Designing a Database for a Real Estate Machine

Nikhita Singh
Zach Mulder
Jeff Khvu
Winne Yan
Ray Valadez
Michael Tran
Christopher Au
Freddy Kurniawan
Meet the Client

Owner: Tom Anthony
“a real estate machine”

- **$** Alterre Partners
  - acquire new properties

- **_asset** Asset Construction
  - renovate properties

- **house** Anthony Associates
  - rent and sell properties
the property pipeline

find → invest → renovate → rent + sell
Key Relations for Overall Operations

**Property** (PropID, Street, City, Zip_Code, Neighborhood, # of sq. ft, # of Bedrooms, # of Bathrooms, Purchase_Date, Renovation_Type)

**Person** (PID, Lname, Fname, HomePhone#, CellPhone#, Fax#, Street, City, Zip_Code)

**Skill** (SkillID, Name, Worker’s Compensation Rate)

**Employee_has_Skill** (SkillID\(^1\) \(1\), PID\(^2\)\(f\), Rating (1-10), Primary Skill Y/N)

**Credit_CARD** (CCN, Card_Type, Credit_Limit, Expiration_Date)

**Employee_has_CC** (CCN\(^1\)\(8\), PID\(^2\)\(f\))

**Employee_works_on_Job** (PID\(^2\)\(f\), JobID\(^1\)\(9\))

**Tenant_Rents_Unit** (PID\(^2\)\(b\), PropID\(^1\)\(a\), Unit#\(^2\)\(a\), Start_Date, End_Date)

✓ Overview of property data
✓ Record key data for all individuals involved
✓ Track employee data
✓ Manage employee skills
✓ Track tenants for rental properties
**Key Relations for Investment Tracking**

Investment (NoteID, PID²a, Renewal, Investor_Name, Year_In, Date_In, Date_Out, Notes_Amount, Share_of_Pool, Investment_Period, Investment_Period_Allocation, Weighted_Shares, Interest, Profit_Share, Total_Return, Year³)

Yearly_Pool (NoteID, PID²a, Year, Investment, Profit, Investor_Profit)

Title_Company (TCID, Company_Name, Company_Phone#, PID²a)

- ✓ Manage individual investments
- ✓ View investment data on an annual basis
- ✓ Track profit sharing and returns
Relations for Construction Management

**Subcontractor** (SCID, Subcontractor_Name, Street, City, Zip_Code, Trade_Code, Pay_Status, Phone#, Website, Construction_Type)

**Subcontractor_Works_on_Job** (SCID\(^{13}\), JobID\(^{10}\), PropID\(^{1b}\), Bid)

**Subcontractor_Insures_Property** (PropID\(^{1b}\), SCID\(^{13}\), Maximum_Coverage, Policy#, Insurance_Type, Deductible, Term_Length)

**Supplier** (SupplierID, Supplier_Name, Street, City, Zip_Code, Trade_Code, Pay_Status, Phone#, Website, Construction_Type)

**Job_Has_Supplier** (SupplierID\(^{16}\), JobID\(^{10}\), PropID\(^{1b}\))

**Construction_Schedule** (ScheduleID, PropID\(^{1b}\), Milestone, Start_Date, End_Date, Duration, %Completed)

**Milestone** (PropID\(^{1b}\), MilestoneID, Milestone, Start Date, End Date, Duration)

**Job** (JobID, PropID\(^{1b}\), Duration, Start_Date, Finish_Date, Predecessors, % Complete, Cost, SkillID_Needed, Skill_Need, Workers_Needed, Subcontractor Y/N)

**Cost_Estimate** (CEID, PropID\(^{1b}\))

- ✓ Manage construction schedules
- ✓ Track subcontractor and supplier info and projects
- ✓ View milestones for each property
- ✓ Identify necessary jobs for each property
- ✓ Estimate construction costs
Query 1: Construction Budget

How can we estimate the construction costs based on data from previous properties?

