Assessment Ended

MA 373 - Practice Final - with solutions has ended.

Problem 1

You are given the following two bonds:

Term	Annual Coupon	Maturity Value	Price
1 Year Bond	60	1,000	1,000.00
2 Year Bond	80	1,000	1,053.20

Calculate the 2 year spot interest rate.

(Round your answer to 4 decimal places.)

LATEX

Incorrect

Correct Answer: 0.0510

We find the one year spot rate, r_1, using the first bond.

$$1{,}000 = \frac{1{,}060}{1+r_1} \Longrightarrow r_1 = \frac{1{,}060}{1{,}000} - 1 = 0.06$$

We find the two year spot rate, r_2, using the second bond and r_1.

$$1{,}053.20 = \frac{80}{1+r_1} + \frac{1{,}080}{(1+r_2)^2}$$

$$\frac{1{,}080}{(1+r_2)^2} = 1{,}053.20 - \frac{80}{1.06} = 977.728$$

$$r_2 = \left(\frac{1{,}080}{977.728}\right)^{.5} - 1 = 0.051$$

Unlimited attempts

VARIABLE NAME	VALUE
$Price$	1,053.20
$Rate$	0.051
X	977.728

RESPONSE	ANSWER	ANSWER RANGE
1.	0.0510	[0.0509, 0.0511]

Problem 2

A 3 year bond has annual coupons.

a. The coupon at the end of the first year is 100.

b. The coupon at the end of the second year is 300.

c. The coupon at the end of the third year is 500.

The bond matures for 700.

Calculate the modified convexity of this bond at an annual effective rate of interest of 7.25%.

(Round your answer to 2 decimal places.)

LATEX

Incorrect

Correct Answer: 8.80

$$v^2 \frac{\sum_t C_t(t)(t+1)v^t}{\sum_t C_t \cdot v^t} = (1+7.25\%)^{-2}\left(\frac{100\,(1)(2)(1+7.25\%)^{-1} + 300\,(2)(3)(1+7.25\%)^{-2} + 1{,}200\,(3)(4)(1+7.25\%)^{-3}}{100\,(1+7.25\%)^{-1} + 300\,(1+7.25\%)^{-2} + 1{,}200\,(1+7.25\%)^{-3}}\right)$$

$$= \frac{11{,}670.47}{1{,}326.77} = 8.7962$$

Unlimited attempts

VARIABLE NAME	VALUE
Den	1,326.77
$ModCon$	8.7962
Num	11,670.47
$Rate$	7.25%

RESPONSE	ANSWER	ANSWER RANGE
1.	8.80	[8.70, 8.90]

Problem 3

An *n* year bond has a par value of 8,000. The bond pays semi-annual coupons of 240 and matures for par.

Linfeng purchases the bond for 8,837.21 based on a yield of 5% convertible semi-annually.

Determine *n*.

(Round your answer to the nearest whole number)

LATEX

Round your answer to 2 decimal places.

Incorrect

Correct Answer: 15.00

I/Y = 5/2 = 2.5, PMT = 240, PV = -8,837.21, FV = 12,000, CPT N ==> 30 ==>15 years

Or

$$8{,}837.21 = 240a_{\overline{n}|} + 8{,}000\,(1.025)^{-n} = 240\left(\frac{1-(1.025)^{-n}}{0.025}\right) + 8{,}000\,(1.025)^{-n} =$$

$$\frac{240}{0.025} - \left(\frac{240}{0.025}\right)(1.025)^{-n} + 8{,}000\,(1.025)^{-n} = 9{,}600 - (9{,}600 - 8{,}000)(1.025)^{-n} = 8{,}837.21$$

$$(1.025)^{-n} = \frac{9{,}600 - 8{,}837.21}{1{,}600} \Longrightarrow n = -\frac{\ln\left(\frac{9{,}600-8{,}837.21}{1{,}600}\right)}{\ln(1.025)} = 30 \Longrightarrow 15$$

Unlimited attempts

VARIABLE NAME	VALUE
j	0.025
$j1$	1.025
n	30
$n2$	15
$price$	8,837.21

RESPONSE	ANSWER	ANSWER RANGE
1.	15.00	-

Problem 4

A 40 year bond with a par value of 100,000 matures at par. The semi-annual coupons are paid at a rate of 9.8% convertible semi-annually. The bond is bought to yield 7% convertible semi-annually. Calculate the amortization of premium in the coupon paid at the end of the 15th year of this bond.

