Achievers offers different platforms to clients to help motivate employees based off rewards for good performance.

Our Challenge
To create a database for the Sales Analysis Department

Quick Recap
Relational Schema

1. PERSON (Email, firstName, lastName)
2. EMPLOYEE (SSN, email, department, jobTitle, phoneNumber, gender, DOB, streetNumber, streetName, streetSuffix, city, state, zip, supervisor)
3. SALES_REP (SSN, email, commission)
4. ENGINEER (SSN, email, salary)
5. MARKETING_EMPLOYEE (SSN, email, salary)
6. POTENTIAL_CLIENT (potentialID, email, stageNumber, dateStageStart, dateStageEnd, dateBecamePotentialClient, isPotential)
7. DISQUALIFIED_CLIENT (disqualifiedID, email, potentialID, reason, conversionDate, isDisqualified)
8. ACTIVE_CLIENT (activeID, email, potentialID, conversionDate, isActive)
9. PAST_CLIENT (pastID, email, activeID, conversionDate, reason, isPast)
10. USER (userID, email, companyID, password, totalPoints, type)
11. STAGE (stageNumber, description, averageDuration)
12. DEMO_PLATFORM (demoPlatformID, demoPlatformDescription, maxUserNumber)
13. CUSTOMIZED_PLATFORM (customizedPlatformID, companyID, description, maxNumberOfUsers)
14. FEATURE (featureID, featureName, description)
15. MARKETING_CAMPAIGN (marketCamID, name, budget, numberOfEmployeesNeeded, startDate, endDate)
16. CAMPAIGN_TYPE (campaignID, campaignTypeName, description)
17. INDUSTRY_TYPE (industryTypeID, industryTypeName, industryTypeDescription)
18. OUTSIDE_COMPANY (companyID, industryTypeID, companyName, headQuarter, numberOfEmployees, numberBranch, branchLocation, annualRevenue)
19. PRIZE (prizeID, supplierCompanyID, pointValue, productName, description)
20. CONTRACT_TYPE (contractTypeID, description)
21. CONTRACT (contractID, activeID, conversionDate, services, allowableUsers, price)
22. SALES_REP_WORKS_STAGE (stageNumber, SSN, startDate, expectedEndDate)
23. DEMO_PLATFORM_IS_FOR_COMPANY (demoPlatformID, companyID)
24. CONTRACT_SPECIFIES_CUSTOMIZED_A_PLATFORM (customizedPlatformID, contractID)
25. EMPLOYEE_HAS_SPECIALITY_IN_INDUSTRY_T (industryTypeID, SSN)
26. O_COMPANY_IS_OF_TYPE_INDUSTRY_TYPE (industryTypeID, companyID)
27. SALES_REP_INITIATE_WITH_POTENTIAL_C (potentialID, SSN, date)
28. EMPLOYEE_SUPERVISES_CONTRACT (SSN, contractID)
29. EMPLOYEE_WORKS_WITH_A_CLIENT (SSN, activeID)
30. M_C_MI_TYPE_OF_CAMPAIGN_TYPE (marketCamID, campaignID)
31. M_EMPLOYEE_WORKS_ON_M_CAMPAIGN (marketCamID, SSN, startDate, endDate)
32. MC_ATTRACTS_POTENTIAL_CLIENT (potentialID, marketCamID)
33. CONTRACT_IS_TYPE_OF_CONTRACT_TYPE (contractTypeID, contractID)
34. MC_TARGETS_INDUSTRY_TYPE (industryTypeID, marketCamID)
35. ENGINEER_MAINTAINS_C_PLATFORM (customizedPlatformID, SSN)
36. USER_GIVES_POINTS_TO_USER (date, time, giveID, givenID, numberPoint, reason)
37. USER_USES_CUSTOMIZED_PLATFORM (userID, customizedPlatformID)
38. PERSON_WORKS_FOR_O_COMPANY (email, companyID)
39. PRIZE_REDEEMED_BY_USER (UID, prizeID, date, quantity)
40. CUSTOMIZED_PLATFORM_HAS_FEATURE (customizedPlatformID, featureID)
41. DEMO_PLATFORM_HAS_FEATURE (demoPlatformID, featureID)
Relational Schema