Construction types:
- mega
- mini
- condo
- new

Generate confidence intervals based on past data:
- mean: 129K to 134K
- lower bound: 90K to 110K
- upper bound: 20K to 35K

Calculate range of construction costs for new property.

Steps:
1. find
2. invest
3. renovate
4. rent & sell
Q1: Construction Budget Process

**SQL**
Extracts data from MS Access regarding past construction projects

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**Microsoft Excel**
Given the renovation type and characteristics of a new property, generates mean and confidence intervals for construction budget

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**Microsoft Access**
Access provides a form to add estimate to the related table

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**Matlab**
Generates analytics on previous properties through box plots

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Concepts Applied
Confidence Intervals
Box Plots
Q1: Construction Budget SQL

SELECT [Cost Estimate].[CostEstimateID], [Property].[PropID], [Property].[# of sq ft], [Property].[Renovation Type],
Sum(IIF([Property].[Renovation Type] = 'New Property', [Property].[# of sq ft]*[Work Class].[New Rev Unit Cost/SF],
IIF([Property].[Renovation Type] = 'Condo', [Property].[# of sq ft]*[Work Class].[Condo Rev Unit Cost/SF],
IIF([Property].[Renovation Type] = 'Mini', [Property].[# of sq ft]*[Work Class].[Mini Rev Unit Cost/SF],
IIF([Property].[Renovation Type] = 'Mega', [Property].[# of sq ft]*[Work Class].[Mega Rev Unit Cost/SF], 0)))) AS PropTotalCost
FROM Property, [Work Class], [Cost Estimate]
WHERE [Property].[PropID] = [Cost Estimate].[PropID]
GROUP BY [Property].[PropID], [Property].[# of sq ft], [Property].[Renovation Type], [Cost Estimate].[CostEstimateID];
Q1: Construction Budget Output

The query displays projected construction cost, and the bounds obtained from confidence intervals are shown in the table.

<table>
<thead>
<tr>
<th>CostEstimateID</th>
<th>PropID</th>
<th># of sq ft</th>
<th>Renovation Type</th>
<th>PropTotalCost</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>2100</td>
<td>New Property</td>
<td>$341,481.00</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td>1500</td>
<td>Condo</td>
<td>$140,910.00</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>1700</td>
<td>Mini</td>
<td>$166,498.00</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>1500</td>
<td>Mega</td>
<td>$243,810.00</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>1600</td>
<td>New Property</td>
<td>$260,176.00</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>2000</td>
<td>Mega</td>
<td>$325,080.00</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>2000</td>
<td>Mini</td>
<td>$195,880.00</td>
</tr>
<tr>
<td>8</td>
<td>8</td>
<td>1300</td>
<td>Condo</td>
<td>$122,122.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CostEstimateID</th>
<th>PropID</th>
<th>Renovation Type</th>
<th>Estimated Construction Cost</th>
<th>Lower Bound</th>
<th>Average</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
<td>New Property</td>
<td>$341,481.00</td>
<td>$230,603.43</td>
<td>$290,665.38</td>
<td>$350,727.32</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>Mini</td>
<td>$166,498.00</td>
<td>$161,375.54</td>
<td>$199,960.83</td>
<td>$238,546.12</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>Mega</td>
<td>$243,810.00</td>
<td>$178,539.62</td>
<td>$225,164.50</td>
<td>$311,789.38</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>New Property</td>
<td>$260,176.00</td>
<td>$230,603.43</td>
<td>$290,665.38</td>
<td>$350,727.32</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>Mega</td>
<td>$325,080.00</td>
<td>$178,539.62</td>
<td>$225,164.50</td>
<td>$311,789.38</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>Mini</td>
<td>$195,880.00</td>
<td>$161,375.54</td>
<td>$199,960.83</td>
<td>$238,546.12</td>
</tr>
<tr>
<td>7</td>
<td>8</td>
<td>Condo</td>
<td>$122,122.00</td>
<td>$105,536.64</td>
<td>$118,207.83</td>
<td>$130,879.03</td>
</tr>
</tbody>
</table>
Matlab Code

```matlab
function [] = myBoxPlot(data1, textdata1)
    X4 = textdata1(:,4);
    X5 = data1(:,5);
    n = length(data1);
    A = [];
    for i=2:(n+1)
        if strcmp(X4(i), 'New Property') == 1
            A(i-1,1) = X5(i-1);
            A(A==0) = [];
        elseif strcmp(X4(i), 'Condo') == 1
            B(i-1,1) = X5(i-1);
            B(B==0) = [];
        elseif strcmp(X4(i), 'Mini') == 1
            C(i-1,1) = X5(i-1);
            C(C==0) = [];
        elseif strcmp(X4(i), 'Mega') == 1
            D(i-1,1) = X5(i-1);
            D(D==0) = [];
        end
    end
    subplot(2,2,1), boxplot(A, 'orientation', 'horizontal');
    title('New Renovation');
    subplot(2,2,2), boxplot(B, 'orientation', 'horizontal');
    title('Condo Renovation');
    subplot(2,2,3), boxplot(C, 'orientation', 'horizontal', 'whisker', 4);
    title('Mini Renovation');
    subplot(2,2,4), boxplot(D, 'orientation', 'horizontal');
    title('Mega Renovation');
    set(gcf, 'color', [1 1 1])
end
```

