Problem 2.4

Power	**0**	**1**	**2**
Coefficients	-1	1	1
Iteration k	λ_k	$f(\lambda_k)$	$f'(\lambda_k)$
0	1	1	3
1	0.666666667	0.111111111	2.333333333
2	0.619047619	0.002267574	2.238095238
3	0.618034448	1.02652E-06	2.236068896
4	0.618033989	2.10665E-13	2.236067977
5	0.618033989	0	2.236067977
6	0.618033989	0	2.236067977
7	0.618033989	0	2.236067977
8	0.618033989	0	2.236067977
9	0.618033989	0	2.236067977
10	0.618033989	0	2.236067977
11	0.618033989	0	2.236067977
12	0.618033989	0	2.236067977
13	0.618033989	0	2.236067977
14	0.618033989	0	2.236067977
15	0.618033989	0	2.236067977
16	0.618033989	0	2.236067977
17	0.618033989	0	2.236067977
18	0.618033989	0	2.236067977
19	0.618033989	0	2.236067977
20	0.618033989	0	2.236067977

Problem 2.6

Payment Period	6
Payment Amoun	$1,000
Annual Interest F	12%
Monthly Int. Rate	1%

Assuming monthly compounding.
If this assumption is not valid, please ignore the answer.

	Option I	Option II
0	$1,000	$1,900
1	$1,000	$900
2	$1,000	$900
3	$1,000	$900
4	$1,000	$900
5	$1,000	$900
Present Vlaue	$5,853.43	$6,268.09

Do not switch the apartments

	Option I	Option II
0	$1,000	$1,900
1	$1,000	$900
2	$1,000	$900
3	$1,000	$900
4	$1,000	$900
5	$1,000	$900
6	$1,000	$900
7	$1,000	$900
8	$1,000	$900
9	$1,000	$900
10	$1,000	$900
11	$1,000	$900
Present Va	$11,367.63	$11,230.87

Switch the apartments.

9.48 periods make two options equal.

Problem 2.13

In general, we say that two projects with cash flows X_i and Y_i, $i = 1, 2, ..., n$, cross if $X_0 < Y_0$ and $\sum_{i=0}^{n} X_i > \sum_{i=1}^{n} Y_i$. Let $P_x(d)$ and $P_y(d)$ denote the present values of these two projects when the discount factor is d.

(a) Show that there is a crossover value $c > 0$ such that $P_x(c) = P_y(c)$.

(b) For Exercise 2.11, calculate the crossover values c.

Solution:

(a) Let's define function $f(d) = P_x(d) - P_y(d)$. For $d = 0$ we have $f(0) = P_x(0) - P_y(0) = X_0 - Y_0 < 0$. For $d = 1$ we have

$$f(1) = P_x(1) - P_y(1) = \sum_{i=0}^{n} X_i - \sum_{i=0}^{n} Y_i > 0.$$

Function $f(d)$ is continuous, so we have that there exists such c, $0 < c < 1$ such that $f(c) = P_x(c) - P_y(c) = 0$.

The statement is proved.

(b)

Year	0	1	2	3	4	5
Project 1	$ (100.00)	$ 30.00	$ 30.00	$ 30.00	$ 30.00	$ 30.00
PV of Project 1	$ (100.00)	$ 28.19	$ 26.50	$ 24.90	$ 23.41	$ 22.00
Project 2	$ (150.00)	$ 42.00	$ 42.00	$ 42.00	$ 42.00	$ 42.00
PV of Project 2	$ (150.00)	$ 39.47	$ 37.10	$ 34.87	$ 32.77	$ 30.80

Value of C	0.9398312
Value of f(C)	-0.000207

Problem 3.5

coupon rate	r	10%
maturity(yr)	n	20
called yr.		5
%plus		5%
Face value	F	1000
No. of coupon per yr.	m	1
Coupon payment per yr.	C	100
Yield	λ	10%

n	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
C		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	1100

Present Value at year "n"	1000	**1000**
New Present Value (up 5%) at year 5		**1050**

In order not to buy the bond back, the coporation will adjust the "Lamda" value in order to satisfy the price of bond.

n	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
C	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	1100

The new Price of Bond at year 5 **1050**

By using the trial and error method, we can solve for the new Lamda.

