Clinical Trial Database Management System

SQL Implementation

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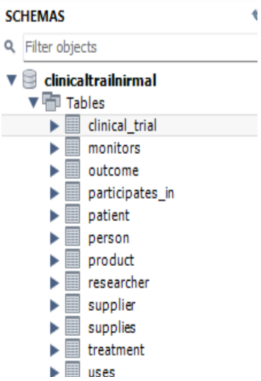
Implementation of Relation Model in MySQL:

MySQL Implementation:

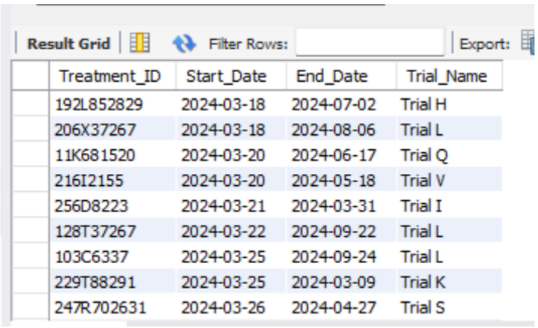
A database name **“clinicaltrialnirmal”** was created in MySQL and the following queries were performed:



```
clinicaltrailnirmal
  Tables
    clinical_trial
    monitors
    outcome
    participates_in
    patient
    person
    product
    researcher
    supplier
    supplies
    treatment
    uses
```

1. **Simple Query: Retrieve Treatments with Start Dates after March 1, 2024, Including Trial Names.**

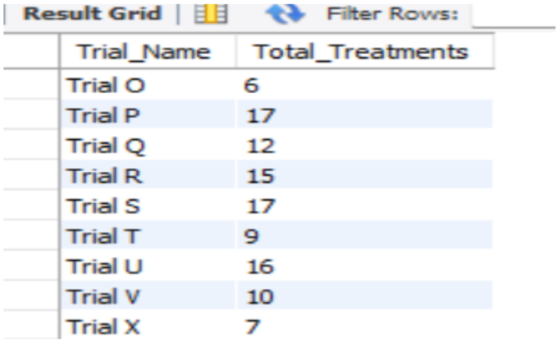
```
SELECT T.Treatment_ID, T.Start_Date, T.End_Date, CT.Trial_Name
FROM TREATMENT T
JOIN CLINICAL_TRIAL CT ON T.Trial_ID = CT.Trial_ID
WHERE T.Start_Date > '2024-03-01'
ORDER BY T.Start_Date ASC;
```



Treatment_ID	Start_Date	End_Date	Trial_Name
192L852829	2024-03-18	2024-07-02	Trial H
206X37267	2024-03-18	2024-08-06	Trial L
11K681520	2024-03-20	2024-06-17	Trial Q
216I2155	2024-03-20	2024-05-18	Trial V
256D8223	2024-03-21	2024-03-31	Trial I
128T37267	2024-03-22	2024-09-22	Trial L
103C6337	2024-03-25	2024-09-24	Trial L
229T88291	2024-03-25	2024-03-09	Trial K
247R702631	2024-03-26	2024-04-27	Trial S

2. **Aggregate Query 1: Count Total Treatments for Each Clinical Trial.**

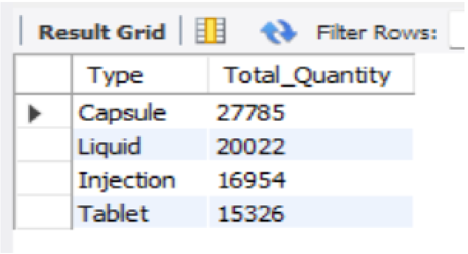
```
SELECT CT.Trial_Name, COUNT(T.Treatment_ID) AS Total_Treatments
FROM CLINICAL_TRIAL CT
JOIN TREATMENT T ON CT.Trial_ID = T.Trial_ID
GROUP BY CT.Trial_Name;
```



Trial_Name	Total_Treatments
Trial O	6
Trial P	17
Trial Q	12
Trial R	15
Trial S	17
Trial T	9
Trial U	16
Trial V	10
Trial X	7