(Round your answer to the nearest two decimal places)

LATEX

Incorrect

Correct Answer: 242.20

Coupon = 100,000(9.8%/2) = 4,900.00

Book Value after the 29th Coupon is the present value of future cash flows:

N = 51, I/Y = 3.5, PMT = 4,900.00, FV = 100,000, CPT PV = 133,080.06

Or

$$= 4{,}900.00\left(\frac{1-(1.035)^{-51}}{0.035}\right) + 100{,}000\,(1.035)^{-51} = 133{,}080.06$$

$133{,}080.06\,(0.035) = 4{,}657.80$ is the interest in the 30th coupon.

$4{,}900.00 - 4{,}657.80 = 242.20$ is the principal in the 30th coupon.

Unlimited attempts

VARIABLE NAME	VALUE
ans	242.20
$coup$	4,900.00
$coupon$	4,900.000000000
int	4,657.80
p	9.8%
$p1$	0.049
pv	133,080.06

RESPONSE	ANSWER	ANSWER RANGE
1.	242.20	[242.15, 242.25]

Problem 5

Sparks-Norris Asset Partners (SNAP) manages the following portfolio of bonds:

Bond	Price	Macaulay Duration
1	5,000	10
2	10,000	6
3	20,000	8
4	15,000	2

The duration is calculated at an annual effective interest rate of 6.00%.

Calculate the modified duration of SNAP's portfolio.

(Round your answer to 2 decimal places.)

LATEX

Incorrect

Correct Answer: 5.66

$D^{Port} = \frac{\Sigma D^t P^t}{\Sigma P^t}$ where D^t is Modified Duration.

In order to get Modified Duration from Macaulay Duration, we multiply Macaulay by v.

$$\frac{\Sigma D^t P^t}{\Sigma P^t} = \frac{10\,(5{,}000) + 6\,(10{,}000) + 8\,(20{,}000) + 2\,(15{,}000)}{5{,}000 + 10{,}000 + 20{,}000 + 15{,}000} v = 5.660$$

Unlimited attempts

VARIABLE NAME	VALUE
$DPort$	5.660
$Rate$	6.00%

RESPONSE	ANSWER	ANSWER RANGE
1.	5.66	[5.64, 5.68]

Problem 6

Sue wants to fully immunize a future payment of 100,000 at time 10 using the following two bonds:

a. A zero coupon bond maturing in 5 years; and

b. A zero coupon bond maturing in 20 years.

Determine the amount that Sue should spend on each bond at an annual effective interest rate of 9.50%.

(Round your answer to 2 decimal places.)

a

Amount spent on bond a : LATEX

Incorrect

Correct Answer: 26,900.95

Unlimited attempts

b

Amount spent on bond b : LATEX

Incorrect

Correct Answer: 13,450.47

Present Value Matching:

Let A = present value of 5 year bond

Let B = present value of 20 year bond

PV(assets)=PV(liabilities)

$A + B = 100{,}000\,(1 + 9.50\%)^{-10}$

Duration Matching:

Duration(assets)=Duration(liabilities)

$5A + 20B = 10\left(100{,}000\,(1 + 9.50\%)^{-10}\right)$

Now we have two equations with two unknowns. We can solve for A and B.