				New Lamda	Price of Bond
Yeild	λ	10%		10.00%	1000.00
Coupon rate	r	10%		9.50%	1039.14
YTM	n	15	years	9.40%	1047.24
Face Value	F	1000		9.30%	1055.44
Coupon payment per year	c	100		9.35%	1051.33
Number of periods per year	m	1		9.36%	1050.51
				9.366%	1050.02
				9.38%	1048.87

The Z Corporation has to deduce the yeild to < **9.366%**

Problem 3.8

mortgage value : P	100000
interest(initial) : r	8%
period : n	30
interest after 5 years	9%
period after 5 years	25

a) original yearly mortgage payment $8,882.74 ($8,882.74)

b) the mortgage balance after 5 years $94,821.30

c) new yearly payment after 5 years $9,653.40

new term will be 38 years after interest change or 43 year since year 1 with the last payment at 5115.25

d) what will be the new term if payments remain the same

38 years	count after interest change	37.5653059
43 years	count from year 1	42.5653059

new term will be 38 years after interest change with the last payment at $ 5115.25

year	Owe	Pay	Unpaid	Interest	Balance	Equity
1	100,000.00	8,882.74	91,117.26	8,000.00	99,117.26	882.74
2	99,117.26	8,882.74	90,234.51	7,929.38	98,163.89	1,836.11
3	98,163.89	8,882.74	89,281.15	7,853.11	97,134.26	2,865.74
4	97,134.26	8,882.74	88,251.52	7,770.74	96,022.26	3,977.74
5	96,022.26	8,882.74	87,139.52	7,681.78	94,821.30	5,178.70
6	94,821.30	8,882.74	85,938.55	7,585.70	93,524.26	6,475.74
7	93,524.26	8,882.74	84,641.51	7,481.94	92,123.45	7,876.55
8	92,123.45	8,882.74	83,240.71	7,369.88	90,610.59	9,389.41
9	90,610.59	8,882.74	81,727.84	7,248.85	88,976.69	11,023.31
10	88,976.69	8,882.74	80,093.95	7,118.14	87,212.08	12,787.92
11	87,212.08	8,882.74	78,329.34	6,976.97	85,306.31	14,693.69
12	85,306.31	8,882.74	76,423.56	6,824.50	83,248.07	16,751.93
13	83,248.07	8,882.74	74,365.32	6,659.85	81,025.17	18,974.83
14	81,025.17	8,882.74	72,142.43	6,482.01	78,624.44	21,375.56
15	78,624.44	8,882.74	69,741.70	6,289.96	76,031.65	23,968.35
16	76,031.65	8,882.74	67,148.91	6,082.53	73,231.44	26,768.56
17	73,231.44	8,882.74	64,348.70	5,858.52	70,207.21	29,792.79
18	70,207.21	8,882.74	61,324.47	5,616.58	66,941.05	33,058.95
19	66,941.05	8,882.74	58,058.30	5,355.28	63,413.59	36,586.41
20	63,413.59	8,882.74	54,530.84	5,073.09	59,603.93	40,396.07
21	59,603.93	8,882.74	50,721.19	4,768.31	55,489.50	44,510.50
22	55,489.50	8,882.74	46,606.76	4,439.16	51,045.92	48,954.08

