Chapter 4 Overview ANSWERS

These ARE NOT full solutions, they explain the choosing which formulas are appropriate, and give the answers (with maybe one or two other steps). You Must Show More Work Than This For Quiz/Test Questions.

Note: For these answers I wounded everything to the nearest penny. There are certainly some answers that are large enough that you could choose to round them to the nearest dollar.

1. Maeby Funke is at a BMW dealership. She has saved up $10,000 to use as a down payment, and because of her salary as a movie executive she determines she can afford to pay $700 a month in car payments. If she qualifies for 4.05% interest and plans to take out a 4 year loan, making monthly payments, what is the most expensive car she can buy?

   - Ordinary Annuity
     (by default)
   - $PV/a_{\pi \text{i}}, \text{ Type}$
     (Maeby is taking out a loan, the interest hurts Maeby, the person making the payments)
   - $PV = PMT a_{\pi \text{i} i}$
     $a_{\pi \text{i}, 0.0405/12} = 44.24497666$
     She can afford to BORROW (up to) $30,971.48 = PV$
     So the Most expensive car she can BUY is $40,971.48$

2. Lindsay Funke is irresponsible and decides to buy a new car without first considering her budget. She buys a Volvo for $41,050. Because her credit isn’t great she qualifies for 7.4% interest and will take out a 5 year loan. Because she looks drunk while making the purchase, the dealership demands that she make her first monthly payment today, and her second payment will be due in one month, and so on. What are Lindsay’s monthly payments and how much in interest will she pay over the life of the loan?

   - Annuity Due
     (we’re explicitly told her first payment is due immediately)
   - $PV/a_{\pi \text{i} i}, \text{ Type}$
     (Lindsay is taking out a loan, the interest hurts Lindsay, the person making the payments)
   - $PV = PMT a_{\pi \text{i} i}(1+i)$
     $a_{\pi \text{i}, 0.074/12} = 50.02385438$
     Her monthly payments are $815.58 = PMT$
   - Lindsay will spend $815.58 \cdot 60 = $48,934.80 repaying her loan, (some of that is repaying the principal she borrowed, the rest is interest)
     Lindsay will pay $7,884.80 in interest over the life of the loan.
     ($48,934.80 - $41,050 = $7,884.80$)
3. George Michael Bluth is responsible, and has been saving $20 a week from his job at the banana stand for the past 4 years in an account that earns 2.99% interest. Today he takes out that money and goes down to a used car lot to buy a car, what is the most expensive car he can buy?

- Ordinary Annuity
  (by default)
- \( FV/s_{\overline{n}|i} \) Type
  (George Michael is saving, the interest helps GM, the person making the payments)
- \( FV = PMTs_{\overline{n}|i} \)
  \( s_{\overline{52}|0.0299/52} = 220.8820958 \)
  The most expensive car George Michael can afford to buy is $4417.64 = FV

4. Lucille Bluth was forced to quit drinking by some health problems. Her son convinced her to take the $80 a week she was spending on alcohol, and deposit it into an account that earns 3.83% interest. If Lucille’s first deposit was the day she opened the account, and that was 5 years ago, how much is in the account today? How much in interest did Lucille earn?

- Annuity Due (her first deposit was immediately)
- \( FV/s_{\overline{n}|i} \) Type
  (Lucile is saving, the interest helps Lucile, the person making the payments)
- \( FV = PMTs_{\overline{n}|i}(1 + i) \)
  \( s_{\overline{260}|0.0383/52} = 286.4473215 \)
  Lucille has $22,932.66 = FV in the account today.

- Lucile deposited a total of $80 \( \times \) 260 = $20,800 into the account, the rest of the money came from interest, so $2,132.66 is what Lucile Earned in interest.

5. Kitty Sanchez just came into $2,500 (it may or may not be hush-money from her employer). She plans to use this $2,500 as a down payment for a $7150 cosmetic surgery procedure she’s planning on having. Assume that Kitty will borrow the rest and make quarterly payments for the next 3 years at 5.25% interest. How much will Kitty’s payments be?

- Ordinary Annuity
  (by default)
- \( PV/a_{\overline{n}|i} \) Type
  (Kitty is taking out a loan, the interest hurts Kitty, the person making the payments)
- \( PV = PMTa_{\overline{n}|i} \)
  \( a_{\overline{12}|0.0525/4} = 11.0359934 \) and \( PV = 4,650.00 \)
  Kitty’s quarterly payments are \( PMT = 421.35 \)
6. Michael Bluth is responsible and has been saving money in a ‘rainy day’ account that has been earning 4.5% interest. Michael works for the family business, and because of some legal trouble the business is in, he will not be getting paychecks for the foreseeable future. Michael’s ‘rainy day’ account has $34,877 in it today. Michael needs to begin paying himself monthly payments out of this account today (to cover expenses for him and his son). He assumes he will need to make these payments over 2 years (while his family business deals with their legal troubles), and he assumes his account will continue earning 4.5% interest. What is the largest monthly payment Michael can afford to pay himself?

