Case Name
The Smithson’s Mortgage

Case Study Teams
This case is designed to be conducted by a team of students. The discussion, questioning, and resolution of differences is an important part of the learning experience. Another significant advantage is the sharing of the workload in preparing the final case study report.

Knowledge Background
This case draws heavily on the material presented in Chapters 2 and 3 of Principles of Engineering Economic Analysis, 4th Edition by White, Case, Pratt, and Agee, particularly Section 3.4 (Principal Amount and Interest Amount in Loan Payments). To a limited extent it draws on concepts from Chapter 4 (Measuring the Worth of Investments), Chapter 5 (Comparison of Alternatives), and Chapter 6 (Depreciation and Income Tax Considerations). The case can be meaningfully addressed after covering Section 3.4.

Deliverables
Case Report - one per team (refer to attached page for additional information)
Peer Evaluations - every individual (refer to attached page for additional information)

Additional Notes to Instructor
( A reasonable amount of time to complete this case is 4-6 weeks.
( The detailed specification of rounding rules in the case is designed to maintain consistency in the responses; otherwise, slight differences in rounding approaches can lead to large differences in final retirement account balances.
( An interesting embellishment to the case is to ask students to examine different objectives for the Smithson’s (e.g., minimizing interest paid rather than maximizing retirement account balance).
Case Description
Paul and Leslie Smithson are buying a new house. They have saved for several years to accumulate a down payment and have now found a house that is just perfect for their needs. It is a beautiful three bedroom Tudor house in a quiet neighborhood in the suburbs. With the help of their real estate agent and after several rounds of offering and counter-offering, they have agreed on a price of $103,000 with the sellers. The only thing that remains to make their new home a reality is to select a mortgage. Paul and Leslie are unsure about the details of making this type of decision and have come to you for guidance because of your expertise in this area.

Paul and Leslie are both 30 years old and professionally employed. They earn generous salaries and fall into the 28% effective tax bracket on their personal income taxes. They dream long term of retiring at the age of 65 so they can travel the country to take in all its scenic beauty. It is this dream that drives them to determine a mortgage arrangement that allows them to generate the maximum retirement account balance that they can create to supplement their company sponsored retirement plans. They currently have accumulated $10,000 to use for the down payment and closing costs on their house. Any excess amount not used in this way could be used as an initial deposit in their retirement savings account. Alternatively, any excess could be used to make a down payment in excess of the minimum requirement. After studying their budget and spending patterns they have determined that they can afford $1,000/month to cover both mortgage payments and personal retirement savings. They are strongly committed to their retirement travel plans, so any of the $1,000 not spent on the mortgage will be invested in the retirement savings account. In addition, any tax savings generated through the mortgage will be deposited in the retirement account. Although they anticipate salary increases over the years until they retire, the impact of inflation and changes in lifestyle will offset these to the extent that the $1,000 per month can be considered constant over the next 35 years.

They have selected a retirement savings vehicle which involves investment in a tax sheltered mutual fund which pays an average of 9% per year compounded monthly. Paul and Leslie, with the help of an investment banker, have studied the history of this fund and are comfortable that the 9%/yr/mo average return over their 35 year retirement savings horizon is reasonable. Undoubtedly their will be ups and downs but the long term average of 9% appears to be reasonable and stable for planning purposes. Since this
is a tax sheltered account, all investments will grow tax free until their retirement.

Paul and Leslie have identified four potential mortgage options. They will make their selection from among these four based on your recommendation.
Available Mortgages

Mortgage I
30 year fixed rate @ 7.58%/yr/mo, monthly payments, minimum 5% down payment, 1 point closing costs

Mortgage II
15 year fixed rate @ 7.13%/yr/mo, monthly payments, minimum 5% down payment, 1 point closing costs

Mortgage III
30 year fixed rate @ 7.08%/yr/2-weeks, bi-weekly payments, minimum 5% down payment, 1 point closing costs

Mortgage IV
15 year fixed rate @ 6.63%/yr/2-weeks, bi-weekly payments, minimum 5% down payment, 1 point closing costs

General Conditions Applicable to All Mortgages

1. All mortgage calculations are rounded to the nearest penny on a payment by payment basis. All accumulated rounding error is compensated for with an adjustment in the final payment.

2. “1 point” closing costs equals 1 percent of the loan value. These costs are associated with creating the loan and are due at the time the loan is originated (along with the down payment). They are not tax deductible.