3. **Aggregate Query 2: Calculate Total Quantity of Each Product Type Used.**

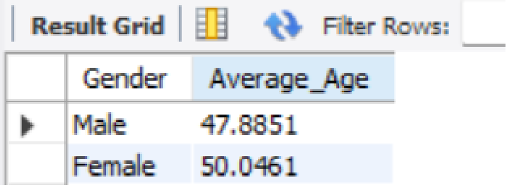
```
SELECT PR.Type, SUM(PR.Quantity) AS Total_Quantity
FROM PRODUCT PR
JOIN USES U ON PR.Product_ID = U.Product_ID
GROUP BY PR.Type;
```



Type	Total_Quantity
Capsule	27785
Liquid	20022
Injection	16954
Tablet	15326

4. Aggregate Query 3: Find the Average Age of Patients by Gender.

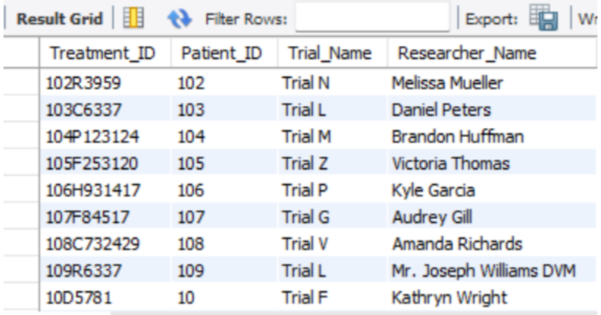
```
SELECT P.Gender, AVG(P.Age) AS Average_Age
FROM PATIENT PT
JOIN PERSON P ON PT.Patient_ID = P.Person_ID
JOIN PARTICIPATES_IN PI ON PT.Patient_ID = PI.Patient_ID
GROUP BY P.Gender;
```



Gender	Average_Age
Male	47.8851
Female	50.0461

5. Inner Join Query: Retrieve the details of treatments, including Treatment_ID, Patient_ID, Trial_Name, and the Researcher monitoring the outcomes.

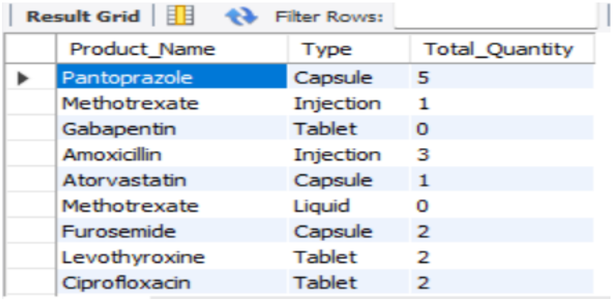
```
SELECT T.Treatment_ID, T.Patient_ID, CT.Trial_Name,
P.Name AS Researcher_Name
FROM TREATMENT T
JOIN CLINICAL_TRIAL CT ON T.Trial_ID = CT.Trial_ID
JOIN OUTCOME O ON T.Treatment_ID = O.Treatment_ID
JOIN MONITORS M ON O.Outcome_ID = M.Outcome_ID
JOIN RESEARCHER R ON M.Researcher_ID = R.Researcher_ID
JOIN PERSON P ON R.Researcher_ID = P.Person_ID;
```



Treatment_ID	Patient_ID	Trial_Name	Researcher_Name
102R3959	102	Trial N	Melissa Mueller
103C6337	103	Trial L	Daniel Peters
104P123124	104	Trial M	Brandon Huffman
105F253120	105	Trial Z	Victoria Thomas
106H931417	106	Trial P	Kyle Garcia
107F84517	107	Trial G	Audrey Gill
108C732429	108	Trial V	Amanda Richards
109R6337	109	Trial L	Mr. Joseph Williams DVM
10D5781	10	Trial F	Kathryn Wright

6. Outer Joint Query: Retrieve Product_Name, Type, and Total_Quantity used in treatments, including products that have not been used in any treatments.