$A = 100{,}000\,(1 + 9.50\%)^{-10} - B$

$A = 40{,}351.41867 - B$

$5\,(40{,}351.41867 - B) + 20B = 10\,(40{,}351.41867)$

$15B = 403{,}514.18670 - 201{,}757.09335$

$B = 13{,}450.47$

$A = 40{,}351.41867 - 13{,}450.47$

$A = 26{,}900.95$

Unlimited attempts

VARIABLE NAME	VALUE
A	26,900.95
B	13,450.47
R	403,514.18670
$Rate$	9.50%
S	201,757.09335
V	40,351.41867

RESPONSE	ANSWER	ANSWER RANGE
a.	26,900.95	[26,900.85, 26,901.05]
b.	13,450.47	[13,450.37, 13,450.57]

Problem 7

Wang Life Insurance Company issues a three year annuity that pays 40,000 at the end of each year. Wang uses the following three bonds to absolutely match the cash flows under this annuity:

a. A zero coupon bond which matures in one year for 1,000.

b. A two year bond which matures for 1,200 and pays an annual coupon of 100. This bond is priced using an annual yield of 7%.

c. A three year bond which matures for 2,000 and pays annual coupons of 75. This bond has a price of 1,750.

It cost Wang 104,000 to purchase all three bonds to absolutely match this annuity.

Calculate the one year spot interest rate.

(Round your answer to 4 decimal places.)

LATEX

Incorrect

Correct Answer: 0.0523

Absolute matching means that the cash flow from the bonds at any given time should be exactly the same as the cash flow from the annuity. In this case, we need the bonds to produce a cash flow of $40,000 at times 1,2, and 3. In order to do this we will need to buy a certain amount of each bond. These values will be "x, y, and z".

Sometimes it is easiest to set up a table that summarizes cash flows:

Bond	Amount	Price	CF at t=1	CF at t=2	CF at t=3
A	X	$1000/(1+r_1)$	1000	0	0
B	Y	1228.928291	100	1300	0
C	Z	1750	75	75	2075

In the table above, the Price for bond B was found using the calculator.

$\boxed{N = 2}\boxed{PMT = 100}\boxed{I/Y = 7}\boxed{FV = 1200}\boxed{CPT}\boxed{PV = 1228.928291}$

Now we can set up a few equations in order to solve for the unknown variables.

First, since there is only one bond with a cash flow at time 3 we can find z very easily:

$2{,}075Z = 40{,}000$

$Z = 19.277$

Then we can find Y:

$1{,}300Y + 75Z = 40{,}000$

$1{,}000Y + 75Z = 40{,}000$

$$Y = \frac{40{,}000 - 75\,(19.277)}{1{,}300} = 29.657$$

Finally we can find X.

$1{,}000X + 100Y + 75Z = 40{,}000$

$$X = \frac{40{,}000 - 75\,(19.277) - 100\,(29.657)}{1{,}000} = 35.5885$$

Now that we know the amount of each bond we are purchasing and we are given our total cost, we just need to find the price of the one year bond which will in turn give us the one year spot rate.

$$104{,}000 = \frac{1{,}000}{1 + r_1}X + 1{,}228.928291Y + 1{,}750Z$$

Note that the price of the first bond $= \dfrac{1{,}000}{1 + r_1}$

Now just plug in the values we found above to get $r_1 = 0.05233$.

Unlimited attempts

RESPONSE	ANSWER	ANSWER RANGE
1.	0.0523	$[0.0522, 0.0524]$

Problem 8

Trevor, Andrew, Emma, and Maddie enter a four-way loan agreement. As part of this agreement, Trevor pays Andrew 1,000 at time 0. At the end of 3 years, Andrew agrees to pay 1,200 to Emma. At the end of 5 years, Emma pays 1,355.09 to Maddie. Finally, at the end of N years, Maddie pays Trevor a total of 2,000.

Using the bottom line approach, all four participants have the same annual yield.

Determine N to three decimal places. (Please note that N is not an integer.)

LATEX

Round your answer to 3 decimal places.

