	-$50,000.00		
FV			
Type			

1 mark EACH for correct inputs for N, i, PMT, and FV (total 4 marks)
1 mark for correct PV

b. (5 marks) How old will Abbey be when the Johnson family makes its first deposit?

Scientific Calculator Approach

$$FV_n = PMT\left[\frac{(1+k)^n - 1}{k}\right] \Rightarrow (1+k)^n = 1 + \frac{k \times FV_n}{PMT}$$

$$n\ln(1+k) = \ln\left[1 + \frac{k \times FV_n}{PMT}\right] \Rightarrow n = \frac{\ln\left[1 + \frac{k \times FV_n}{PMT}\right]}{\ln(1+k)}$$

$$n = \frac{\ln\left[1 + \frac{0.03 \times \$185,854.92}{\$18,295}\right]}{\ln(1.03)} = \frac{\ln(1.304763465)}{0.029558802} = \frac{0.266021771}{0.029558802} = 8.999748077 \cong 9$$

If one did not realize that the equation could be solved for n, one could always use an iterative trial and error approach.

Try n = 10

$$\$18,295 \times \left[\frac{1.03^{10} - 1}{0.03}\right] = \$209,731.67 > \$185,854.92$$

Try n = 9

$$\$18,295 \times \left[\frac{1.03^{9} - 1}{0.03}\right] = \$185,860.85 \cong \$185,854.92$$

The savings annuity will start at age 17 – 9 = 8. However, since this is an ordinary annuity, the first payment is actually made at age 9!

Scientific Calculator Marking Scheme

1 mark for correct expression
1 mark for recognizing PV in part a. is FV in this part
1 mark for correctly substituting PMT and k
1 mark for correct n = 9
1 mark for correct age of 9 when the first payment will be made

Excel or Financial Calculator Approach

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N		1	9.00
Rate, i	3.00%		
PV			
PMT	-$18,295.00		
FV	$185,854.92		
Type			

1 mark EACH for the correct inputs for i, PMT, and FV (total 3 marks)
1 mark for the correct N = 9
1 mark for correct age of 9 for first payment

c. (5 marks) Suppose that Henry and Lesley wish to buy Abbey a Honda Civic as a graduation present on her 22nd birthday. The estimated cost of the Civic is $30,000. To the nearest dollar, how much larger must each annual deposit be so that Henry and Lesley will be able to buy Abbey the Civic on her 22nd birthday?

Excel or Financial Calculator Approach

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N	5		
Rate, i	3.00%		
PV		1	$25,878.26
PMT			
FV	-$30,000.00		
Type			

The Johnson family will need to accumulate an additional $25,878.26 by Abbey's 17th birthday to provide her with a Civic on her 22nd birthday.

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N	9		
Rate, i	3.00%		
PV			
PMT		1	-$2,547.30
FV	$25,878.26		
Type			

To the nearest dollar, each deposit must be $2,547 larger for the Johnson family to provide Abbey with a Civic.

Excel or Financial Calculator Marking Scheme

1 mark correct inputs to find additional PV at age 17

1 mark for the correct additional PV at age 17
1 mark for correct inputs given previous results to find the annual deposit increase
1 mark for correct annual deposit increase given previous results
1 mark bonus for everything correct to receive full credit of 5 marks for this part

NB. The scientific calculator approach was not shown but results and marking are similar.

8. (20 marks) It is now 27 January 2011 and you are considering the purchase of an outstanding bond that was issued on 27 January 2003. It has an 8 percent coupon and is semi-annual pay. The bond matures on 27 January 2023 (i.e. a 20-year original maturity). The bond has ten-year call protection until 27 January 2013. After 27 January 2013, it is callable at 108 (that is, at 108 percent of par, or $1,080). Interest rates have **increased** since the bond was issued, and it is now selling at **$748.99**.

   a. (5 marks) What is the yield to maturity (YTM) for this bond?

