

# MAT 142 worksheet: amortization schedule

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If you receive an amortized loan, such as a home mortgage, then an amortization schedule shows how much of each monthly payment goes toward interest, and how much goes toward the repayment of principal. You may need this information to determine your income tax.

In this exercise you construct an amortization schedule using a spreadsheet program such as Microsoft Excel.

## Note

- The instructions below apply to most spreadsheet programs. If the instructions are inaccurate or incomplete, then let me know.
- I developed this exercise using OpenOffice.org Calc. If your computer lacks the Microsoft Office suite, and if you have the authority to install software, then consider downloading OpenOffice.org (easy, free, good). If you don't have authority to install software, then try Google Docs & Spreadsheets (web-based, beta, requires registration). I've never used it, but in basic features it appears similar to Excel and Calc.
- If you have trouble finding or using a spreadsheet program, then you have the option of constructing a portion of the spreadsheet by hand instead. However, this option is tedious and may yield fewer insights. Don't give up on the computer option before coming to office hours for help.

## Option 1: amortization schedule with computer

1. Open a spreadsheet program and begin a new spreadsheet.\*
2. Add column headings to your spreadsheet.
  - (a) In cell A1 enter 'At end of month...'
  - (b) In cell B1 (just to the right) enter 'Interest paid'.
  - (c) In cell C1 enter 'Principal paid'.
  - (d) In cell D1 enter 'Balance'.

3. Complete the first column.
  - (a) In cell A2 enter '0'. After hitting 'enter', move the cursor back to cell A2.
  - (b) Complete the column by dragging the lower-right corner of cell A2 downward to enclose an additional 360 cells in column A. When you release the mouse button, the rows should be numbered 0 to 360.\*
4. Enter the loan amount '-200000' in cell D2.
5. Compute the interest due at the end of the month.
  - (a) At the end of the month, the interest due is the previous month's balance times  $-0.06/12$ . In particular, at the end of month 1, the interest due is  $200000(0.06/12)$ . In cell B3 enter the formula ' $=D2*(-0.06/12)$ '. Hit the 'enter' key to leave the cell. The formula should be replaced automatically by the number 1000.
  - (b) Move the cursor back to cell B3 and drag the lower-right corner downward until a total of 360 cells in column B are enclosed. You may see a bunch of zeroes below cell B3.\*
6. Compute the principal payment made each month.
  - (a) In class we determined that the total monthly payment on this loan is 1199.10. Of this amount, whatever does not go toward interest goes toward principal. In cell E2 enter the monthly payment '1199.10'.
  - (b) In cell C3 enter the formula ' $=\$E\$2-B3$ '. The dollar signs tell the program always to use cell E2 as input to the formula. Without them the program thinks that 'E2' means 'the cell two columns right and one row above'. This makes a difference when you copy the formula to lower rows.
  - (c) Drag the lower-right corner of cell C3 downward until a total of 360 cells in column C are enclosed.\*
7. Compute the balance remaining at the end of each month.
  - (a) The new balance is the previous balance plus the portion of the monthly payment that goes to principal. In cell D3 enter the formula ' $=D2+C3$ '.
  - (b) Drag the lower-right corner of cell D3 downward until a total of 360 cells in column D are enclosed.\*
8. Change the parameters.
  - (a) Your ASU SunCard has an ASU ID number and an affiliate ID number. Take the last four digits of your affiliate ID number, add two zeroes to the end, and put a minus sign in front. Substitute this number for -200000 in cell D2.

- (b) Based on the new loan amount, what is the monthly payment? (See ‘House, model B’ from class.) Substitute this number for 1199.10 in cell E2.
- (c) Observe that the entire spreadsheet is updated automatically.\*

9. Interpret.

- (a) What information does the updated spreadsheet provide? (What is it good for?) Use complete sentences and mention *all* parameters (loan amount, interest rate, ...).
- (b) Cell A102 contains the number 100. The figures in this row represent the state of the mortgage after month 100. Explain the significance of each number in this row.\*
- (c) Describe the trend in column B. (Starting at the top of the column and scanning down the sheet, how do the numbers change? Do they decrease? Increase? Rapidly? Slowly? To what value?)
- (d) Describe the trend in column C and the trend in column D.
- (e) What number appears in cell D362? What is its significance?

Save your spreadsheet in a file and send it to me as an email attachment. Parts of the worksheet that call for a response should be submitted on paper. Remember to show your work in determining the monthly payment.

**Option 2: amortization schedule by hand**

1. On a sheet of notebook paper, draw a table with five columns labeled A to E and five rows labeled 1 to 5. The cell in column B, row 4, for example, is called cell B4.
2. Follow the instructions from ‘Option 1’ to fill in the table. Ignore items marked with an asterisk (\*). Instead of entering formulas into cells, you must evaluate the formulas. In particular, your spreadsheet is complete when:
  - (a) In column A, each cell below A2 contains the number 1 plus the value of the cell above.
  - (b) In column B, each cell below B2 contains the balance from the row above, multiplied by  $-0.06/12$ .
  - (c) In column C, each cell below C2 contains the monthly payment minus the value of the cell to the left.
  - (d) In column D, each cell below D2 contains the balance from the row above, plus the value of the cell to the left.

When a new loan amount and monthly payment are introduced, you need to produce another five-by-five spreadsheet.