N:M Relationships

13. SALES_REP_WORKS_STAGE (stageNumber2, SSN1.1, startDate, expectedEndDate)
14. DEMO_PLATFORM_IS_FOR_COMPANY (demoPlatformID3, companyID9)
15. CONTRACT_SPECIFIES_CUSTOMIZED_A_PLATFORM (customizedPlatformID4, contractID12)
16. EMPLOYEE_HAS_SPECIALITY_IN_INDUSTRY_T (industryTypeID8, SSN1.1)
17. O_COMPANY_IS_OF_TYPE_INDUSTRY_TYPE (industryTypeID8, companyID9)
18. SALES_REP_INITIATE_WITH_POTENTIAL_C (potentialID1.2, SSN1.1, date)
19. EMPLOYEE_SUPERVISES_CONTRACT (SSN1.1, contractID12)
20. EMPLOYEE_WORKS_WITH_A_CLIENT (SSN1.1, activeID1.4)
21. M_C_IS_TYPE_OF_CAMPAIGN_TYPE (marketCamID6, campaignID7)
22. M_EMPLOYEE_WORKS_ON_M_CAMPAIGN (marketCamID6, SSN1.1.3, startDate, endDate)
23. MC_ATTRACTS_POTENTIAL_CLIENT (potentialID1.2, marketCamID6)
24. CONTRACT_IS_TYPE_OF_CONTRACT_TYPE (contractTypeID11, contractID12)
25. MC_TARGETS_INDUSTRY_TYPE (industryTypeID8, marketCamID6)
26. ENGINEER_MAINTAINS_C_PLATFORM (customizedPlatformID4, SSN1.1.2)
27. USER_GIVES_POINTS_TO_USER (date, time, giveID1.6, givenID1.6, numberPoint, reason)
28. USER_USES_CUSTOMIZED_PLATFORM (userID1.6, customizedPlatformID4)
29. PERSON_WORKS_FOR_O_COMPANY (email1.1, companyID9)
30. PRIZE_REDEEMED_BY_USER (UID1.6, prizeID10, date, quantity)
31. CUSTOMIZED_PLATFORM_HAS_FEATURE (customizedPlatformID4, featureID5)
32. DEMO_PLATFORM_HAS_FEATURE (demoPlatformID3, featureID5)
DP REVIEW I

Briefing of the Achievers company and first draft of the EER Diagram.

DP REVIEW II

Second draft of the EER diagram, relational schema and the preliminary results of our first five queries.

DP REVIEW III

- Finalization of the EER diagram, relational schema, and improved versions of our first 5 queries.
- SQL implementation of the first 5 queries to pull the relevant data from MS Access.
- Example data and relationships were implemented inside of the MS Access database.
Relationships
Query 1