Approximation Approach

$$YTM = \frac{\left[\$80 + \left(\frac{(\$1{,}000 - \$748.99)}{12}\right)\right]}{\left[\frac{(2 \times \$748.99 + \$1{,}000)}{3}\right]} = \frac{\$100.9175}{\$832.66} = 0.121198928 \cong 0.1212 \; or \; 12.12\%$$

Approximation Marking Scheme

1 mark for correct expression for the approximate YTM
1 mark for correctly substituting for I in the approximate YTM formula
1 mark for correctly substituting for n in the approximate YTM formula
1 mark for correctly substituting for F and B in the approximate YTM formula
1 mark for correct value for approximate YTM

Trial and Error Approach

We need to solve the following equation for k_b:

$$B = I \times \left[\frac{1 - \frac{1}{(1+k_b)^n}}{k_b}\right] + \frac{F}{(1+k_b)^n}$$

Since this is a semi-annual pay bond, I is the semi-annual interest payment of $40, n is the number of semi-annual periods to maturity which is 2 x 12 = 24, and k_b is the effective semi-annual YTM. To get the nominal annual YTM, we must remember to multiply our result by 2. Since the bond is selling at a discount, the YTM must be greater than the

coupon interest rate. Since the coupon rate is 8% and the discount is large, let us try 12 percent as the YTM. That is, let us try 12%/2 = 6% for k_b.

$$\$40 \times \left[\frac{1 - \frac{1}{(1+0.06)^{24}}}{0.06} \right] + \frac{\$1{,}000}{(1+0.06)^{24}} = \$502.0143 + \$246.9785 = \$748.99$$

Therefore, the nominal annual yield to maturity is 12%.

Trial and Error Marking Scheme

1 mark for correct expression for bond valuation
1 mark for correctly substituting for I = $40 in the bond valuation formula
1 mark for correctly substituting for n = 24 in the bond valuation formula
1 mark for correctly substituting for F and B in the bond valuation formula
1 mark for correct value for the nominal annual YTM

Excel or Financial Calculator Solution

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N	24		
Rate, i		1	6.00%
PV	-$748.99		
PMT	$40.00		
FV	$1,000.00		
Type			

Note that we have calculated the effective semi-annual interest rate. YTM = 2 x 6.00% = 12.00%. If we used the BAII+ calculator with these inputs with P/Y = C/Y = 1, we would have calculated I/Y = 6.00% and also had to multiply by 2 to get YTM. However, if we had used these inputs with P/Y = C/Y = 2, we would directly calculate I/Y = YTM = 12.00%.

Excel or Financial Calculator Marking Scheme

1 mark EACH for correct inputs for N, PV, PMT, and FV
1 mark for correct value of 12.00% for YTM

b. (5 marks) What is the yield to call (YTC) for this bond, if it were called on 27 January 2013?

Approximation Approach

$$YTC = \frac{\left[\$80 + \left(\frac{(\$1{,}080 - \$748.99)}{2} \right) \right]}{\left[\frac{(2 \times \$748.99 + \$1{,}080)}{3} \right]} = \frac{\$245.505}{\$859.3266667} = 0.285694613 \cong 0.2857 \text{ or } 28.57\%$$

Approximation Marking Scheme

1 mark for correct expression for the approximate YTC
1 mark for correctly substituting for I in the approximate YTC formula
1 mark for correctly substituting for n in the approximate YTC formula
1 mark for correctly substituting for B and CP in the approximate YTC formula
1 mark for correct value for approximate YTC

Trial and Error Approach

We need to solve the following equation for k_b:

$$B = I \times \left[\frac{1 - \frac{1}{(1+k_b)^n}}{k_b} \right] + \frac{CP}{(1+k_b)^n}$$

