NORTHEASTERN UNIVERSITY, BOSTON

DAMG6210 Data Mgt and Database Design

University Recommendation System

https://github.com/Muskansri1/University_Recommendation_System

SUBMITTED BY:-

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Sameer Nimse	002752914

ABOUT THE PROJECT:

The opportunity to study in the US has been a dream for many international students. More than 1 million foreign students apply to graduate school for higher studies in the US. Multiple factors such as the tuition fees, university ranking, courses available, return on investment, etc. play a huge role in the final selection of a university,

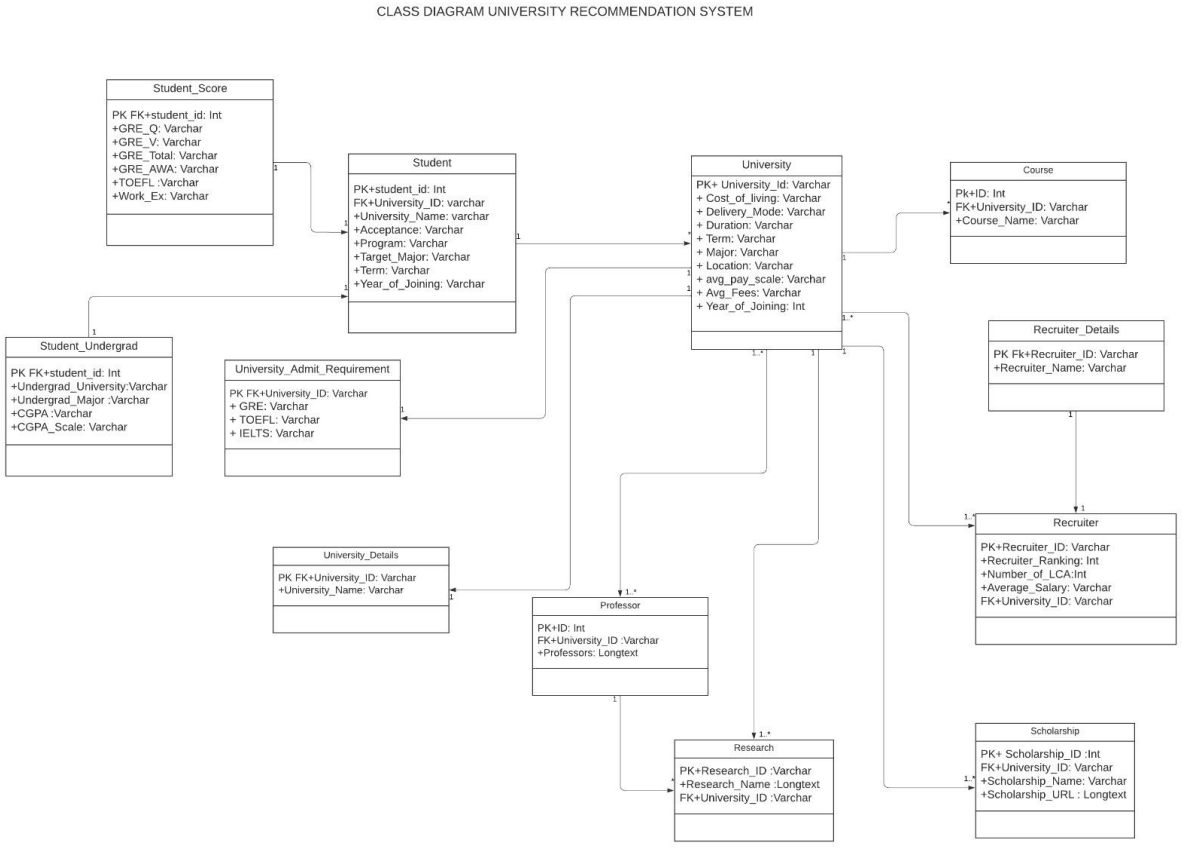
The abundance of information and lack of credible data on the internet often leaves ambitious students in a dilemma. They are often left confused about the major they want to get in or the professor they are interested in, or even their chances of getting into the university.

In this project, we aim to build a university recommendation system that would act as a one-stop platform for students to aid them in their university shortlisting process.