1. PERSON (Email, firstName, lastName)
1.1. EMPLOYEE (SSN, email1, department, jobTitle, phoneNumber, gender, DOB, streetNumber, streetName, streetSuffix, city, state, zip, supervisor)
1.1.1. SALES_REP (SSN1.1, email1.1, commission)
1.1.2. ENGINEER (SSN1.1, email1.1, salary)
1.1.3. MARKETING EMPLOYEE (SSN1.1, email1.1, salary)
1.2. POTENTIAL_CLIENT (potentialID, email1, stageNumber2, dateStageStart, dateStageEnd, dateBecamePotentialClient, isPotential)
1.3. DISQUALIFIED_CLIENT (disqualifiedID, email1, potentialID1.2, reason, conversionDate, isDisqualified)
1.4. ACTIVE_CLIENT (activeID, email1, potentialID1.2, conversionDate, isActive)
1.5. PAST_CLIENT (pastID, email1, activeID1.4, conversionDate, reason, isPast)
1.6. USER (userID, email1, companyID9, password, totalPoints, type)
2. STAGE (stageNumber, description, averageDuration)
3. DEMO_PLATFORM (demoPlatformID, demoPlatformDescription, maxUserNumber)
4. CUSTOMIZED PLATFORM (customizedPlatformID, companyID9, description, maxNumberOfUsers)
5. FEATURE (featureID, featureName, description)
6. MARKETING_CAMPAIGN (marketCamID, name, budget, numberOfEmployeesNeeded, startDate, endDate)
7. CAMPAIGN_TYPE (campaignID, campaignTypeName, description)
8. INDUSTRY_TYPE (industryTypeID, industryTypeName, industryTypeDescription)
9. OUTSIDE COMPANY (companyID, industryTypeID8, companyName, headQuarter, numberOfEmployees, numberBranch, branchLocation, annualRevenue)
10. PRIZE (prizeID, supplierCompanyID9, pointValue, productName, description)
11. CONTRACT_TYPE (contractTypeID, description)
12. CONTRACT (contractID, activeID1.4, conversionDate1.4, services, allowableUsers, price)
13. SALES_REP_WORKS_STAGE (stageNumber2, SSN1.1.1, startDate, expectedEndDate)
14. DEMO_PLATFORM_IS_FOR_COMPANY (demoPlatformID3, companyID9)
15. CONTRACT_SPECIFIES_CUSTOMIZED_A_PLATFORM (customizedPlatformID4, contractID12)
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28. USER_USES_CUSTOMIZED_PLATFORM (userID1.6, customizedPlatformID4)
29. PERSON_WORKS_FOR_O_COMPANY (email1.1, companyID9)
30. PRIZE_REDEEMED_BY_USER (UID1.6, prizeID10, date, quantity)
31. CUSTOMIZED_PLATFORM_HAS_FEATURE (customizedPlatformID4, featureID5)
32. DEMO_PLATFORM_HAS_FEATURE (demoPlatformID3, featureID5)
Q1: Potential Client Platform Suggestion

How should Achievers determine which platform to suggest to potential clients?

Achievers can utilize past data to focus their sales pitch on a particular platform, thus maximizing the likelihood of client conversion.
K-means clustering groups data into clusters based on data points for each ‘case’.

In this instance each platform is assigned to the cluster whose mean yields the least within-cluster sum of squares. Intuitively this is called the ‘nearest’ mean. Then each potential client is assigned to a cluster.

**GOAL: Minimize Objective Function**

\[
J = \sum_{j=1}^{k} \sum_{i=1}^{n} \left\| \mathbf{x}_{i}^{(j)} - \mathbf{c}_j \right\|^2,
\]

Where the \( \mathbf{x}_{i}^{(j)} \) are the data points and the \( \mathbf{c}_i \) are the cluster locations.
Query 1 SQL

Creates table with data for each active client ordered by platform ID

* ordering by platform ID is crucial for the Matlab code to work

```
SELECT a.platformID, c.numberBranch, i.industryTypeID, c.numberofEmployee, c.annualRevenue
FROM OUTSIDE_COMPANY AS c, OUTSIDE_COMPANY_IS_OF_TYPE_INDU AS i, ACTIVE_PLATFORM_IS_FOR AS a
WHERE a.companyID = c.companyID AND i.companyID = a.companyID
ORDER BY a.platformID;
```