3. Paul and Leslie’s timing is such that the annual mortgage cycle will coincide with the calendar year.

4. Tax savings are calculated on a calendar year basis. An amount equal to 1/12th of the annualized savings is deposited in the retirement account each calendar month.

5. Available retirement plan funds are deposited on a monthly basis. The monthly deposit is equal to 1/12th of the annual excess of available over required (i.e., excess = 12 * 1,000 - (annual mortgage payments)).

6. Interest payments on all mortgages are tax deductible. This generates tax savings for each payment based on the following equation:
   tax savings = effective tax rate * the interest portion of the mortgage payment
Deliverables (Minimum Acceptable)
(  Description of the general methodology used to address the Smithson’s case

(  Discussion of assumptions required/utilized within your methodology

(  Walk through (including numeric values) of the application of the methodology to one of the mortgages

(  Summary of the application of the methodology to the remaining mortgages

(  Table of the retirement account balance 35 years hence for each of the mortgages

(  A specific statement of recommendations

(  A detailed amortization schedule for the recommended mortgage
General Conditions Applicable to All Mortgages

Rounding of numerical results should be carried out as follows:

- Carry interest values and time value factors to at least 6 digits of accuracy.
- Payment Amount (conventional rounding to the nearest penny)
- Interest Component of Payments (round down to the nearest penny - adjust final payment to clear loan (zero balance))
- Tax Savings (conventional rounding to the nearest penny)
- 1/12th Tax Savings (round down to the nearest penny - adjust December payment to achieve proper annual total)
- 1/12th Annual Excess (round down to the nearest penny - adjust December payment to achieve proper annual total)
- Print all monetary values to the penny, rounding as specified above

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\[ \text{tax savings} = \text{effective tax rate} \times \text{the interest portion of the mortgage payment} \]
For each case study a formal, typed report is to be turned in by each team. The report should have the following general characteristics:

Reports should be typed and double spaced.

Reports will be graded on organization, style, and grammar as well as content.

Your report should sufficiently document the case, your approach, and your conclusions such that one year from now you (or I) could pick it up, read it, and easily understand your work.

The body of the report (text exclusive of graphs, charts, and appendices) should be approximately ten pages in length. The following sub-sections should be included or addressed in some fashion:

- **Overview of the Case**
- **Problem Statement**
  - your interpretation of the situation including explicit consideration of any necessary assumptions
- **Solution Methodology**
  - overall approach as well as a discussion of engineering economy principles utilized
- **Recommendations and Conclusions**
  - be specific and discuss sensitivities.

Make extensive use of graphs and charts as appropriate.

You may use any software tools you deem appropriate in analyzing the case.

Make use of appendices as appropriate (copy of the case problem, details of the model used for evaluation, etc.)

An individual's grade for the case study will be based on an overall evaluation of the report plus peer evaluations.
CASE STUDY PEER EVALUATION

NOTE!! These evaluations will not be seen by your teammates, they will be seen only by me. They are essentially an opportunity for you to provide input to help recognize your fellow team members for their efforts on the case study.

At the top of a sheet of paper please write (1) your name and (2) the case name. Below this write the names of your teammates. After the name of each teammate assign a rating to that person of either ++, +, 0, -, --. The descriptors below may be helpful as a framework for evaluation. Please be as honest and fair as you can be - call it the way you see it! These ratings will impact the distribution of the overall case study grade to the individual team members.

Potential Rating Descriptors:

++ Could be described using many of the following words: Team member was an ideal team player. Actively contributed to the case study. Contributed and also listened carefully to input from other team members. Participated and provided leadership in conceptualizing an approach, doing the analysis, and the preparation of charts, graphs, and the final report. Played an important role in the success of the team. I would definitely want this person on my team in industry.

+ I would be pleased if this person were on my team in industry.

0 Could be described using many of the following words: Team member was a satisfactory team player. Attended, but did not play a particularly decisive or influential role in decisions of the team. Showed up for meetings and discussions and adequately performed the duties specified by other team members. Played some contributory role during analysis and report preparation. I would be indifferent if this person were on my team in industry.

- I would prefer that this person not be on my team in industry.

-- Could be described using many of the following words: Team member gave the impression of not really caring about the case study and/or the team. Missed one or more meetings without a believable or "important" excuse. Was, in large part, carried by the team, did not contribute except in a minimal way, simply to be able to say he/she participated. I would not want this person on my team in industry.