Incorrect

Correct Answer: 11.405

Andrew's cashflows are 1000 at time 0, and -1200 at time 3; His equation of value is

$$1000\,(1+i)^3 = 1200 \Rightarrow i = \left(\frac{1200}{1000}\right)^{\frac{1}{3}} - 1 = 0.062658569$$

To find N, Trevor's cashflows are -1000 at time 0, and 2000 at time N. His equation of value is

$$1000\,(1.062658569)^N = 2000 \Rightarrow N = \frac{\ln\left(\frac{2000}{1000}\right)}{\ln 1.062658569} = 11.405$$

Unlimited attempts

RESPONSE	ANSWER	ANSWER RANGE
1.	11.405	-

Problem 9

An annuity immediate pays 100 at the end of each year for 5 years. Calculate the Macaulay convexity and the Modified convexity of this annuity at an annual effective rate of 6.75%.

(Round your answers to 2 decimal places.)

a

Modified Convexity : LATEX

Incorrect

Correct Answer: 11.49

$$v^2 \frac{\sum_t C_t(t)(t+1)v^t}{\sum_t C_t \cdot v^t} =$$

$$(1.0675)^{-2}\left(\frac{100\,(1)(2)(1.0675)^{-1} + 100\,(2)(3)(1.0675)^{-2} + 100\,(3)(4)(1.0675)^{-3} + 100\,(4)(5)(1.0675)^{-4} + 100\,(5)(6)(1.0675)^{-5}}{100\,(1.0675)^{-1} + 100\,(1.0675)^{-2} + 100\,(1.0675)^{-3} + 100\,(1.0675)^{-4} + 100\,(1.0675)^{-5}}\right)$$

$= 11.4897$

Unlimited attempts

b

Macaulay Convexity : LaTeX

Incorrect

Correct Answer: 10.22

Note: As you can see from Modified Convexity, the 100 in the numerator and denominator will cancel since all cash flows are 100. Therefore, the 100's have not been included in the formulas below.

$$\frac{\sum_t C_t(t)^2 v^t}{\sum_t C_t \cdot v^t}$$

$$= \frac{1(1.0675)^{-1} + 2^2(1.0675)^{-2} + 3^2(1.0675)^{-3} + 4^2(1.0675)^{-4} + 5^2(1.0675)^{-5}}{(1.0675)^{-1} + (1.0675)^{-2} + (1.0675)^{-3} + (1.0675)^{-4} + (1.0675)^{-5}}$$

$$= \frac{1(1.0675)^{-1} + 4(1.0675)^{-2} + 9(1.0675)^{-3} + 16(1.0675)^{-4} + 25(1.0675)^{-5}}{(1.0675)^{-1} + (1.0675)^{-2} + (1.0675)^{-3} + (1.0675)^{-4} + (1.0675)^{-5}}$$

$$= 10.2236$$

Unlimited attempts

VARIABLE NAME	VALUE
$MacCon$	10.2236
$ModCon$	11.4897
r	0.0675
$r1$	1.0675
$Rate$	6.75%

RESPONSE	ANSWER	ANSWER RANGE
a.	11.49	[11.48, 11.50]
b.	10.22	[10.21, 10.23]

Problem 10

A 20 year bond has a par value of *F*. The bond has a maturity value of 1.25*F*. The bond pays semi-annual coupons at a rate of 6% compounded semi-annually.

The bond is bought at a discount of 28.99 when purchased to yield 5% convertible semi-annually.

Determine *F*.