Creates a table with data for potential clients

```
SELECT p.potentialID, c.numberBranch, i.industryTypeID, c.numberofEmployee, c.annualRevenue
FROM OUTSIDE_COMPANY AS c, OUTSIDE_COMPANY_IS_OF_TYPE_INDU AS i, POTENTIAL_CLIENT AS p
WHERE p.potentialID = c.companyID AND i.companyID = c.companyID
ORDER BY p.potentialID
```
Query 1 MATLAB

```matlab
function [C,IDX] = query1(X,Y)
% takes inputs, X: active client matrix and Y: potential client matrix
% returns matrix IDX with potential client ID and cluster (ie platform #)
% and matrix C with cluster point locations
[n,m] = size(X);
Q = X(1,:);
C = [];

% Runs kmeans for each platform type & stores centroid locations in matrix C
% Only active clients evaluated at this point
for i = 2:n;
    if X(i,1) == X(i-1,1);
        Q = [Q; X(i,:)];
    else
        [IDX, A] = k_means(Q,1);
        C = [C;A];
        Q = [];
    end
end

[IDX, A] = k_means(Q,1);
C = [C;A];
P = Y;
P(:,1) =[];
C(:,1) =[];
% Runs kmeans with potential clients given the centroid locations in C
IDX = k_means(P, C);
IDX= horzcat(Y(:,1), IDX);
end
```

Function takes data from the two queries and runs k-means clustering twice to return a platform suggestion for each potential client.
Query 1 Result

EDU>> [C, IDX] = query1(X,Y)

C =

<p>| | | | | |</p>
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IDX =

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<tr>
<td>1008</td>
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</tr>
</tbody>
</table>

IDX contains potential customer IDs and their respective suggested platforms
Query 1 Benefits

- Achievers is able to more effectively sell to potential clients
- Insight into what type of companies are prone to buy what products
- With more data, can be extended to suggest other platforms to current clients as a form of advertisement
- Ability to verify if a customer's decision on which platform to buy is the most appropriate platform to increase customer satisfaction and thus customer retention
Query 2
Q2: Client Acquisition Process Analysis

How can we determine when there is a small probability a potential client will become an active client?

1. Gather past time durations spent in stages from clients who became active clients.
2. Generate distributions and calculate mean and lambda for exponential distribution.
3. Raise red flags on potential clients which have small probability of advancing to next stage.
Query 2 Plan

**SQL Code**
Pull the duration of days that active clients spent in each stage as a potential client.

**MS Excel**
Graph exponential distributions, calculate means, lambdas, and raise red flags for potential clients that are unlikely to be converted to active clients.

**MS Access**
Use the list of flagged clients to find patterns, to track those clients who are unlikely to move to the next stage and don’t waste resources on that client.

**Concepts**
Probability & Statistics
Query 2 SQL

```
SELECT P.dateLeaveStageChange - P.dateEnterStage
FROM POTENTIAL_CLIENT P, ACTIVE_CLIENT A
WHERE P.stageNumber = # and A.email=P.email
```

# of Days Active Clients spend in each stage

```
SELECT P.StageNumber, AVG(P.dateStageEnd - P.dateStageStart) as Mean, 1/AVG(P.dateStageEnd - P.dateStageStart) as Lamda
FROM POTENTIAL_CLIENT P, ACTIVE_CLIENT A
WHERE A.email=P.email
GROUP BY P.stageNumber;
```

Returns list of potential client emails and the date they entered the stage.
Returns list of potential client emails and the date they entered the stage.

```
SELECT P.email, P.stageStartDateTime
FROM POTENTIAL_CLIENT AS P
WHERE P.stageEndDateTime Is Null AND P.stageNumber = #
```
**Probability of not advancing prior to this time < Red Flag Probability (0.05)**

**Current Date - Date Stage was Entered**

**1st Query Input**

**2nd Query Input**

**Query 2 Result**

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<th>Email</th>
<th>Current</th>
<th>Duration</th>
<th>Probability of Advancing Prior To T</th>
<th>Probability of Not Advancing Prior To T</th>
<th>Raise Red Flag</th>
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**Probability an active client will advance prior to this time.**

\[ f(x) = 1 - e^{-\lambda x} \]

**Probability an active client will NOT advance prior to this time.**

\[ f(x) = e^{-\lambda x} \]

**USER INPUT:**

Raise red flag if probability has less than this percentage of advancing.
Query 2 Benefits

- Can use this analysis to raise red flags when clients are in a stage for an excessive amount of a time.