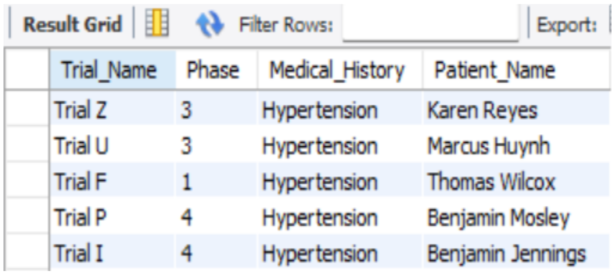
```
SELECT PR.Name AS Product_Name, PR.Type,
SUM(U.Product_ID IS NOT NULL) AS Total_Quantity
FROM PRODUCT PR
LEFT JOIN USES U ON PR.Product_ID = U.Product_ID
GROUP BY PR.Product_ID;
```



Product_Name	Type	Total_Quantity
Pantoprazole	Capsule	5
Methotrexate	Injection	1
Gabapentin	Tablet	0
Amoxicillin	Injection	3
Atorvastatin	Capsule	1
Methotrexate	Liquid	0
Furosemide	Capsule	2
Levothyroxine	Tablet	2
Ciprofloxacin	Tablet	2

7. Nested Query 1: Retrieve Trial_name, Phase, and Patients with Hypertension as Medical History.

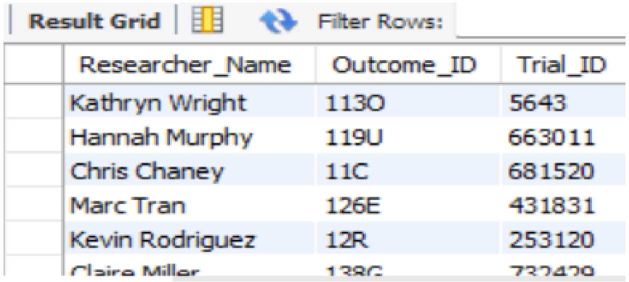
```
SELECT DISTINCT CT.Trial_Name, CT.Phase, PT.Medical_History, P.Name AS Patient_Name
FROM CLINICAL_TRIAL CT
JOIN PARTICIPATES_IN PI ON CT.Trial_ID = PI.Trial_ID
JOIN PATIENT PT ON PI.Patient_ID = PT.Patient_ID
JOIN PERSON P ON PT.Patient_ID = P.Person_ID
WHERE PT.Medical_History = 'Hypertension';
```



Trial_Name	Phase	Medical_History	Patient_Name
Trial Z	3	Hypertension	Karen Reyes
Trial U	3	Hypertension	Marcus Huynh
Trial F	1	Hypertension	Thomas Wilcox
Trial P	4	Hypertension	Benjamin Mosley
Trial I	4	Hypertension	Benjamin Jennings

8. Nested Query 2: Retrieve Researchers who had Monitored Positive Outcomes in Clinical Trials.

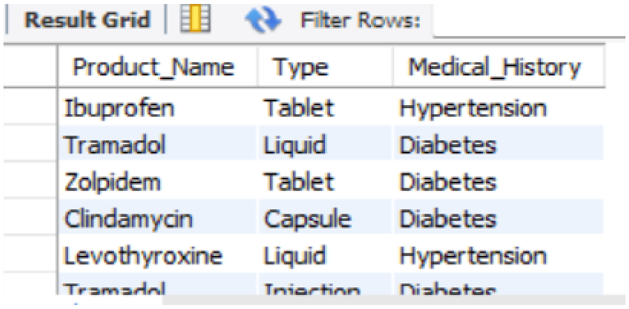
```
SELECT DISTINCT P.Name AS Researcher_Name,
O.Outcome_ID, CT.Trial_ID
FROM RESEARCHER R
JOIN PERSON P ON R.Researcher_ID = P.Person_ID
JOIN MONITORS M ON R.Researcher_ID = M.Researcher_ID
JOIN OUTCOME O ON M.Outcome_ID = O.Outcome_ID
JOIN TREATMENT T ON O.Treatment_ID = T.Treatment_ID
JOIN CLINICAL_TRIAL CT ON T.Trial_ID = CT.Trial_ID
WHERE O.Result = 'Positive';
```



Researcher_Name	Outcome_ID	Trial_ID
Kathryn Wright	113O	5643
Hannah Murphy	119U	663011
Chris Chaney	11C	681520
Marc Tran	126E	431831
Kevin Rodriguez	12R	253120
Claire Miller	138G	732429

9. Correlated Query 1: Retrieve list of Product name and Type used in Treatments for Patients with Hypertension or Diabetes.

