

## Assignment #7: Internet Application – Property Value Calculator

**DUE:** 12:00 noon, Thursday, June 10

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### Overview

Columbus realtors typically charge a commission of 3% for facilitating the purchase of a house. This commission is charged by both the realtor representing the seller (the seller's agent) and the realtor representing the buyer (the buyer's agent), for a total of 6% on any exchange of property. To earn this commission, the seller's agent provides advice for setting the asking price, advertises the house, runs open houses, and helps during the closing. The buyer's agent, on the other hand, helps to identify a house that matches their client's needs, informs the assessment of whether the property is a good value at the asking price, suggests points on which to negotiate, and helps during the closing.

Perhaps the single most useful service provided by the buyer's agent is the assessment of whether the property is a good value. That is, how does the true value of the property compare to the asking price? Of course, the final assessment is made by the buyer and can be based on many factors, some of which are very difficult to quantify (*e.g.*, "curb appeal"). The realtor, however, provides objective information about recent sales in the immediate neighborhood. These are called "comps", for "comparable sales" and are usually restricted to around a half-dozen homes that have sold recently and are similar to the house under consideration in as many ways as possible, including: location, square footage, number of bedrooms, number of bathrooms, appraised value, lot size, and whether the garage is attached (to name a few).

While helpful, comps provide only a few datapoints. Furthermore, invariably the parameters of a comp do not exactly agree with those of the house under consideration (*e.g.* it is slightly larger, has fewer bathrooms, or sold several years ago). What is missing is a comprehensive analysis of all of the objective measures that feed into the valuation of a home. Such a comprehensive analysis would provide a definitive estimate of a given house, given these objective, quantified parameters.

In this assignment, you will design and implement a Java application that provides such an analysis. You will likely bring together many elements from previous labs including, possibly:

- Obtaining, via http, the information needed to answer the user's query (as you did in Assignment #3),
- Using a multivariate linear regression to perform a comprehensive analysis (as you did in Assignment #4),
- Using Javascript effectively for the front-end of your application (as you did in Assignment #4), and

- Parsing XML data and transforming it to XHTML (as you did in Assignment #6).

Please note that these elements are *not* required aspects of your solution. The functionality of your solution is more important than whether you have used each of these technologies.

## Client Requirements

Your clients are home owners and prospective home owners in Franklin County, Ohio. They want to answer the question: “How much is Home X worth?”. A slight variation on this question would be “How much can I spend on an improvement project for Home X and expect to recover my investment?”. Answering these questions amounts to the same calculation: given a set of quantified measures (either those of Home X in the case of the first question or those of the modified Home X in the case of the second question), what is the best estimate of the value of this house? As a specific example of the first question, a user may wish to know: “If I put my house on the market today, how much should I expect to get?”. As a specific example of the second question, a user may wish to know: “How much value does a 400 square foot addition add to my house?”

The set of comparable homes used to answer these questions should be under the control of the user. There is an old adage in the real estate field that the three most important elements of home price are: location, location, and location. You should require, therefore, that the user specify the location in which to perform the valuation. I would expect to enter the following information, at a minimum, in order to use your application:

1. A valid street address in Franklin County (or, perhaps, the full name of the house owner), and
2. Some measure of radius around this address to use as a basis of comparison. (This measure can be an integer in the range 1 to 4, for example, with 1 being the smallest area around the address and 4 being the largest supported radius.)

In addition to this basic location information, I would expect to be able to control <sup>1</sup> the following aspects of the comparison group of houses:

- Sale price (eg exclude homes with sale price equal to zero, or greater than some limit, or outside some absolute window, or outside some window relative to the sale price of the house at the main address).
- Square footage (eg consider only homes with size in a certain range).
- Year sold (eg consider only homes sold this year, or in the last 4 years).
- Number of bedrooms (eg consider only homes with the same number of bedrooms, or with 4 bedrooms – regardless of the number of bedrooms in the house at the main address)

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<sup>1</sup>The ability to control is not the same as the *requirement* to control. Some limitations on comparison group might have reasonable default values, freeing your user from having to make an explicit decision or selection for each parameter.

This list is meant to be illustrative rather than exhaustive.

From the selected comparison group of homes, there are many things one might like to know, including:

- How many houses are in this comparison group?
- What are the houses in this comparison group? (*i.e.*, property information for each house)
- What is the best fit linear regression on this group?
- How good is the fit of this regression?
- Are there any outliers that should be excluded from the analysis?

Again, this list is meant to be illustrative rather than exhaustive. You are encouraged to anticipate ways in which your application can help the user. For example, providing an ascii version of the data used in your comparison group could allow a user to export the data to a spreadsheet and graph it or manipulate it in other ways.

Remember that every home purchase results in a 6% commission. The average home price in Columbus is around \$150,000, representing \$9000 in commission per transaction. Your application, therefor, represents (potentially) considerable value to your customer base!

## Net Present Value

You should use the net present value for homes in all of your calculations.

The value of money changes over time as a function of inflation. Similarly, the value of an asset, such as a home changes over time (this is called appreciation, assuming the change is positive). Therefore, to compare valuations that were performed at different times, the calculated values must be normalized to the same time. Thus, in the case of home prices, you should use the net present value of the latest sale of the property. For example, a house that sold for \$100,000 a year ago would be estimated as being worth  $\$100,000 * (1 + i)$  today, where  $i$  is the rate of appreciation for houses (in Franklin County). In general, a house that sold  $d$  years ago for  $V$  dollars would be estimated to be worth  $V * (1 + i)^d$ .

Some things to consider as you apply this net present value technique include:

- Net present value does not account for fundamental changes in the asset's value since the last valuation. A house, for example, may have had an addition built or some other significant modification since its last sale.
- Net present value is very sensitive to the value chosen for rate of appreciation. The current estimated value of houses that have not changed hands in a long time are significantly affected by even small changes in this rate. It is customary to permit this rate to be controlled by the user (and to provide a reasonable default of course).
- The time since the last sale need not be (and, in fact, typically will not be) an integer. You should use a finer granularity in measuring how much time has elapsed.

## Hints

Feel free to turn to your TA for help, hints, and feedback. Your TA and instructor can each serve as prospective clients to advise you on functionality requirements for your application. In order to ensure a uniform grading standard, however, all hints on completing this assignment (*i.e.*, on how to meet these requirements) will come from a single source, your TA.

## What to turn in

You may choose to develop your solution as either a stand-alone java program or as an http-accessible web application. In the former case, you should use the CSE submit command to turn in your implementation and documentation (including, at a minimum, a README file that gives installation and usage instructions). In the latter case, you should use the tomcat subdirectory that you used in Assignment #4, under:

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/usr/class/cis894/jakarta-tomcat-5.0.19/webapps
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You can check with the grader for the exact name of your group's subdirectory here. Please keep the following points in mind:

- *Do not share* the name of this directory with anyone else in the class. Your JSP files will be world readable so you should protect your solutions by keeping the directory name confidential.
- *Do not modify* the contents of this directory after the lab due date. We will consider the contents of this directory to be your “submission”, so the timestamp of the files should predate the lab due time.
- Include an index.html file in this directory so that we can test your system without knowing the name of a particular page in your directory.
- Include documentation, accessible from this page, for using the application.