23	51,045.92	8,882.74	42,163.18	4,083.67	46,246.85	53,753.15
24	46,246.85	8,882.74	37,364.11	3,699.75	41,063.85	58,936.15
25	41,063.85	8,882.74	32,181.11	3,285.11	35,466.22	64,533.78
26	35,466.22	8,882.74	26,583.48	2,837.30	29,420.77	70,579.23
27	29,420.77	8,882.74	20,538.03	2,353.66	22,891.69	77,108.31
28	22,891.69	8,882.74	14,008.95	1,831.34	15,840.28	84,159.72
29	15,840.28	8,882.74	6,957.54	1,267.22	8,224.76	91,775.24
30	8,224.76	8,882.74	-657.98	657.98	0.00	100,000.00

year after	year	Owe	Pay	Unpaid	Interest	Balance	Equity
	1	100,000.00	8,882.74	91,117.26	8,000.00	99,117.26	882.74
	2	99,117.26	8,882.74	90,234.51	7,929.38	98,163.89	1,836.11
	3	98,163.89	8,882.74	89,281.15	7,853.11	97,134.26	2,865.74
	4	97,134.26	8,882.74	88,251.52	7,770.74	96,022.26	3,977.74
	5	96,022.26	8,882.74	87,139.52	7,681.78	94,821.30	5,178.70
1	6	94,821.30	8,882.74	85,938.55	8,533.92	94,472.47	5,527.53
2	7	94,472.47	8,882.74	85,589.73	8,502.52	94,092.25	5,907.75
3	8	94,092.25	8,882.74	85,209.51	8,468.30	93,677.81	6,322.19
4	9	93,677.81	8,882.74	84,795.07	8,431.00	93,226.07	6,773.93
5	10	93,226.07	8,882.74	84,343.32	8,390.35	92,733.67	7,266.33
6	11	92,733.67	8,882.74	83,850.93	8,346.03	92,196.96	7,803.04
7	12	92,196.96	8,882.74	83,314.21	8,297.73	91,611.94	8,388.06
8	13	91,611.94	8,882.74	82,729.20	8,245.07	90,974.27	9,025.73
9	14	90,974.27	8,882.74	82,091.53	8,187.68	90,279.21	9,720.79
10	15	90,279.21	8,882.74	81,396.47	8,125.13	89,521.60	10,478.40
11	16	89,521.60	8,882.74	80,638.86	8,056.94	88,695.80	11,304.20
12	17	88,695.80	8,882.74	79,813.06	7,982.62	87,795.68	12,204.32
13	18	87,795.68	8,882.74	78,912.93	7,901.61	86,814.55	13,185.45
14	19	86,814.55	8,882.74	77,931.80	7,813.31	85,745.11	14,254.89
15	20	85,745.11	8,882.74	76,862.37	7,717.06	84,579.43	15,420.57
16	21	84,579.43	8,882.74	75,696.69	7,612.15	83,308.83	16,691.17
17	22	83,308.83	8,882.74	74,426.09	7,497.80	81,923.89	18,076.11
18	23	81,923.89	8,882.74	73,041.14	7,373.15	80,414.29	19,585.71
19	24	80,414.29	8,882.74	71,531.55	7,237.29	78,768.83	21,231.17
20	25	78,768.83	8,882.74	69,886.09	7,089.20	76,975.29	23,024.71
21	26	76,975.29	8,882.74	68,092.54	6,927.78	75,020.32	24,979.68
22	27	75,020.32	8,882.74	66,137.58	6,751.83	72,889.40	27,110.60
23	28	72,889.40	8,882.74	64,006.66	6,560.05	70,566.71	29,433.29
24	29	70,566.71	8,882.74	61,683.96	6,351.00	68,034.97	31,965.03
25	30	68,034.97	8,882.74	59,152.22	6,123.15	65,275.37	34,724.63