- Then the right questions can be asked to improve the process and patterns can be identified.
Query 3
Q3: Product Demand Forecast

How can we determine the demand for each product for the following month?

1. Gather past time data for product orders
2. Run exponential smoothing on data
3. Order the right amount of products in order to avoid stock
SQL Code
Pull the product order quantity for each month

MATLAB
Run exponential smoothing

MS Access
Return productId with forecasted demand for the following

Concepts
Probability & Statistics
SELECT p.prizeID, Sum(p.quantity) AS total, Month(p.Date) AS [month], Year(p.Date) AS [year] 
FROM PRIZE_REDEEMED_BY_USER AS p 
GROUP BY p.prizeID, Month(p.Date), Year(p.Date) 
ORDER BY p.prizeID, Year(p.Date), Month(p.Date);

Organizes prizes by productID then sums the quantity per month grouped by month and year

VBA code
Using dexplore to pull data from MSA

Run data through smoothing

```matlab
alpha=0.3;
% Assign data to output variable
data = curr.Data;
% figuring out how many dates there are for each product
sizeproduct=size(data);
wow=zeros(1,sizeofproduct(1));
x = zeros(1,max(data(:,1)));
for i=1:max(data(:,1))
    wow(data(:,1)==i);
    x(i) = sum(wow);
end

sizex=size(x);
quantityarray=zeros(sizex(2),x(1));
% assume all products have same length of dates
% assume product goes in order from 1, no missing numbers

% this fills in the quantity ordered for each product
for i=1:sizex(2)
    for k=1:x(1)
        quantityarray(1,k) = data((i-1)*x(1) + k,2);
    end
end

finalarray=zeros(sizex(2),2);
% this creates product number per each row
for j=1:sizex(2)
    finalarray(j)=j;
end

% throws forecast in the finalarray
for m=1:sizex(2)
    D = quantityarray(m,:);
    finalarray(m,2) = ceil(supersmooth(alpha, D));
end
```

Smoothing Function

```matlab
function [ F ] = supersmooth( alpha, D )
    matrix=size(D,2);
    matrixplusone=matrix+1;
    S=zeros(1, matrixplusone);
    S(1)=mean(D);
    for i=2:(matrixplusone)
        S(i)=alpha*D(i-1)+(1-alpha)*(S(i-1));
    end
    F = S(matrixplusone);
end
```
Query 3 Result

Next month demand

Calculate product demand for next month

ans =
1  9
2 10
3 11
With this query, the client will be able to estimate the product demand for the following month

Allows business to factor in recent data trends

Allows Achiever’s to smooth the demand of products and bulk order products in advanced
Query 4
Q4: Marketing Campaign Process Analysis

Which factors affect the success of a marketing campaign and how can we predict future campaign success?

- Gather the factors that might impact the success of a marketing campaign
- Test these factors using a Multiple Linear Regression based on past marketing data
- Use the regression equation to predict the success of a new campaign by defining success as a high leads/cost ratio
Query all the past years’ marketing data to extract factors that may affect the success of a marketing campaign.

**MS Excel**

Define “Success” as Leads Generated/Cost of a campaign and run a multiple linear regression using success as the dependent variable, retaining only independent variables with low p-values.

**SQL Code**

Create a query that implements the final regression equation to determine the success of all past campaigns.