box plots show spread of construction costs for each type of property
Query 2: Project Management

How can we track the progress on a property and identify critical tasks?

28 “To-dos”

Design
Demolition
Grading & Site Prep
Plumbing
Foundation
Framing
Roofing
Windows
Exterior Doors & Frames
Electrical
HVAC & Sheet Metal
Insulation
Drywall
Cabinets
Doors & Trim
Garage Doors
Painting
Tile
Granite
Wood Top
Shower Doors
Finish Hardware
Flooring
Appliances
Decorative Light Fixtures
Cleaning
Fencing
Landscaping

Gantt Chart
Q2: Project Management Process

**Microsoft Project**
Input jobs by property and start and end date of construction project. Automatically generates timeline for project using CPM and identifies critical jobs.

**Microsoft Excel**
Links to Microsoft Project data and tracks changes.

**Microsoft Access**
Displays jobs related to each property and provides analytics + progress reports.

**Concepts Applied**
Critical Path Method
Network Graphs
Q2: Project Management

- **Tasks & Duration**
  - Table listing tasks like Design, Demolition, Grading & Site Prep, etc., with corresponding durations.

- **Timeline**
  - Bar chart showing dates from April 14, 2013, to August 18, 2013.
  - Critical tasks marked with specific days.
  - Slack time indicated for certain tasks.

- **Budget**
  - Bar chart showing budget allocation with amounts like $10,000.00, $15,000.00, $10,500.00, etc.

- **Slack**
  - Assigned to ID

- **Track % Completion**
  - Displays completion percentage for each task.

- **Displays Current Date**
  - Indicates the current date on the timeline.

- **Critical Tasks**
  - High-priority tasks highlighted on the timeline.
Q2: Project Management SQL

```
SELECT [Job].[Property], [Job].[Task Name],
(IIF([Job].[% Complete]=100,'Complete', IIF([Job].
[Complete]>0 AND [Job].[% Complete]<100,'In Progress',
IIF([Job].[% Complete]=0 AND Date()>[Job].
[Start], 'Late', IIF([Job].[% Complete]=0,'Pending',' ')))) AS Completion,
job.Start, job.Finish, job.[% Complete]
FROM Job
ORDER BY job.start;
```
## Q2: Project Management Output