- Annuity Due (he needs to start paying himself today)
- \( PV/a_{\bar{n}|i} \) Type.
  (The Bank is taking out a loan, the interest hurts the bank, the person making the payments)
  (Or, the interest helps Michael, the person receiving the payments)

\[
PV = PMT \cdot a_{\bar{n}|i}(1 + i) \\
a_{\bar{n}|0.045/12} = 22.9106561
\]
Michael can afford to pay himself (up to) \$1,516.62 = PMT a month.

7. The City of Newport Beach had to borrow $500,000 from an investment group to cover some budget gaps in their law enforcement budget. The loan has an effective interest rate of 6%, and the City of Newport beach will repay the entire amount (including interest) in 7 years, but will make no payments on the loan before then. To cover this expense they set up a sinking fund and make quarterly payments into an account that earns 4.1% interest. What will their quarterly payments be?

- First we need to determine how much they will owe. This is a “Midterm1” question:
  The City of Newport Beach had to borrow $500,000 from an investment group to cover some budget gaps in their law enforcement budget. The loan has an effective interest rate of 6%, and the City of Newport beach will repay the entire amount (including interest) in 7 years.
  What is the total amount they will repay in 7 years?
  Answer: $751,815.13 (This was found using compound interest, compounded yearly)

- Now Onto the new stuff:
- Ordinary Annuity
  (by default)
- \( FV/s_{\bar{n}|i} \) Type
  (The City is saving, the interest helps The City, the person making the payments)

\[
FV = PMT \cdot s_{\bar{n}|i} \\
s_{\bar{n}|0.041/4} = 32.24186295
\]
Their quarterly payments are \$23,317.98 = PMT
8. The City of Newport found a different lender who will loan them the $500,000 at 6.9% interest. This lender will expect monthly payments that result in the loan being paid off in 7 years. What will their monthly payments be?

- Ordinary Annuity
  (by default)
- \( PV/\alpha_{\bar{n}|i} \)
  (The City is doing a loan, the interest hurts The City, the person making the payments)

\[ PV = PMT \alpha_{\bar{n}|i} \]
\[ a_{\bar{84}|0.069/12} = 68.64596704 \]
Their monthly payments are $7,283.75 = PMT

9. Compare the Lenders in Question 7 and Question 8, which lender is the cheapest for the city of Newport Beach, explain.

- With option one (sinking fund) they make 28 quarterly payments, each $23,317.98, so they spend a total of $652,903.44 repaying the loan.
- With option two, they make 84 monthly payments of $7,283.75, so they spend a total of $611,835.00 repaying the loan.
- Since in both cases they got $500,000, then spend 7 years making payments (or setting aside money into the sinking fund), they should choose the option that costs the less. This is option 2. (they save over $40,000).
10. *There’s always money in the Banana Stand*

George Sr. has been ‘saving’ money by literally hiding it in the walls of the Banana Stand (where it earns no interest). The day the banana stand opened in 1953 George Sr. hid $5000 in the walls. Assume that he did the same each year for the next 50 years (bringing us to 2003, when the ‘Top Banana’ episode of Arrested Development came out)

(a) How much money in total did George Sr. hide in the Banana stand?

• $50 \times 5000 = \$250,000$

(b) If instead of hiding his $5000 per year in the Banana Stand, George Sr. had invested the $5000 per year in an investment that only paid 1.1% interest\(^1\), what would his investment be worth at the end of 50 years?

• Annuity Due
  (his first deposit was immediate)
• FV/$s_{ni}$ Type
  (George Sr. is saving, the interest helps George Sr., the person making the payments)

\[ FV = PMT \times s_{ni} (1 + i) \]
\[ s_{0.011/1} = 66.18689725 \]
George Sr. would have had \( FV = \$334,574.77 \) in the account at the end of 50 years.

(c) How much in interest did George Sr. forgo by hiding his money in the banana stand? \(^2\)

• He gave up \$84,574.77 in interest.

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\(^1\)Interest rates on savings accounts in the 1950’s were roughly 1%, interest rates on savings accounts today are near 0.01%, unless you use the online bank Ally, where they are roughly 1%. In the decades between interest rates on savings accounts tended to be higher. And for part of the 80’s they were closer to 9%. So it’s very reasonable to assume George Sr. could have found a safe investment that averaged 1.1% over those 50 years.

\(^2\)It’s possible that George Sr. was hiding the money in the Banana Stand to avoid paying taxes, or to avoid having his illegal activities detected...so maybe he had his reasons.