**MS Access**

Define “Success” as Leads Generated/Cost of a campaign and run a multiple linear regression using success as the dependent variable, retaining only independent variables with low p-values.
Query 4 SQL

Extracting Data on past Marketing Campaigns

Extracting each variables that might affect the marketing campaign success

Multiple Regression Result

Multiple linear regression result from excel data analysis

Adjusted R Squared = 0.90

p-values <.05

Success = .0972 - .0116*(industry type 1001) + .0044*(industry type 1002) - .0158*(industry type 1003) + .0221*(industry type 1004) - .0041*(industry type 1005) + .0275*(industry type 1006) + .0031*(industry type 1007) - .0352*(industry type 1008) + .0388*(industry type 1009) + .0288*(campaign 7001) + .0063*(campaign 7002) + .0126*(campaign 7003) - .0070*(campaign 7004) + .0048*(duration) + .0034*(number of employees needed)
### Query 4 Multiple Regression Output

#### Summary Output

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<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
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#### ANOVA

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**Binary variables representing Targeted Industry Type and Marketing Campaign Type**

These are the corresponding coefficients of each independent variable tested.

A low p-value indicates the independent variable has a significant impact on the dependent variable.
SELECT DISTINCT mc.marketCamID, (mc.endDate-mc.startDate) AS duration, mc.campaignID AS Campaign_Type, mc.numberOfEmployeesNeeded AS Employee_Count, mc.budget AS budget, target.IndustryTypeID AS industry_Type, (0.0048*(mc.endDate-mc.startDate) + 0.0034*mc.numberOfEmployeesNeeded+(0.0972) + (IIf(target.industryTypeID=1001,0.116, IIf(target.industryTypeID=1002,0.0044, IIf(target.industryTypeID=1003,-0.0158, IIf(target.industryTypeID=1004, 0.0221, IIf(target.industryTypeID=1005,-0.0041 ,IIf(target.industryTypeID=1006,0.275, IIf(target.industryTypeID=1007,0.031, IIf(target.industryTypeID=1008,-0.0352,IIf(target.industryTypeID=1009,0.0388, IIf(mc.campaignID=7001,0.0288, IIf(mc.campaignID=7002,0.0063, IIf(mc.campaignID=7003,0.0126, IIf(mc.campaignID=7004,-0.007,0)))))))))))))) AS Success FROM MARKETING_CAMPAIGN AS mc, MC_TARGET_INDUSTRY_TYPE AS target WHERE (((mc.marketCamID)=[target].[marketCamID]));
Every time Achiever’s adds a new marketing campaign, they can pull up its record and success inputs. They can then compare the success of the new campaign to all past campaigns to gauge its effectiveness.
Query 4 Benefits

- Defines a metric to determine the success of a marketing campaign and compare amongst years of past campaigns.
- Allows Achiever’s to see which factors impact the success of a campaign and to what degree.
- Achiever’s can plan how to maximize the success of new campaigns.
Q5: Marketing Employee Scheduling

How can Achievers quickly and automatically schedule their employees in less than one minute?
- Pull the marketing project need to be done in the next week or next month
- Pull the employee SSN and their capacity
- Query the specialty weight of each employee for each marketing project

SQL Code

- Query out the list of marketing project and employee schedule

SQL

- Read the data from MS Access query tables
- Schedule employee to work for each marketing project such that the total specialty weight is maximize
- Create a result table in MS Access Database

AMPL

Mixed Integer Linear Programming
Transportation Problem

Concepts
### Q5: Marketing Employee Scheduling

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Q5: Marketing Employee Scheduling

AMPL Result

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Report

Schedule

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<td>Hall</td>
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<tr>
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<td>Foster</td>
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<td>Pastrana</td>
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<td>Badu</td>
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<tr>
<td>70250000000KwR8</td>
<td>Toni</td>
<td>Hawk</td>
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</table>
**AMPL Code**

```AMPL
p.mod
set marketCamID;
set SSN;

param weight {i in SSN, j in marketCamID};

param Capacity {i in SSN}; #each employee can work up to certain #amount of project a week
param numberOfEmployeesNeeded {j in marketCamID}; # number of worker needed for each marketing project

var x {i in SSN, j in marketCamID} binary;

maximize utility: sum{i in SSN, j in marketCamID} (x[i,-j]*weight[i,j]); #we want to maximize the specialty of each employee toward a type of #marketing subject to worker_requiredment{j in marketCamID}:
   sum{i in SSN} x[i,j] = numberOfEmployeesNeeded[j];
#each project required a certain amount of employees subject to availability{i in SSN}:
   sum{j in marketCamID} x[i,j] <= Capacity[i];

#each worker only can work at most i project a week
```