(Round your answer to the nearest two decimal places)

LaTeX

Incorrect

Correct Answer: 923.88

$$r = \frac{0.06}{2} = 0.03; F = F; C = 1.25F; j = \frac{0.05}{2} = 0.025; n = (20)(2) = 40$$

$$P = C - 28.99 = 1.25F - 28.99 \qquad \text{Since the bond sells at a discount}$$

$$P = Fra_{\overline{40}|} + Cv^{40} \Longrightarrow 1.25F - 28.99 = F(0.03)\left(\frac{1-(1.025)^{-40}}{0.025}\right) + 1.25F(1.025)^{-40}$$

Solve for F.

$$1.25F - 28.99 = F(.753083252) + (0.46553828)F \Longrightarrow F = \frac{28.99}{1.25 - 1.218621532} = 923.88$$

Unlimited attempts

RESPONSE	ANSWER	ANSWER RANGE
1.	923.88	[923.78, 923.98]

Problem 11

A callable bond matures in 10 years for 1000. The bond pays semi-annual coupons of 42.

The bond may be called at the end of year 6 or year 8. The call value at the end of year 6 is 1085. The call value at the end of year 8 is 1043.

Andrew purchased this bond at issue to yield 6% convertible semi-annually. The price is P_1.

Two years after issue, Andrew sells the bond for a price of P_2. to yield 5% convertible semi-annually.

Calculate P_2 - P_1.

(Round your answer to the nearest two decimal places)

LATEX

Incorrect

Correct Answer: 14.13

N	I/Y	PMT	FV	Price
12	3	-42	-1085	1179.07
16	3	-42	-1043	1177.53
20	3	-42	-1000	1178.53

$P_1 = 1177.53$

At the end of two years, to find the price, you now have a bond that matures in 8 years and can be called at the end of 4 years or 6 years. You calculate the price at each of those points and then choose the lowest.

N	I/Y	PMT	FV	Price
8	2.5	-42	-1085	1191.66
12	2.5	-42	-1043	1206.35
16	2.5	-42	-1000	1221.94

$P_2 = 1191.66$

$P_2 - P_1 = 1191.66 - 1177.53 = 14.13$

Unlimited attempts

RESPONSE	ANSWER	ANSWER RANGE
1.	14.13	[14.10, 14.16]

Problem 12

A 30 year special bond has annual coupons and a maturity value of 100,000. The annual coupons are 500 in the first year, 1,000 in the second year, 1,500 in the third year and continue to increase by 500 each year.

Calculate the amount of principal in the 29th coupon assuming that the bond was purchased to a yield rate of 4.4%.

(Round your answer to the nearest two decimal places)

LATEX

Incorrect

Correct Answer: 9,246.41

We need the book value right after the 28th coupon which is the present value of future cash flows = Present value of 29th coupon + the present value of the 30th coupon + the present value of the maturity value.

29th coupon = (29)(500) = 14,500 and 30th coupon = (30)(500) = 15,000

Then present value =

$14{,}500v + 15{,}000v^2 + 100{,}000v^2 = 14{,}500\,(1.044)^{-1} + 115{,}000\,(1.044)^{-2} = 119{,}399.67$

Coupon = 14,500

Interest = 119,399.67(0.044) = 5,253.59

Principal = 14,500 - 5,253.59 = 9,246.41

Unlimited attempts

VARIABLE NAME	VALUE
ans	9,246.41

RESPONSE	ANSWER	ANSWER RANGE
1	9,246.41	[9,246.36, 9,246.46]

$dn3$	9,246.41	1.	9,246.41	[9,246.36, 9,246.46]
$c29$	14,500.00			
$c30$	15,000.00			
i	4.4%			
$i1$	1.044			
$i2$	0.044			
int	5,253.59			
pv	119,399.67			

Problem 13

Lauren wants to fully immunize a future payment of X at time Y using the following two bonds:

a. Bond A is a zero coupon bond maturing in 2 years; and

b. Bond B is a zero coupon bond maturing in 10 years.

Lauren pays 13,622.79 for Bond A and 6,192.18 for Bond B. Determine X and Y if the annual effective interest rate of 5%.

