Adam Gincel

BT321

Problem Set 1

I pledge my honor that I have abided by the Stevens Honor System.

1. Question 1
    a. 1.1
        i. Monthly payment: N = 15 * 12 = 180, PV = 500000, i/y = 4%/12 = 0.3333%, fv = 0, **PMT = Xa = 3698.44**

Month	Before Month	Payment	Interest	Principal	Remaining
1	$ 500,000.00	$3,698.44	$1,666.67	$ 2,031.77	$497,968.23
2	$ 497,968.23	$3,698.44	$1,659.89	$ 2,038.55	$495,929.68
3	$ 495,929.68	$3,698.44	$1,653.10	$ 2,045.34	$493,884.34
4	$ 493,884.34	$3,698.44	$1,646.28	$ 2,052.16	$491,832.18
5	$ 491,832.18	$3,698.44	$1,639.44	$ 2,059.00	$489,773.18
6	$ 489,773.18	$3,698.44	$1,632.58	$ 2,065.86	$487,707.32
7	$ 487,707.32	$3,698.44	$1,625.69	$ 2,072.75	$485,634.57
8	$ 485,634.57	$3,698.44	$1,618.78	$ 2,079.66	$483,554.91
9	$ 483,554.91	$3,698.44	$1,611.85	$ 2,086.59	$481,468.33
10	$ 481,468.33	$3,698.44	$1,604.89	$ 2,093.55	$479,374.78
11	$ 479,374.78	$3,698.44	$1,597.92	$ 2,100.52	$477,274.26
12	$ 477,274.26	$3,698.44	$1,590.91	$ 2,107.53	$475,166.73
13	$ 475,166.73	$3,698.44	$1,583.89	$ 2,114.55	$473,052.18
14	$ 473,052.18	$3,698.44	$1,576.84	$ 2,121.60	$470,930.58
15	$ 470,930.58	$3,698.44	$1,569.77	$ 2,128.67	$468,801.91
16	$ 468,801.91	$3,698.44	$1,562.67	$ 2,135.77	$466,666.14
17	$ 466,666.14	$3,698.44	$1,555.55	$ 2,142.89	$464,523.26
18	$ 464,523.26	$3,698.44	$1,548.41	$ 2,150.03	$462,373.23
19	$ 462,373.23	$3,698.44	$1,541.24	$ 2,157.20	$460,216.03
20	$ 460,216.03	$3,698.44	$1,534.05	$ 2,164.39	$458,051.65
21	$ 458,051.65	$3,698.44	$1,526.84	$ 2,171.60	$455,880.05
22	$ 455,880.05	$3,698.44	$1,519.60	$ 2,178.84	$453,701.21
23	$ 453,701.21	$3,698.44	$1,512.34	$ 2,186.10	$451,515.11
24	$ 451,515.11	$3,698.44	$1,505.05	$ 2,193.39	$449,321.72
25	$ 449,321.72	$3,698.44	$1,497.74	$ 2,200.70	$447,121.02
26	$ 447,121.02	$3,698.44	$1,490.40	$ 2,208.04	$444,912.98
27	$ 444,912.98	$3,698.44	$1,483.04	$ 2,215.40	$442,697.58
28	$ 442,697.58	$3,698.44	$1,475.66	$ 2,222.78	$440,474.80
29	$ 440,474.80	$3,698.44	$1,468.25	$ 2,230.19	$438,244.61
30	$ 438,244.61	$3,698.44	$1,460.82	$ 2,237.62	$436,006.99
31	$ 436,006.99	$3,698.44	$1,453.36	$ 2,245.08	$433,761.90
174	$ 25,547.32	$3,698.44	$ 85.16	$ 3,613.28	$ 21,934.04
175	$ 21,934.04	$3,698.44	$ 73.11	$ 3,625.33	$ 18,308.71
176	$ 18,308.71	$3,698.44	$ 61.03	$ 3,637.41	$ 14,671.30
177	$ 14,671.30	$3,698.44	$ 48.90	$ 3,649.54	$ 11,021.77
178	$ 11,021.77	$3,698.44	$ 36.74	$ 3,661.70	$ 7,360.07
179	$ 7,360.07	$3,698.44	$ 24.53	$ 3,673.91	$ 3,686.16
180	$ 3,686.16	$3,698.44	$ 12.29	$ 3,686.15	$ 0.01

        ii.

        iii.

iv. The first column shows the amount money remaining on the loan before the payment is processed. As this is a fixed rate loan, the payment remains the same each month. This is Xa, calculated in 1a using a Financial Calculator. Interest is then calculated as 0.3333% of the current value of the loan (column A). Principal is the total payment minus interest. Principal is then subtracted from the before value, to get us our new remaining value for the following month. This is repeated until the loan reaches 0 (in this case 1 cent), 180 months later.

b. 1.2

i. After 36 months of paying at Xa / 2, or $1849.22, the PV of the loan is $493029.84. Using a Financial Calculator with N = 180 – 36 = 144, I/Y = 0.3333%, PV = 493029.84, FV = 0, **PMT = Xb = $4319.62.**