Since this is a semi-annual pay bond, I is the semi-annual interest payment of \$40, n is the number of semi-annual periods to first call which is 2 x 2 = 4, and k_b is the effective semi-annual YTC. To get the nominal annual YTC, we must remember to multiply our result by 2. Since the bond is selling at a discount, the YTC must be greater than the coupon interest rate. Furthermore, since the call price is above the face value and since the time to first call is much shorter than the term to maturity, the YTC must be substantially more than the YTM. Let us try 28%/2 = 1% for k_b.

$$\$40 \times \left[\frac{1 - \frac{1}{(1+0.14)^4}}{0.14} \right] + \frac{\$1{,}080}{(1+0.14)^4} = \$116.5485 + \$639.4467 = \$756.00$$

Since the calculated bond price is somewhat above the actual bond price, we need to slightly raise k_b. Try k_b = 14.50%.

$$\$40 \times \left[\frac{1 - \frac{1}{(1+0.1450)^4}}{0.1450} \right] + \frac{\$1{,}080}{(1+0.1450)^4} = \$115.3639 + \$628.3503 = \$743.71$$

Now lets perform a linear interpolation over a ½ percentage point range. To get to our desired result, the bond price has to drop from \$756.00 to \$748.99 for a decline of \$7.01 as we increase k_b from 14%. When we increase from 14% to 14.50%, the price decline is \$756.00 - \$743.71 = \$12.29.

$$k_b = 14.00\% + \left[\frac{(\$756.00 - \$748.99)}{(\$756.00 - \$743.71)}\right] \times (14.50\% - 14.00\%)$$

$$k_b = 14.00\% + \left(\frac{\$7.01}{\$12.29}\right) \times 0.50\% = 14.00\% + 0.285\% = 14.285\%$$

Therefore, the nominal annual yield to call is 2 x 14.285% = 28.57%%

Trial and Error Marking Scheme

1 mark for correct expression for bond valuation under calling scenario
1 mark for correctly substituting for I = $40 in the bond valuation formula
1 mark for correctly substituting for n = 4 in the bond valuation formula
1 mark for correctly substituting for CP and B in the bond valuation formula
1 mark for correct value for the nominal annual YTM

Excel or Financial Calculator Solution

TVM Calculator

TVM	INPUTS	COMPUTE	SOLUTION
Periods, N	4		
Rate, i		1	14.28%
PV	-$748.99		
PMT	$40.00		
FV	$1,080.00		
Type			

Note that we have calculated the effective semi-annual interest rate. YTC = 2 x 14.28% = 28.56%. If we used the BAII+ calculator with these inputs with P/Y = C/Y = 1, we would have calculated I/Y = 14.28% and also had to multiply by 2 to get YTC. However, if we had used these inputs with P/Y = C/Y = 2, we would directly calculate I/Y = YTC = 28.57%.

Excel or Financial Calculator Marking Scheme

1 mark EACH for correct inputs for N, PV, PMT, and FV
1 mark for correct value of 28.57% for YTC

Note that the approximation formula gives the exact answer to the nearest 0.01%. This is truly extraordinary!

c. (5 marks) Which return do you think investors actually expect? Explain your reasoning?

The firm is certainly not going to pay a call premium to refinance its bond issue at rate that is higher than the 8% coupon rate on the bond. So, investors should expect to earn the lower YTM, not the higher YTC.

5 marks for a clear explanation about why bondholders should expect to earn the YTM

d. (5 marks) Suppose that the bond were currently selling at a premium. Explain whether investors would think that the YTM or YTC is more relevant.

In this case the YTC is usually less than the YTM. So, the bondholders should expect to earn the YTC. A more detailed analysis (not required to receive full credit) would compare the PV of the interest savings to the firm from refunding at a lower interest rate compared to the cost of the call premium. For example, if the remaining life of the bond is only slightly greater than the time until it can be called, then the firm probably will not find it cost effective to call the issue.