(Round your answers to 2 decimal places.)

a

X = LATEX

Incorrect

Correct Answer: 24,680.00

Unlimited attempts

b

Y = LATEX

Incorrect

Correct Answer: 4.50

Present Value Matching:

$x\,(1.05)^{-y} = 13{,}622.79 + 6{,}192.18$

Duration Matching:

$yx\,(1.05)^{-y} = 2\,(13{,}622.79) + 10\,(6{,}192.18)$

Now we have two equations with two unknowns, so we can solve for x and y:

$x = 19{,}814.97\,(1.05)^{y}$

$y = (19{,}814.97\,(1.05)^{y})(1.05)^{-y} = 89{,}167.38$

$y = \frac{89{,}167.38}{19{,}814.97}$

$y = 4.5$

$x = 19{,}814.97\,(1.05)^{4.5}$

$x = 24{,}680.00$

Unlimited attempts

RESPONSE	ANSWER	ANSWER RANGE
a.	24,680.00	[24,679.90, 24,680.10]
b.	4.50	[4.40, 4.60]

Problem 14

A 10-year bond has a maturity value of 10,000 and semi-annual coupons of 500. Calculate the price of this bond immediately after the 13th coupon at a yield rate of 5.6% convertible semi-annually. (Remember that the price of a bond at any point during its lifetime is the present value of future cash flows).

(Round your answer to the nearest two decimal places)

LATEX

Incorrect

Correct Answer: 11,381.05

Price is equal to the present value of future cash flows.

N = 7, I/Y = 5.672 = 2.800, PMT = 500, FV = 10,000, CPT PV ==> 11,381.05

Or

$$500\left(\frac{1-\left(1+\frac{0.056}{2}\right)^{-7}}{\left(\frac{0.056}{2}\right)}\right)+10{,}000\left(1+\frac{0.056}{2}\right)^{-7}=11{,}381.05$$

Unlimited attempts

VARIABLE NAME	VALUE
ans	11,381.05
i	5.6%
$i1$	0.056
$i2$	5.6
$i3$	2.800

RESPONSE	ANSWER	ANSWER RANGE
1.	11,381.05	[11,380.95, 11,381.15]

Problem 15

15.1 A bond has a Macaulay Duration of 4.450926 and a Macaulay Convexity of 21.19773 when calculated using an annual effective interest rate of 8%. The price of the bond is 1096.19. (Round your answers to 2 decimal places.)

a. Estimate the price of the bond if the annual interest rate increases to 8.40% using the first order modified approximation.

LATEX

Incorrect

Correct Answer: 1,078.12

$$P(i)=P(i_0)\left[1-(ModDur)(i-i_0)+(ModConv)\left(\frac{(i-i_0)^2}{2}\right)\right]$$

If we ignore the last term, we have

$P(i)=P(i_0)[1-(ModDur)(i-i_0)]$

$ModDur=v(MacDur)=\frac{4.450926}{1.08}$

$P(i)=1{,}096.19\left[1-\left(\frac{4.450926}{1.08}\right)(8.40\%-0.08)\right]=1{,}078.12$

Unlimited attempts

15.2 b. Estimate the price of the bond if the annual interest rate increases to 8.40% using the first order Macaulay approximation.

LATEX

Incorrect

Correct Answer: 1,078.30

$$P(i)=P(i_0)\left[\frac{1+i_0}{1+i}\right]^{MacDur}=(1{,}096.19)\left[\frac{1.08}{1+8.40\%}\right]^{4.450926}=1{,}078.30$$

Unlimited attempts

15.3 c. The values in this problem are based on a 5 year bond with annual coupons of 70 and a maturity value of 1,200. What would the actual price be at 8.40%.

