Homework 4

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4.4

a

$$\begin{aligned} NPV &= -1000 \times exp(-0.06 \times 0) - 600 \times exp(-0.06 \times 2) + 1750 \times exp(-0.06 \times 1) \\ &= -1000 - 600 \times 0.8869204 + 1750 \times 0.9417645 \\ &= -1000 - 532.1522 + 1648.088 \\ &= 115.9358 \\ \\ &= \$115.94 \end{aligned}$$

b

$$\begin{aligned} NPV &= -1000 \times 1 - 600 \times 1.04^{-1} \times 1.055^{-2} + 1750 \times 1.04^{-1} \\ &= -1000 - 600 \times 0.9114109 + 1750 \times 0.9615385 \\ &= -1000 - 546.8465 + 1682.692 \\ &= 135.8455 \\ \\ &= \$135.85 \end{aligned}$$

4.5

Code help from documentation of `jrvfinance` package link .

```
cf <- tibble(year = seq(0, 4, 1),
             contribution = c(10000,1000,1000,0,0),
             income = c(1550, 500, 500, 200, 200),
             withdrawal = c(0, 0 , 3000, 7000, 7000)) %>%
  mutate(net = withdrawal - contribution - income)

irr(cf$net)
```

```
## [1] 0.04622805
```

From the above calculation, we have an IRR of 4.622%

4.7

The impossible IRR is (a), which is greater than -1. According to the text: *Thus, $IRR = \frac{1}{v} - 1 = 11.66\%$. Note that $v < 0$ implies $IRR < -1$, i.e., the loss is larger than 100%, which will be precluded from consideration. We discard this from the possible solutions to the polynomial equation created when solving for IRR.

4.9

$$
\begin{aligned}
TWRR &= \left(1 + \frac{2200 - 2000}{2000}\right)\left(1 + \frac{3500 - 4200}{4200}\right) - 1 \\
&= \left(\frac{11}{10}\right)\left(\frac{5}{6}\right) - 1 \\
&= 0.9166667 - 1 \\
&= -0.0833 \\
&= -8.33\%
\end{aligned}
$$

5.4

Prospective

Since the payments are not level, we can use the prospective method by simply discounting the remaining payments to the time $t = 2$.

$$
\begin{aligned}
B_2 &= -3000 \times \left(1.05^2\right)^{-1} \\
&= -3000 \times 0.9070295 \\
&= -2721.089 \\
&= -\$2271.09
\end{aligned}
$$

Retrospective

Begin by calculating $L = B_0$.

$$
\begin{aligned}
B_0 &= -1000 \times \left(1.05^2\right)^{-1} - 2000 \times \left(1.05^2\right)^{-2} - 3000 \times \left(1.05^2\right)^{-3} \\
&= -907.0295 - 1645.405 - 2238.646 \\
&= -4791.081 \\
&= L
\end{aligned}
$$

Thus, the accumulated loan amount $L(1+i)^m$ at the time of interest, 2, is $-4791.081 \times 1.05^4 = -5823.589$. From this, we add the accumulated payments at t = 2, which is $1000 \times 1.05^2 + 2000 \times 1.05^0 = 3102.5$ and arrive at

$$-5823.589 + 3102.500 = -2721.089$$

, the same answer as calculated via the prospective method.

5.9

We first find P by:

$$
\begin{aligned}
5000 &= P \times 1.07^-1 + 0.95P \times 1.07^{-2} \times 0.95^2 \times 1.07^{-3} + 0.95^3 P \times 1.07^{-4} \\
&= P(3.155142) \\
P &= \$1584.72
\end{aligned}
$$

```
tibble(Year = seq(0, 4),
       Installment = c(NA_integer_, 1584.715, 1505.479, 1430.205, 1358.695),
       `Interest Paid` = c(NA_integer_, 350, 263.57, 176.6363, 88.88649),
       `Principle Repaid` = c(NA_integer_, 1234.715, 1241.909, 1253.569, 1269.809),
        `Outstanding Balance` = c(5000, 3765.285, 2523.376, 1269.807, 0)) %>%
  mutate(across(2:5, ~ if_else(!is.na(.x), paste0("$", map_dbl(.x, round, digits = 2)),
```

```
                                  as.character(.x)))) %>%
  gt()
```

Year	Installment	Interest Paid	Principle Repaid	Outstanding Balance
0	NA	NA	NA	\$5000
1	\$1584.71	\$350	\$1234.71	\$3765.28
2	\$1505.48	\$263.57	\$1241.91	\$2523.38
3	\$1430.2	\$176.64	\$1253.57	\$1269.81
4	\$1358.69	\$88.89	\$1269.81	\$0

5.13

We can convert this given value for B_5 into a multiple of $a_{\overline{n-t|}i}$. Then, we know the overall loan amount is the same value times $a_{\overline{n|}i}$

$$\begin{aligned} a_{\overline{n-t|}i} &= a_{\overline{10-5|}i} \\ &= a_{\overline{5|}i} \\ &= a_{\overline{5|}0.09} \\ &= 3.889651 \end{aligned}$$

Thus, if $B_5 = \$30,304.29$, we have $30,304.29 = (3.889651)(7791.005) = (a_{\overline{5|}0.09})(7791.005)$, and can calculate the loan balance $B_0 = (a_{\overline{10|}0.09})(7791.005) = (6.417658)(7791.005) = \$50,000.00$. Finally, using our knowledge of amortization tables, the interest portion in the third payment $I_3 = (i)(a_{\overline{n-3+1|}0.09})(7791.005) = (0.09)(5.534819)(7791.005) = \$3,880.96$.