<table>
<thead>
<tr>
<th>Property</th>
<th>Task Name</th>
<th>Completion</th>
<th>Start</th>
<th>Finish</th>
<th>% Complete</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Demolition</td>
<td>In Progress</td>
<td>4/25/2013</td>
<td>5/7/2013</td>
<td>20%</td>
</tr>
<tr>
<td>1</td>
<td>Foundation</td>
<td>Late</td>
<td>5/1/2013</td>
<td>5/30/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Grading &amp; Site</td>
<td>In Progress</td>
<td>5/7/2013</td>
<td>5/16/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Design</td>
<td>Pending</td>
<td>5/31/2013</td>
<td>6/14/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Plumbing</td>
<td>Pending</td>
<td>6/17/2013</td>
<td>7/18/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Framing</td>
<td>Pending</td>
<td>6/17/2013</td>
<td>6/28/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Insulation</td>
<td>Pending</td>
<td>7/1/2013</td>
<td>7/5/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Roofing</td>
<td>Pending</td>
<td>7/1/2013</td>
<td>7/16/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Electrical</td>
<td>Pending</td>
<td>7/1/2013</td>
<td>7/24/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>HVAC &amp; Sheet</td>
<td>Pending</td>
<td>7/1/2013</td>
<td>7/16/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Drywall</td>
<td>Pending</td>
<td>7/8/2013</td>
<td>7/11/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Exterior Doors</td>
<td>Pending</td>
<td>7/19/2013</td>
<td>8/7/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Windows</td>
<td>Pending</td>
<td>7/19/2013</td>
<td>8/7/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Doors &amp; Trim</td>
<td>Pending</td>
<td>7/25/2013</td>
<td>8/7/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Garage Doors</td>
<td>Pending</td>
<td>7/25/2013</td>
<td>7/31/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Tile</td>
<td>Pending</td>
<td>7/25/2013</td>
<td>8/1/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Flooring</td>
<td>Pending</td>
<td>7/25/2013</td>
<td>8/7/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Shower Doors</td>
<td>Pending</td>
<td>8/2/2013</td>
<td>8/5/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Painting</td>
<td>Pending</td>
<td>8/8/2013</td>
<td>8/21/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Cabinets</td>
<td>Pending</td>
<td>8/8/2013</td>
<td>8/27/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Granite</td>
<td>Pending</td>
<td>8/28/2013</td>
<td>8/29/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Wood Top</td>
<td>Pending</td>
<td>8/28/2013</td>
<td>8/29/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Finish Hardware</td>
<td>Pending</td>
<td>8/30/2013</td>
<td>9/5/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Appliances</td>
<td>Pending</td>
<td>9/6/2013</td>
<td>9/12/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Decorative Lights</td>
<td>Pending</td>
<td>9/6/2013</td>
<td>9/10/2013</td>
<td>0%</td>
</tr>
<tr>
<td>1</td>
<td>Cleaning</td>
<td>Pending</td>
<td>9/13/2013</td>
<td>9/13/2013</td>
<td>0%</td>
</tr>
</tbody>
</table>

find **invest** **renovate** rent & sell
What is the best way to schedule workers?

1. Find all employees
2. Sort by skills & availability
3. Generate optimal schedule

Query 3: Worker Schedule
Q3: Worker Schedule Process

**Custom VBA Macro**
Generates data file from MS Access

**Python**
Code initiates the AMPL program run

**AMPL**
Solves integer program that minimizes cost of worker wages while fulfilling skill and worker requirements

**Custom VBA Macro**
AMPL saves output and macro translates into readable output in MS Access

**Concepts Applied**
Integer Programs
Scheduling
Q3: Worker Schedule SQL

```
SELECT DISTINCT j.id, e.pid, j.SkillID, e.[Hourly Rate]*(1+s.[Worker's Compensation Rate]) AS [Loaded Rate]
FROM skill AS s, (job AS j INNER JOIN [Employee Skill Rating] AS es ON j.skillid=es.skillid) INNER JOIN employee AS e ON e.pid = es.pid
WHERE e.[Employment Type] = "Laborer" and s.skillid = j.skillid
ORDER BY e.pid, j.id;
```