26	31	65,275.37	8,882.74	56,392.63	5,874.78	62,267.41	37,732.59
27	32	62,267.41	8,882.74	53,384.67	5,604.07	58,988.74	41,011.26
28	33	58,988.74	8,882.74	50,105.99	5,308.99	55,414.98	44,585.02
29	34	55,414.98	8,882.74	46,532.23	4,987.35	51,519.58	48,480.42
30	35	51,519.58	8,882.74	42,636.84	4,636.76	47,273.60	52,726.40
31	36	47,273.60	8,882.74	38,390.86	4,254.62	42,645.48	57,354.52
32	37	42,645.48	8,882.74	33,762.74	3,838.09	37,600.83	62,399.17
33	38	37,600.83	8,882.74	28,718.09	3,384.07	32,102.16	67,897.84
34	39	32,102.16	8,882.74	23,219.42	2,889.19	26,108.62	73,891.38
35	40	26,108.62	8,882.74	17,225.87	2,349.78	19,575.65	80,424.35
36	41	19,575.65	8,882.74	10,692.90	1,761.81	12,454.71	87,545.29
37	42	12,454.71	8,882.74	3,571.97	1,120.92	4,692.89	95,307.11
38	43	4,692.89	5,115.25	-422.36	422.36	0.00	100,000.00

Problem 3.12

End of year payments	Bond A	Bond B	Bond C	Bond D
Year 1	100	50	0	0+1000
Year 2	100	50	0	0
Year 3	100+1000	50+1000	0+1000	0

(a) Price

	Bond A	Bond B	Bond C	Bond D
Face value, F	1000	1000	1000	1000
Coupon amount, C	100	50	0	0
Yield, λ	0.15	0.15	0.15	0.15
Number of years, n	3	3	3	1
Number of coupon pays per year, m	1	1	1	1
λ/m	0.15	0.15	0.15	0.15
PV of face value	657.52	657.52	657.52	869.57
PV of coupon pays	228.32	114.16	0.00	0.00
Price, P	885.84	771.68	657.52	869.57

(b) Duration

Bond A

Year	Payment	Disc. fct.	PV of pymt	Weight	Year x Weight
1	100	0.86957	86.95652	0.09816	0.10
2	100	0.75614	75.61437	0.08536	0.17
3	1100	0.65752	723.26786	0.81648	2.45
Sum			885.83874	1.00000	2.72

Bond B

Year	Payment	Disc. fct.	PV of pymt	Weight	Year x Weight
1	50	0.86957	43.47826	0.05634	0.06
2	50	0.75614	37.80718	0.04899	0.10
3	1050	0.65752	690.39204	0.89466	2.68
Sum			771.67749	1.00000	2.84

Bond C

Year	Payment	Disc. fct.	PV of pymt	Weight	Year x Weight
1	0	0.86957	0.00000	0.00000	0.00
2	0	0.75614	0.00000	0.00000	0.00
3	1000	0.65752	657.51623	1.00000	3.00
Sum			657.51623	1.00000	3.00

Bond D

Year	Payment	Disc. fct.	PV of pymt	Weight	Year x Weight
1	1000	0.86957	869.56522	1.00000	1.00
2	0	0.75614	0.00000	0.00000	0.00
3	0	0.65752	0.00000	0.00000	0.00
Sum			869.56522	1.00000	1.00

(c) Which bond is most sensitive to a change in yield?

	Bond A	Bond B	Bond C	Bond D
D	2.72	2.84	3.00	1.00
λ	0.15	0.15	0.15	0.15
m	1	1	1	1
D_m	2.36	2.47	2.61	0.87

> Bond C is most sensitive.

(d) Constraints for immunization

$V_A + V_B + V_C + V_D = PV$
$D_AV_A + D_BV_B + D_CV_C + D_DV_D = 2PV$

(e) Immunize the portfolio

I would choose **Bond D**, whose duration is shortest,
and which is the least sensitive to a change in yield.

$V_C + V_D = PV$
$D_CV_C + D_DV_D = 2PV$

$PV = 1512.28733$
$D_C = 3.00$
$D_D = 1.00$

[1] $V_C + V_D = 1512.2873$
[2] $3V_C + 1V_D = 3024.5746$

[2]-[1] $2V_C = 1512.2873$

$V_C = 756.1437$
$V_D = 756.1437$

(f) Other choices to lower total cost?

None.