5 marks for a clear explanation about why bondholders should expect to earn the YTC

NB. Below is an excellent formula for finding the approximate YTM if you do not have a financial calculator or Excel. Although the variables in the formula refer to values for an annual pay bond, the result is still acceptable for a semi-annual pay bond. If you want to calculate the YTC, just replace the face value F with the call price CP and adjust n to be the number of years until the call occurs.

$$YTM = \frac{\left[I + \left(\frac{(F - B)}{n} \right) \right]}{\left[\frac{(2B + F)}{3} \right]}$$

9. (15 marks) Magna International is a well-known automobile parts manufacturer. Although it is a Canadian company, its functional currency is the U.S. dollar. Magna is expecting to receive EUR36 million from BMW in one month. The cost of the parts that it shipped to BMW is USD44 million. The treasurer of Magna instructs you to obtain the USD-EUR one-month currency forward contract rate from ScotiaBank. The bank is willing to enter into a one-month forward contract at USD1.30000/EUR. The treasurer then instructs you to talk with Magna's chief economist to obtain the economist's estimate of the probability distribution for USD-EUR spot rates in one month. The chief economist believes that in one month there is a 25 percent probability that the exchange rate will be USD1.20000/EUR, a 50 percent probability that the exchange rate will be USD1.31250/EUR, and a 25 percent probability that the exchange rate will be USD1.42500/EUR.

   a. (5 marks) What U.S. dollar profit does Magna earn on its part sales to BMW if it enters into a one-month forward currency contract with CIBC?

USD Revenues = EUR Revenues x Forward Rate = EUR36M x USD1.30000/EUR = USD46.8M

USD Π = USD Revenues – USD Costs = USD46.8M – USD44M = USD2.8M

Marking Scheme

1 mark for correct expression for USD Revenues
1 mark for correct value for USD Revenues
1 mark for correct expression for USD Π

1 mark for correct value for USD Π
1 mark bonus for everything correct to receive full credit of 5 marks for this part

b. (5 marks) Assuming that the chief economist's forecasted probability distribution is correct, what U.S. dollar profit does Magna expect to earn on its part sales to BMW exchanges euros for U.S. dollars at the spot rate that prevails in one month?

Optimistic Scenario

USD Revenues = EUR36M x USD1.42500/EUR = USD51.3M

USD Π = USD Revenues – USD Costs = USD51.3M – USD44M = USD7.3M

Most Likely Scenario

USD Revenues = EUR36M x USD1.31250/EUR = USD47.25M

USD Π = USD Revenues – USD Costs = USD47.25M – USD44M = USD3.25M

Pessimistic Scenario

USD Revenues = EUR36M x USD1.20000/EUR = USD43.2M

USD Π = USD Revenues – USD Costs = USD43.2M – USD44M = - USD0.8M

Expected USD Π

[0.25 x USD7.3M] + [0.5 x USD3.25M] + [0.25 x (- USD0.8M)] =

USD1.825M + USD1.625M – USD0.200M = USD3.25M

Marking Scheme

1 mark for correct value of optimistic scenario profits
1 mark for correct value of most likely scenario profits
1 mark for correct value of pessimistic scenario revenues
1 mark for correct expression for expected profits
1 mark for correct value of expected profits

NB. Many students may simply calculate the expected profits in a single step by calculating the expected exchange rate of USD1.31250/EUR and not calculate the optimistic, most likely, and pessimistic profits separately. If done correctly, this is acceptable. Calculating the scenarios separately, however, shows the riskiness of speculating.

c. (5 marks) The treasurer directs you to recommend whether or not Magna should enter into a one-month forward currency contract. Explain your recommendation.

The expected USD Π is USD425,000 higher by speculating on the value of the spot rate in one month. However, there is 25 percent chance of a loss of USD0.8M. This is USD3.6M less than the outcome of USD2.8M by using a forward contract. Although the expected profit is somewhat higher by speculating, the risk is simply too great. Furthermore, the expected profit by speculating may be inaccurate, as it is dependent on the forecasting ability of the chief economist. I recommend using the forward contract.

Marking Scheme
3 marks for recognizing that there is a risk-return tradeoff
2 marks for the correct recommendation