Calculates Burden Rate

Total cost of worker i to perform job j

```
SELECT id, pid, job.skillid, [Skill Rating (1-10)] AS rating
FROM job INNER JOIN [employee skill rating] ON job.skillid = [employee skill rating].skillid
ORDER BY pid, id;
```

Skill Matrix

Provides the skill of worker i performing job j
Q3: Worker Schedule Model

Integer Program

Min $\sum_{i=1}^{n} \sum_{j=1}^{m} C_{ij} x_{ij}$

s.t. $\sum_{i=1}^{n} S_{ij} x_{ij} \geq N_j \sum_{i=1}^{n} x_{ij} \forall j$

$x_{ij} \leq A_{ij} \forall i, j$

$\sum_{i=1}^{n} x_{ij} = W_j \forall j$

$(x_{ki} + x_{kj}) O_{ij} \leq 1 \forall i, j, k$

$x_{ij} = 1 \exists i, j$

Where $x_{ij} = \begin{cases} 1 & \text{if worker } i \text{ is scheduled for job } j \\ 0 & \text{otherwise} \end{cases}$

$n$ is the number of workers

$m$ is the number of jobs

$C$ is the cost of worker $i$ completing job $j$

$N$ is the average skill needed for job $j$

$S$ is the skill of worker $i$ for job $j$

$A$ is the availability of worker $i$ for job $j$ (Assume $A_{ij} = 1$)

$W$ is the number of workers needed for job $j$

$O_{ij} = \begin{cases} 1 & \text{if job } i \text{ overlaps job } j \\ 0 & \text{otherwise} \end{cases}$
Q3: Worker Schedule Output

<table>
<thead>
<tr>
<th>ID</th>
<th>Property</th>
<th>Task Name</th>
<th>Duration</th>
<th>Start</th>
<th>Finish</th>
<th>Predecessor</th>
<th>% Complete</th>
<th>Cost</th>
<th>SkillID</th>
<th>SkillNeed</th>
<th>WorkersNec</th>
<th>Subcontract</th>
<th>Assigned_Tc</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1 Design</td>
<td>1 Design</td>
<td>11 days</td>
<td>5/31/2013</td>
<td>6/14/2013</td>
<td>2, 3, 5</td>
<td>0%</td>
<td>$32,000.00</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>142,144</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1 Demolition</td>
<td>1 Demolition</td>
<td>10 days</td>
<td>4/25/2013</td>
<td>5/7/2013</td>
<td></td>
<td></td>
<td>$10,000.00</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>136</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1 Grading &amp; Site</td>
<td>1 Grading &amp; Site</td>
<td>8 days</td>
<td>5/7/2013</td>
<td>5/16/2013</td>
<td></td>
<td></td>
<td>$15,000.00</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>136,144</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1 Plumbing</td>
<td>1 Plumbing</td>
<td>24 days</td>
<td>6/17/2013</td>
<td>7/18/2013</td>
<td></td>
<td></td>
<td>$62,000.00</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>1 Foundation</td>
<td>1 Foundation</td>
<td>10 days</td>
<td>5/1/2013</td>
<td>5/30/2013</td>
<td></td>
<td></td>
<td>$1,800.00</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>115</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>1 Framing</td>
<td>1 Framing</td>
<td>10 days</td>
<td>6/17/2013</td>
<td>6/28/2013</td>
<td></td>
<td></td>
<td>$14,200.00</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>142</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>1 Roofing</td>
<td>1 Roofing</td>
<td>12 days</td>
<td>7/1/2013</td>
<td>7/16/2013</td>
<td></td>
<td></td>
<td>$6,000.00</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>142</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>1 Windows</td>
<td>1 Windows</td>
<td>14 days</td>
<td>7/19/2013</td>
<td>8/3/2013</td>
<td></td>
<td></td>
<td>$9,000.00</td>
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</table>

- **find**
- **invest**
- **renovate**
- **rent & sell**

code auto populates task assignments to individuals

output indicates optimal assignment of jobs to people
What should be the listing price for a new property?