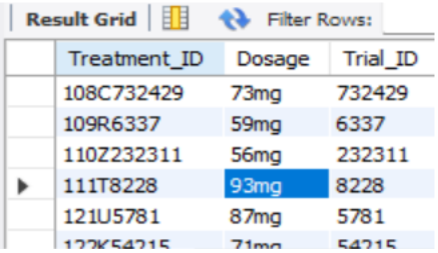
```
SELECT DISTINCT PR.Name AS Product_Name, PR.Type,
PT.Medical_History
FROM PRODUCT PR
JOIN USES U ON PR.Product_ID = U.Product_ID
JOIN TREATMENT T ON U.Treatment_ID = T.Treatment_ID
JOIN PATIENT PT ON T.Patient_ID = PT.Patient_ID
WHERE PT.Medical_History IN ('Hypertension', 'Diabetes');
```



Product_Name	Type	Medical_History
Ibuprofen	Tablet	Hypertension
Tramadol	Liquid	Diabetes
Zolpidem	Tablet	Diabetes
Clindamycin	Capsule	Diabetes
Levothyroxine	Liquid	Hypertension
Tramadol	Injection	Diabetes

10. Correlated Query 2: Retrieve Treatment_ID with Dosages above the Average Dosage per trial.

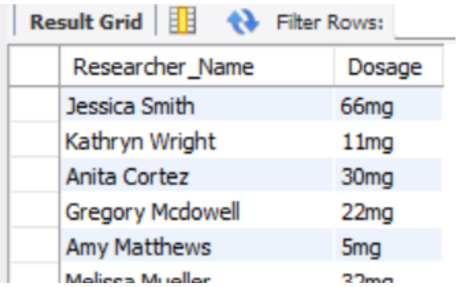
```
SELECT T.Treatment_ID, T.Dosage, T.Trial_ID
FROM TREATMENT T
WHERE CAST(SUBSTRING_INDEX(T.Dosage, 'mg', 1) AS UNSIGNED) >
    (SELECT AVG(CAST(SUBSTRING_INDEX(Dosage, 'mg', 1) AS UNSIGNED))
     FROM TREATMENT
     WHERE Trial_ID = T.Trial_ID);
```



Treatment_ID	Dosage	Trial_ID
108C732429	73mg	732429
109R6337	59mg	6337
110Z232311	56mg	232311
111T8228	93mg	8228
121U5781	87mg	5781
122K54215	71mg	54215

11. >=ALL / >ANY Query : Retrieve the names of researchers who are monitoring outcomes for treatments with a dosage greater than any treatment in "Phase 3" trials.

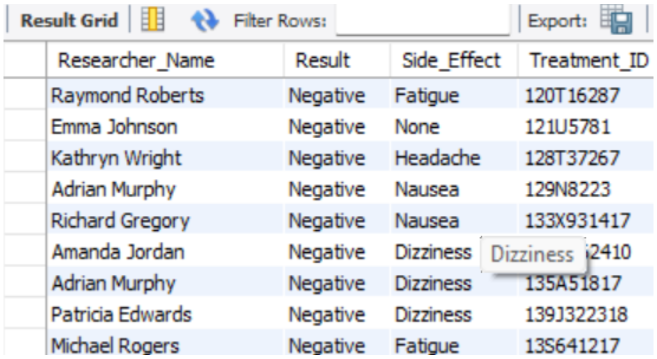
```
SELECT DISTINCT P.Name AS Researcher_Name, T.Dosage
FROM RESEARCHER R
JOIN PERSON P ON R.Researcher_ID = P.Person_ID  -- Adjusted join to use
Researcher_ID and Person_ID
JOIN MONITORS M ON R.Researcher_ID = M.Researcher_ID
JOIN OUTCOME O ON M.Outcome_ID = O.Outcome_ID
JOIN TREATMENT T ON O.Treatment_ID = T.Treatment_ID
WHERE CAST(SUBSTRING_INDEX(T.Dosage, 'mg', 1) AS UNSIGNED) > ANY
(
   SELECT CAST(SUBSTRING_INDEX(T2.Dosage, 'mg', 1) AS UNSIGNED)
   FROM TREATMENT T2
   JOIN CLINICAL_TRIAL CT ON T2.Trial_ID = CT.Trial_ID
   WHERE CT.Phase = 3 );
```



Researcher_Name	Dosage
Jessica Smith	66mg
Kathryn Wright	11mg
Anita Cortez	30mg
Gregory Mcdowell	22mg
Amy Matthews	5mg
Melissa Mueller	32mg

12. Exists Query: Retrieve all researchers who have monitored outcomes associated with treatments with "Negative" results.