**AMPL Command**

```AMPL
Schedule.run

option solver cplex;
model p.mod;
table project 'ODBC' 'database.mdb' 'project': marketCamID <- {marketCamID}, numberOfEmployeesNeeded;
read table project;
table worker 'ODBC' 'database.mdb' 'worker': SSN <- {SSN}, Capacity;
read table worker;
table w 'ODBC' 'database.mdb' 'specialty': {SSN, marketCamID}, weight;
read table w;
solve;
table result 'ODBC' 'database.mdb' 'result': {SSN, marketCamID}, x;
write table result;
reset;
```
Query 5 SQL

Pull the marketing project need to be done in the next week or next month:

```sql
SELECT marketCamID, Webinar, Social, Inbound, Event, numberOfEmployeesNeeded
FROM MARKETING_CAMPAIGN
WHERE (((startDate)>=#1/1/2015#) AND ((endDate)<=#3/1/2015#));
```

Pull the employee SSN and their capacity

```sql
SELECT SSN, Webinar, Social, Inbound, Event, Capacity
FROM MARKETING_EMPLOYEE;
```

Query the specialty weight of each employee for each marketing project

```sql
FROM project as p, worker as w;
```

Query out the list of marketing project and employee (by name) schedule:

```sql
SELECT p.firstName, p.lastName, r.marketCamID
FROM PERSON AS p, result AS r, EMPLOYEE AS e
WHERE r.x = 1 and r.SSN = e.SSN and e.email = p.email
```
Save money by not paying someone to schedule Achiever’s employees.

Save time that would be used to schedule other employees.

Managers can easily employees with the press of a button.
Normalization
Normalization - 1NF

Before:
Outside_Company (companyID, industryTypeID, companyName, headQuarter, Number_Of_Employees, numberBranch, branchLocation, annualRevenue, industryTypes)

This would violate 1NF because industryTypes is a multi-attribute.

After (Fixed):
Outside_Company (companyID, industryTypeID, companyName, headQuarter, Number_Of_Employees, numberBranch, branchLocation, annualRevenue)

O_Company_Is_of_Type_Industry_Type (industryTypeID, companyID)
Normalization - 2NF

Before:
Potential_Client(potentialID, companyID, potential_email, companyName)

This would violate 2NF because companyName can be determined by companyID alone. It can therefore be split into 3 relations.

After (Fixed):
Potential_Client(potentialID, potential_email)
Outside_Company(companyID, companyName)
Potential_Client_Works_For_O_Company (potentialID, companyID)
Normalization - 3NF

Before:
Contract (contractID, activeID, allowableUsers, customizedPlatformID, maxUsers)

This violate 3NF because customizedPlatformID can determine maxUsers.

After (Fixed):
Contract (contractID, activeID, allowableUsers, customizedPlatformID, maxUsers)

Customized_Platform (customizedPlatformID, maxUsers)
Before:

Employee_Works_With_Client (SSN, clientID, clientCompanyID, companyName, date)

This violate 3NF because clientCompanyID can determine companyName.

After (Fixed):

Contract (contractID, activeID, allowableUsers, customizedPlatformID, maxUsers)

Customized_Platform (customizedPlatformID, maxUsers)
Normalization - BCNF

Before:
Sales_Rep_Initiate_With_Potential_Client (potentialID, SSN, dateInitiated, dueDate)

This violates BCNF because dueDate can determine dateInitiated but not potentialID and SSN.

After (Could Fix):
Sales_Rep_Initiate_With_Potential_Client (potentialID, SSN, dueDate)
Potential_Client (potentialID, dateInitiated)
Thank You