Query 4: Selling Price

- Extract data on properties
- Apply analysis
  - Multiple regression models
  - ANOVA
- Project selling price

Formula:

\[ \text{Selling Price} = \text{no. beds} + \text{no. bath} + \text{sq. ft} + \text{construction cost} + \text{advertising cost} \]
Q4: Selling Price Process

**Microsoft Excel**
Based on past property data, generates a multiple regression model to determine the optimal selling price.

**Concepts Applied**
Multiple Regression
ANOVA

**SQL**
Based on multiple regression model, outputs the optimal price for a new property based on property characteristics.

**Microsoft Access**
Displays similar properties in a detailed report.
Q4: Selling Price Regression Model

Price

= 23656
- 290481*(Neighborhood A)
- 49212*(Neighborhood B)
+ 32629*(Neighborhood C)
+ 31232*(Neighborhood D)
+ 2997*(Neighborhood E)
+ 26030*(Neighborhood F)
- 288*(Neighborhood G)
- 21459*(Neighborhood H)
- 78600*(Neighborhood I)
+ 11388*(Neighborhood J)
+ 19352*(NoBedroom)
+ 28392*(NoBathroom)
- 75*(SqFt)
- 0.52*(Purchase Price)
+ 0.07*(Construction Cost)
+ 17*(Advertising Cost)

R² = 0.95

adjusted R² = 0.91
Q4: Selling Price SQL

SELECT DISTINCT [Property].[PropID], 19352.32*Property.[# of bedrooms]+28392.23*Property.[# of bathrooms]+(-75.78)*Property.[# of sq ft]+(-0.52)*Property.[Purchase Price]+17.32*[Advertising Cost].[Total Advertisement Cost]+0.71*[Construction Cost].Average +23656.39+(If(Property.[Zip code]=94706,-290481.61,If(Property.[Zip code]=94578,-49212.43,If(Property.[Zip code]=94619,32629.51,If(Property.[Zip code]=94501,31232.4,If(Property.[Zip code]=94610,2997.06,If(Property.[Zip code]=94602,26030.27,If(Property.[Zip code]=94605,-288.91,If(Property.[Zip code]=94606,-21459.23,If(Property.[Zip code]=94702,-78600.34,If(Property.[Zip code]=94621,11388.34,0)))))))))) AS EstimatedPrice
FROM Property, [Advertising Cost], [Cost Estimate], [Construction Cost]

outputs optimal sales price based on Excel regression model
uses IF statements to account for different property ZIP codes
gets variables for regression on property characteristics
Q4: Selling Price Output

estimated selling price determined by multiple regression model

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</table>
The New Property Dashboard

Search Criteria:
- Price: 650,000 to 700,000
- Beds: 2
- Bath: 1
- Sq. ft: 1800

Neighborhood Map With Similar Properties

Crime Rate Heat Map Overlay

View Detailed School Ratings

Cragmont Elementary School
830 Regal Rd
Berkeley CA 94708
(510) 644-8810

Grade: K-5
Students: 393
Teachers: 23

GreatSchools rating: 8 out of 10
Query 5: Return on Investment

What is the estimated return for each stakeholder?