LATEX

Incorrect

Correct Answer: 1,078.31

$$70\left(\frac{1-(1+8.40\%)^{-5}}{8.40\%}\right)+1{,}200\,(1+8.40\%)^{-5}=1{,}078.31$$

Unlimited attempts

VARIABLE NAME	VALUE
A	1,078.12
B	1,078.30
C	1,078.31

RESPONSE	ANSWER	ANSWER RANGE
15.1.	1,078.12	[1,078.02, 1,078.22]
15.2.	1,078.30	[1,078.20, 1,078.40]
15.3.	1,078.31	[1,078.21, 1,078.41]

	1,018.31	1,018.31	[1,018.21, 1,018.41]
Rate	8.40%		

Problem 16

Yegor borrows 25,000 from Kunyang. The loan will be repaid with three annual payments of 9619.95.

Kunyang reinvests the payments at an annual effective rate of r.

After reinvestment, Kunyang realizes an annual yield rate of 7% on the loan.

Determine r.

LATEX

Incorrect

Correct Answer: 0.06

We know the accumulated value for Kunyang at time 3 is the same:

$25{,}000\,(1.07)^3 = 9{,}619.95\,(1+r)^2 + 9{,}619.95\,(1+r) + 9{,}619.85 = 30{,}626.075$

$\Rightarrow 9{,}619.95\,(1+r)^2 + 9{,}619.95\,(1+r) - 21{,}006.125 = 0$

Let $(1+r) = x$

$\Rightarrow 9{,}619.95x^2 + 9{,}619.95x - 21{,}006.125 = 0$

$$x = \frac{-9{,}619.95 \pm \sqrt[2]{(9{,}619.95)^2 - 4\,(9{,}619.95)(-21{,}006.125)}}{2\,(9{,}619.95)}$$

$x = -2.060000, 1.060000$

So, $1 + r = 1.060000 \Rightarrow r = 0.060000$

Unlimited attempts

RESPONSE	ANSWER	ANSWER RANGE
1.	0.06	[0.05999, 0.06001]

Problem 17

Haokun borrowed money to buy a new car. Payments are made monthly. The loan has a nominal interest rate of 6.0% compounded monthly. Immediately after the 18th payment, Haokun has an outstanding balance of 10,500.

Calculate the amount of interest in the 19th payment.

(Round your answer to the nearest two decimal places)

LATEX

Incorrect

Correct Answer: 52.50

$Interest = (OLB_{k-1})(i)$

$10{,}500\left(\frac{0.060}{12}\right) = 52.50$

Unlimited attempts

VARIABLE NAME	VALUE
ans	52.50
i	6.0%
i1	0.060
p	10,500

RESPONSE	ANSWER	ANSWER RANGE
1.	52.50	[52.40, 52.60]

Problem 18

The following is a list of prices for zero-coupon bonds with par value of 1,000 and maturities as follows:

Years to Maturity	Price of Bond
1	836.51
2	703.30

2	703.30
3	719.12
4	905.26

Calculate $f_{[2,4]}$.

LaTeX

Incorrect

Correct Answer: -0.12

First, we need to find spot rates using bootstrapping.

Using the second bond,

$$703.30 = \frac{1000}{(1+r_2)^2} \Longrightarrow r_2 = \sqrt{\frac{1000}{703.30}} - 1 = 0.192421207$$

We can also use the forth bond,

$$905.26 = \frac{1000}{(1+r_4)^4} \Longrightarrow r_4 = \left(\frac{1000}{905.26}\right)^{\frac{1}{4}} - 1 = 0.025195443$$

$$(1+r_2)^2\left(1+f_{[2,4]}\right)^2 = (1+r_4)^4$$

$$\Longrightarrow f_{[2,4]} = \sqrt{\frac{(1+r_4)^4}{(1+r_2)^2}} - 1 = \sqrt{\frac{(1+0.025195443)^4}{(1+0.192421207)^2}} - 1 = -0.12$$

Unlimited attempts

VARIABLE NAME	VALUE
ans	-0.12
$P1$	836.51
$P2$	703.30
$P3$	719.12
$P4$	905.26
$r2$	0.192421207
$r4$	0.025195443

RESPONSE	ANSWER	ANSWER RANGE
1.	-0.12	$[-2.12, 1.88]$