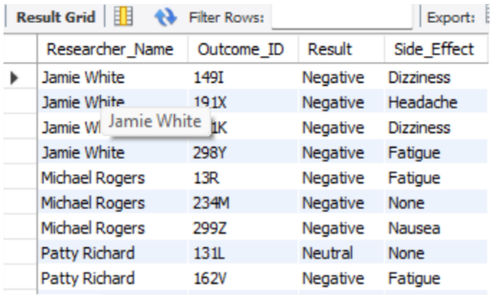
```
SELECT DISTINCT P.Name AS Researcher_Name, O.Result,
O.Side_Effect, T.Treatment_ID
FROM RESEARCHER R
JOIN PERSON P ON R.Researcher_ID = P.Person_ID
JOIN MONITORS M ON R.Researcher_ID = M.Researcher_ID
JOIN OUTCOME O ON M.Outcome_ID = O.Outcome_ID
JOIN TREATMENT T ON O.Treatment_ID = T.Treatment_ID
WHERE O.Result = 'Negative';
);
```



Researcher_Name	Result	Side_Effect	Treatment_ID
Raymond Roberts	Negative	Fatigue	120T16287
Emma Johnson	Negative	None	121U5781
Kathryn Wright	Negative	Headache	128T37267
Adrian Murphy	Negative	Nausea	129N8223
Richard Gregory	Negative	Nausea	133X931417
Amanda Jordan	Negative	Dizziness	2410
Adrian Murphy	Negative	Dizziness	135A51817
Patricia Edwards	Negative	Dizziness	139J322318
Michael Rogers	Negative	Fatigue	13S641217

13. Non- Exists Query: Retrieve all the researchers monitoring outcomes without any “positive” results.

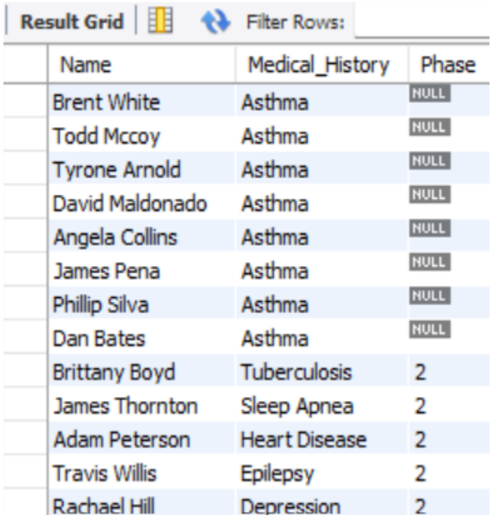
```
SELECT DISTINCT P.Name AS Researcher_Name, O.Outcome_ID, O.Result,
O.Side_Effect
FROM RESEARCHER R
JOIN PERSON P ON R.Researcher_ID = P.Person_ID
JOIN MONITORS M ON R.Researcher_ID = M.Researcher_ID
JOIN OUTCOME O ON M.Outcome_ID = O.Outcome_ID
WHERE NOT EXISTS (
   SELECT 1
   FROM OUTCOME O2
   JOIN MONITORS M2 ON O2.Outcome_ID = M2.Outcome_ID
   WHERE M2.Researcher_ID = R.Researcher_ID AND O2.Result = 'Positive'
);
```



Researcher_Name	Outcome_ID	Result	Side_Effect
Jamie White	149I	Negative	Dizziness
Jamie White	191X	Negative	Headache
Jamie White	1K	Negative	Dizziness
Jamie White	298Y	Negative	Fatigue
Michael Rogers	13R	Negative	Fatigue
Michael Rogers	234M	Negative	None
Michael Rogers	299Z	Negative	Nausea
Patty Richard	131L	Neutral	None
Patty Richard	162V	Negative	Fatigue

14. Set Operations (Union) Query 2: Retrieve the names of patients who have a medical history of "Asthma" or have participated in a "Phase 2" clinical trial.