- Find investments + profits for a given year
- Apply analytics
- Determine return per $1 for each investor
Q5: Return on Investment Process

**Microsoft Access**
Investment table contains data on all investments made

**Microsoft Excel**
Conducts analytics on investments and actual profits and % for each investor

**Microsoft Access**
Displays analytics in investor table

**SQL**
SQL extracts info and calculated per $1 return for each investor and outputs report

Concepts Applied:
Engineering Economics
Q5: Return on Investment SQL

SELECT A.Return+B.Return AS Returns, A.Investment +B.Investment AS Investments, (A.Return+B.Return)/(A.Investment+B.Investment) AS Rate FROM

(SELECT sum([Investment Calculation].[Total Return]) AS Return, sum([Investment Calculation].[Note Amount]) AS Investment FROM [Investment Calculation] WHERE [Investment Calculation].[Year]=2008) AS A,

(SELECT sum([Investment Calculation].[Total Return]) AS Return, sum([Investment Calculation].[Note Amount]) AS Investment FROM [Investment Calculation] WHERE [Investment Calculation].[Year]=2009) AS B;

calculates average and outputs estimated return rate as return/$1 invested

table generated with sum of investments for a given year

table generated with sum of investments for another given year
Q5: Investment Model and Output

Applying Engineering Economics
Present and Future Value Calculations
Time Shares
Shared Allocation

\[ \frac{PV\left(\sum_{i=1}^{n} 2009.return_i \right) + PV\left(\sum_{i=1}^{n} 2010.return_i \right)}{PV\left(\sum_{i=1}^{n} 2009.note_i \right) + PV\left(\sum_{i=1}^{n} 2010.note_i \right)} \]

2008 to 2009 ratio: 0.78
2009 to 2010 ratio: 1.02
2010 to 2011 ratio: 1.15
Decomposing to 1NF and 2NF:

Job (JobID, ProplD\textsuperscript{1b}, Duration, Start_Date, Finish_Date, Predecessors, % Complete, Cost, SkillID_Needed, Skill_Need, Workers_Needed, Subcontractor Y/N)

To normalize to 1NF and 2NF:

Job (JobID, ProplD\textsuperscript{1b}, Duration, Start_Date, Finish_Date, % Complete, Cost, SkillID_Needed, Skill_Need, Workers_Needed, Subcontractor Y/N)

Predecessors (JobID, Predecessor)
Decomposing to 3NF & BCNF

Job (JobID, PropID\textsuperscript{1b}, \textbf{Duration}, Start_Date, Finish_Date, Predecessors, % Complete, Cost, SkillID_Needed, Skill_Need, Workers_Needed, Subcontractor Y/N)

To normalize to 3NF:

Job (JobID, PropID\textsuperscript{1b}, Start_Date, Finish_Date, % Complete, Cost, Skill_Need, Workers_Needed, Subcontractor Y/N)

Job_Predecessors (JobID, Predecessor)

Job_Timeline (Start_Date, Finish_Date, Duration)
Decomposing to 2NF

Investment (NoteID, PID\textsuperscript{2a}, Renewal, \textbf{Investor\_Name}, Year\_In, Date\_In, Date\_Out, Notes\_Amount, Share\_of\_Pool, Investment\_Period, Investment\_Period\_Allocation, Weighted\_Shares, Interest, Profit\_Share, Total\_Return, Year\textsuperscript{5})

To normalize to 2NF:

Investment (NoteID, PID\textsuperscript{2a}, Renewal, Year\_In, Date\_In, Date\_Out, Notes\_Amount, Share\_of\_Pool, Investment\_Period, Investment\_Period\_Allocation, Weighted\_Shares, Interest, Profit\_Share, Total\_Return, Year\textsuperscript{5})

Investment\_Name (PID\textsuperscript{2a}, Investor\_Name)
To normalize to BCNF:

Construction_Schedule \((\text{ScheduleID, PropID}^{1b}, \text{Milestone})\)

Schedule_Milestone \((\text{PropID}^{1b}, \text{Milestone}, \text{Start\_Date}, \text{End\_Date}, \% \text{Completed})\)

Schedule_Start \((\text{Start\_Date, End\_Date, Duration})\)
Thank You To....

Tom Anthony
Ian Cameron

Terri Brown
Frank Adams
Hany Rezke

Other members of the Anthony Associates, Asset Construction, and Alterre Partner teams