172	38209.88474	4316.616	127.3663	4189.25	34020.635
173	34020.63492	4316.616	113.4021	4203.214	29817.421
174	29817.42094	4316.616	99.3914	4217.225	25600.196
175	25600.19624	4316.616	85.33399	4231.282	21368.914
176	21368.91413	4316.616	71.22971	4245.386	17123.528
177	17123.52774	4316.616	57.07843	4259.538	12863.99
178	12863.99007	4316.616	42.87997	4273.736	8590.2539
179	8590.253933	4316.616	28.63418	4287.982	4302.272
180	4302.272013	4316.616	14.34091	4302.275	-0.00318

ii.

iii. As we can see, this converges to $0 at 180 months, as expected.

c. 1.3

i. In contract A we see tax savings of $48,660.19. In contract B we see tax savings of $55,480. This makes Contract B more preferable, as it has a higher tax shield value of debt.

ii. Applying this to Question 4's early payment gives us Tax Savings of $36,807.76. As this payment plan ends sooner, it makes sense that this yields less interest, and thus, less tax savings.

d. 1.4 Extra Credit

i. At the end of Month 60, the remaining amount on the Loan is $426,352.92. Using a Financial Calculator, with N = 4 * 12 = 48, i/y = 0.3333%, PV = 426352.9249, FV = 0, **PMT = Xc = $9626.6459**

100	85213.29	9626.646	284.0443	9342.602	75870.6929
101	75870.69	9626.646	252.9023	9373.744	66496.94931
102	66496.95	9626.646	221.6565	9404.989	57091.9599
103	57091.96	9626.646	190.3065	9436.339	47655.62054
104	47655.62	9626.646	158.8521	9467.794	38187.8267
105	38187.83	9626.646	127.2928	9499.353	28688.47356
106	28688.47	9626.646	95.62825	9531.018	19157.45591
107	19157.46	9626.646	63.85819	9562.788	9594.668191
108	9594.668	9626.646	31.98223	9594.664	0.004518732

ii.

iii. As we can see, from setting the payment to Xc from months 61 to 108 yields a FV of 0, as expected.

2. Question 2

a. Using PV = $120,000, I/Y = 3.45%/12 = 0.2875%, N = 10y * 12m = 120, FV = 0, **PMT =** $1183.8218

115	$	7,032.00	$1,183.82	$ 20.22	$1,163.60	$ 5,868.40
116	$	5,868.40	$1,183.82	$ 16.87	$1,166.95	$ 4,701.45
117	$	4,701.45	$1,183.82	$ 13.52	$1,170.31	$ 3,531.14
118	$	3,531.14	$1,183.82	$ 10.15	$1,173.67	$ 2,357.47
119	$	2,357.47	$1,183.82	$ 6.78	$1,177.04	$ 1,180.43
120	$	1,180.43	$1,183.82	$ 3.39	$1,180.43	$ (0.00)

i.

ii. As we can see, if rates were unchanging, using this payment value we would reach FV $0 in 120 months, as expected.

b. Paying the exact rate of $1183.82 each month yields $109,773.44 remaining at the end of 2017. Using this value into 2018 with N = 108, PMT = $1250, PV = 109773.44, FV = 0, **I/Y = 0.3941**
    i. Times 12, this gives us 4.7292%, which, -1% to account for premium, gives us 3.7292%. This means that the Treasury rate would have to spike to increase from 2.45% to 3.7292%, a change of 1.2792%, to cause Aaron to start defaulting on his loan.

c. If Aaron had been paying $1250 each month through 2017, at the end of the year there would be $108,966.62 remaining on his account. Substituting that value into the Financial Calculator solution from before yields **I/Y = 0.4087**
    i. Multiplied by 12, this gives us 4.9048%. Subtract 1% to account for the premium, which gives us 3.9048%. This means the Treasury rate would have to spike 1.4548% to cause Aaron to start defaulting on his loan.

3. Question 3
    a. To determine the current interest rate I used N = 360, PMT = -2000, FV = 0, and PV = 400,000, as that is the 80% debt of the $500,000 house. This yielded 0.3656% per month, or 4.3871% per year.
    b. Using these numbers, we can experiment with the interest rate and see that, should the interest rate fall to 0.2161% per month, or 2.5932% per year, that the PV of the loan will exceed the total value of the house.
    c. As such, once interest rates fall that low, it would make sense to strategically default on this loan, as the loan is more of a burden than the house in that given market.
4. Question 4
    a. Using a Financial Calculator with N=96, i/y=0.458333, PV=65000, FV=0, I determined **PMT=$838.4558 a month**.
        i. Using this we can replace i/y with 4%/12 = 0.3333% and determine the new PV of that refinanced loan, which would be **PV = $68786.3548**
            1. This is a $3786.3548 increase in value.
    b. To be offered $5000 to take this refinance is a bad deal, as you only gain $3786.3548. In short, that would make you lose $1213.6452.
        i. The absolute maximum fee that should be accepted for this refinance is the total amount gained, $3786.3548, but even then it wouldn't make sense as

it would be a net zero to the loanholder. A value sufficiently below that maximum would be best.