財務工程導論 HW2

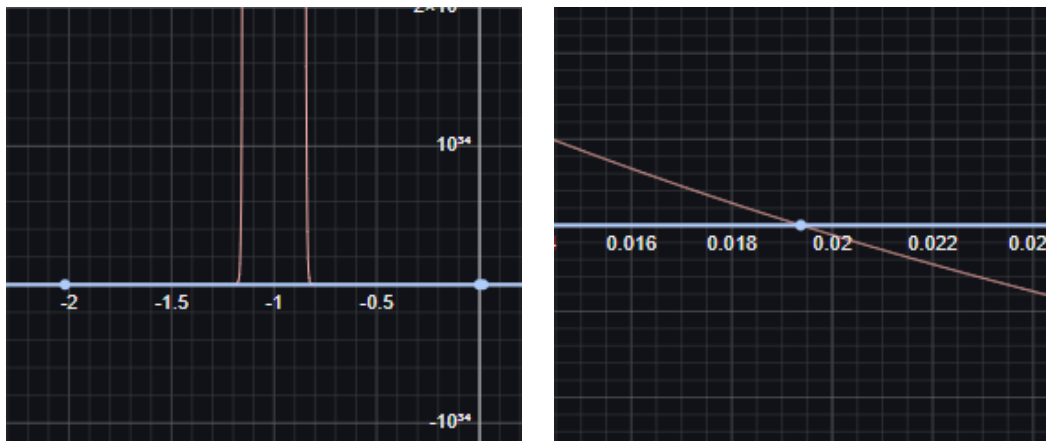## 111511141 賴昱凱

解題方法:

1. 計算 YTM

    在嘗試的過程中，我發現本次作業的方程式都很不好解，尤其是在不知道 YTM 範圍的情況下，利用 bisection 以及 newton method 都很難解，因為異號的上下界在方程式中很不好找，又很多斜率近乎為 0 的地方，導致無法很順利的使用 HW1 的方式完成。

以 $f(x) = \frac{100}{(1+x)^{40}} - 46.413$ 為例:

    因此我後來決定先使用 Approximate YTM 的公式:

$$Approximate\ YTM = \frac{C + \dfrac{FV - PV}{N}}{\dfrac{FV + PV}{2}}$$

    先計算出大約的 YTM 在哪裡，再使用 bisection method 將上下界設在 (Approximate YTM + 0.001, Approximate YTM - 0.001)計算，就成功計算出每個數值，並對應到 Data 中的 offering yield 皆十分接近。

2. 計算 dirty, clean price

    Actual/actual:

    我利用一天一天加的方式，利用巢狀 while 迴圈配合每個月的天數，以及判斷是否為閏年來計算實際的天數。

30/360:

$$num\ of\ days = 360 \times (y2 - y1) + 30 \times (m2 - m1) + (d2 - d1)$$

並利用公式:

$$Dirty\ Price = C \times (1 + r)^{-\omega} + C \times (1 + r)^{-\omega-1} + \cdots + C \times (1 + r)^{-\omega-n+1}$$
$$+ 100 \times (1 + r)^{-\omega-n+1}, \quad r = calculated\ YTM$$
$$Accrued\ Interest = C \times (1 - \omega)$$
$$Dirty\ Price = Clean\ Price + Accrued\ Interest$$

計算出 Dirty Price 及 Clean Price。

執行結果:

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1.
   YTM (calculated):    3.87501
     Offering Yield:    3.87500
Actual/Actual:
        Dirty Price:   46.43737
        Clean Price:   46.43737
30/360:
        Dirty Price:   46.43775
        Clean Price:   46.43775
2.
   YTM (calculated):    7.99586
     Offering Yield:    7.99516
Actual/Actual:
        Dirty Price:   99.58757
        Clean Price:   99.47900
30/360:
        Dirty Price:   99.58939
        Clean Price:   99.47897
3.
   YTM (calculated):    2.76573
     Offering Yield:    2.76572
Actual/Actual:
        Dirty Price:  100.00743
        Clean Price:   99.95493
30/360:
        Dirty Price:  100.00077
        Clean Price:   99.95494
4.
   YTM (calculated):    5.67755
     Offering Yield:    5.67711
Actual/Actual:
        Dirty Price:   99.81967
        Clean Price:   99.77369
30/360:
        Dirty Price:   99.82056
        Clean Price:   99.77368
5.
   YTM (calculated):    6.34124
     Offering Yield:    6.34097
Actual/Actual:
        Dirty Price:   99.74901
        Clean Price:   99.69739
30/360:
        Dirty Price:   99.74988
        Clean Price:   99.69738
6.
   YTM (calculated):    4.08511
     Offering Yield:    4.08510
Actual/Actual:
        Dirty Price:   99.38377
        Clean Price:   99.30733
30/360:
        Dirty Price:   99.38512
        Clean Price:   99.30734
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7.
   YTM (calculated):    2.44915
     Offering Yield:    2.44910
Actual/Actual:
        Dirty Price:   99.81628
        Clean Price:   99.77056
30/360:
        Dirty Price:   99.81724
        Clean Price:   99.77057
8.
   YTM (calculated):    5.62206
     Offering Yield:    5.62210
Actual/Actual:
        Dirty Price:   99.78788
        Clean Price:   99.68066
30/360:
        Dirty Price:   99.78952
        Clean Price:   99.68064
9.
   YTM (calculated):    1.92706
     Offering Yield:    1.92703
Actual/Actual:
        Dirty Price:   99.78952
        Clean Price:   99.75373
30/360:
        Dirty Price:   99.79021
        Clean Price:   99.75375
10.
   YTM (calculated):    3.32006
     Offering Yield:    3.32005
Actual/Actual:
        Dirty Price:   99.47062
        Clean Price:   99.40847
30/360:
        Dirty Price:   99.47167
        Clean Price:   99.40847
11.
   YTM (calculated):    4.80601
     Offering Yield:    4.80599
Actual/Actual:
        Dirty Price:   99.20519
        Clean Price:   99.11422
30/360:
        Dirty Price:   99.20657
        Clean Price:   99.11421
12.
   YTM (calculated):    5.01458
     Offering Yield:    5.08000
Actual/Actual:
        Dirty Price:   99.84264
        Clean Price:   99.77422
30/360:
        Dirty Price:   99.84366
        Clean Price:   99.77421
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