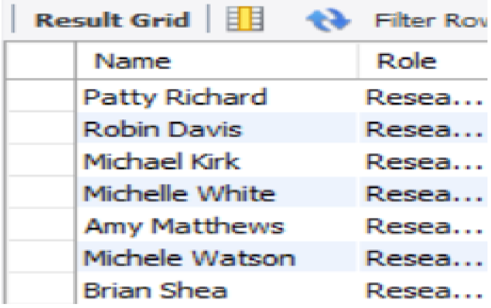
```
SELECT P.Name, PT.Medical_History, NULL AS Phase
FROM PERSON P
JOIN PATIENT PT ON P.Person_ID = PT.Patient_ID  -- Adjusted join to use
Patient_ID in PATIENT
WHERE PT.Medical_History = 'Asthma'

UNION

SELECT P.Name, PT.Medical_History, CT.Phase
FROM PERSON P
JOIN PATIENT PT ON P.Person_ID = PT.Patient_ID  -- Adjusted join to use
Patient_ID in PATIENT
JOIN PARTICIPATES_IN PI ON PT.Patient_ID = PI.Patient_ID
JOIN CLINICAL_TRIAL CT ON PI.Trial_ID = CT.Trial_ID
WHERE CT.Phase = 2;
```



Name	Medical_History	Phase
Brent White	Asthma	NULL
Todd Mccoy	Asthma	NULL
Tyrone Arnold	Asthma	NULL
David Maldonado	Asthma	NULL
Angela Collins	Asthma	NULL
James Pena	Asthma	NULL
Phillip Silva	Asthma	NULL
Dan Bates	Asthma	NULL
Brittany Boyd	Tuberculosis	2
James Thornton	Sleep Apnea	2
Adam Peterson	Heart Disease	2
Travis Willis	Epilepsy	2
Rachael Hill	Depression	2

15. Set Operations (Union) Query: Retrieve the names of people who are either patients or researchers.

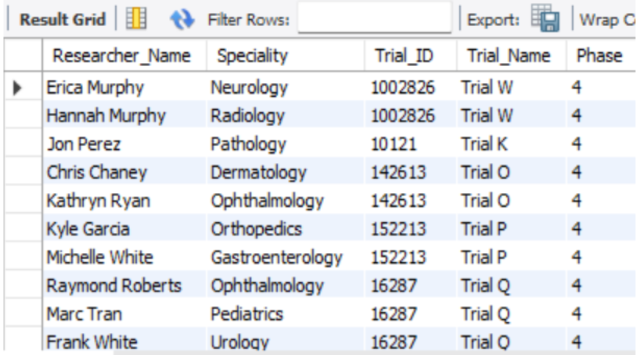
```
SELECT P.Name, 'Patient' AS Role
FROM PERSON P
JOIN PATIENT PT ON P.Person_ID = PT.Patient_ID

UNION

SELECT P.Name, 'Researcher' AS Role
FROM PERSON P
JOIN RESEARCHER R ON P.Person_ID = R.Researcher_ID;
```



Name	Role
Patty Richard	Resea...
Robin Davis	Resea...
Michael Kirk	Resea...
Michelle White	Resea...
Amy Matthews	Resea...
Michele Watson	Resea...
Brian Shea	Resea...

16. Subquery: Find all researchers who are monitoring outcomes from the trial with the maximum phase.

```
SELECT DISTINCT P.Name AS Researcher_Name, R.Speciality,
CT.Trial_ID, CT.Trial_Name, CT.Phase
FROM RESEARCHER R
JOIN PERSON P ON R.Researcher_ID = P.Person_ID
JOIN MONITORS M ON R.Researcher_ID = M.Researcher_ID
JOIN OUTCOME O ON M.Outcome_ID = O.Outcome_ID
JOIN TREATMENT T ON O.Treatment_ID = T.Treatment_ID
JOIN CLINICAL_TRIAL CT ON T.Trial_ID = CT.Trial_ID
WHERE CT.Phase = (SELECT MAX(Phase) FROM
CLINICAL_TRIAL);
```



Researcher_Name	Speciality	Trial_ID	Trial_Name	Phase
Erica Murphy	Neurology	1002826	Trial W	4
Hannah Murphy	Radiology	1002826	Trial W	4
Jon Perez	Pathology	10121	Trial K	4
Chris Chaney	Dermatology	142613	Trial O	4
Kathryn Ryan	Ophthalmology	142613	Trial O	4
Kyle Garcia	Orthopedics	152213	Trial P	4
Michelle White	Gastroenterology	152213	Trial P	4
Raymond Roberts	Ophthalmology	16287	Trial Q	4
Marc Tran	Pediatrics	16287	Trial Q	4
Frank White	Urology	16287	Trial Q	4