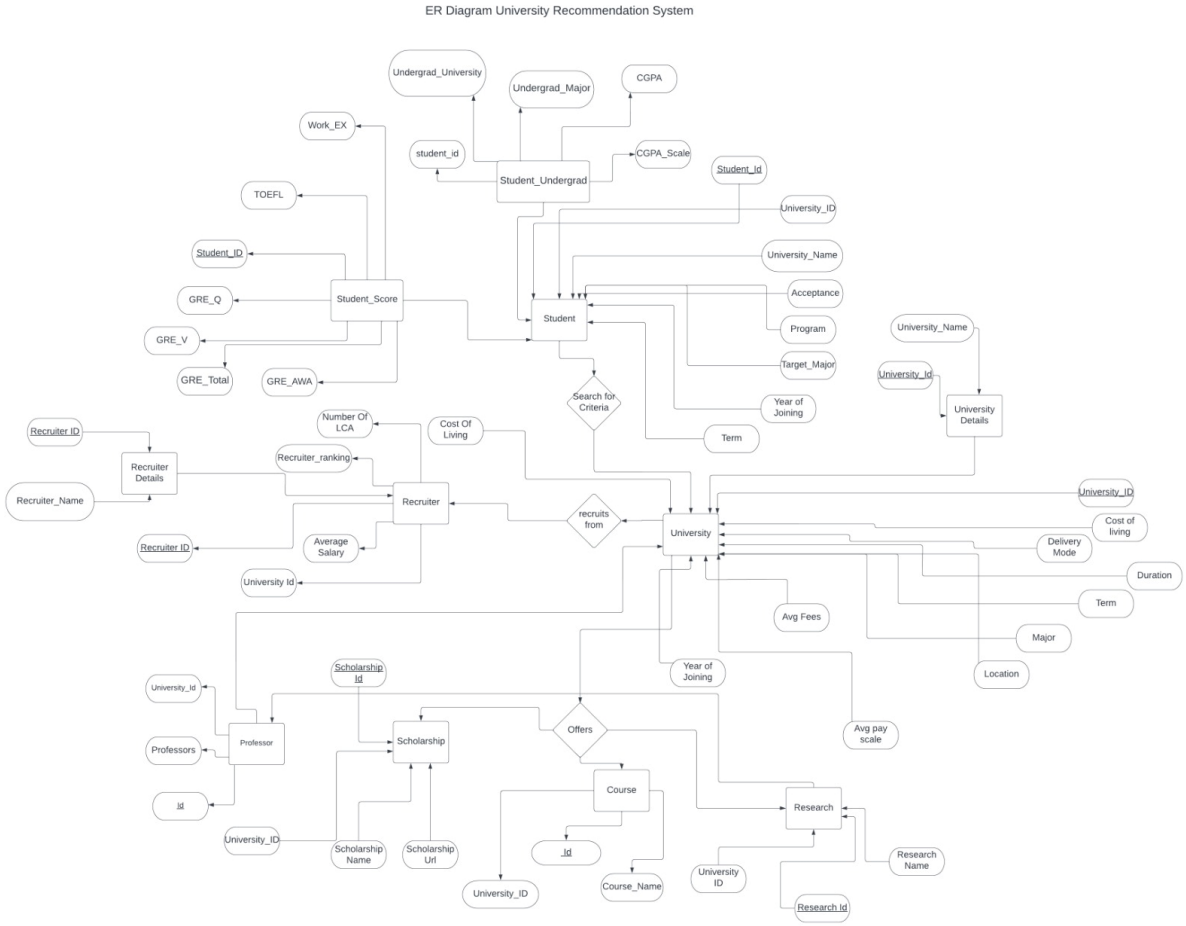
The application/website would feature data from data sources like Yocket, USnews, Admits.fyi, Edulix, timeshighereducation etc. We would scrap the mentioned data from the university websites. The data collected would be cleaned and fed into the database which would be standardized so that the potential students could do their research. The students could have an overview of the entire course curriculum, professors who would be taking a particular course at the university, and university ranking.

We also aim to include a prediction system in the application to let the potential students predict their chances of getting into the university based on their GRE, TOEFL, Undergrad GPA, work experience, etc.

CLASS DIAGRAM:



ER DIAGRAM


ER Diagram University Recommendation System
Undergrad_University
Undergrad_Major
CGPA
Work_EX
student_id
CGPA_Scale
Student_Undergrad
Student_Id
TOEFL
University_ID
Student_ID
University_Name
GRE_Q
Student_Score
Acceptance
Student
Program
GRE_V
University_Name
Target_Major
University_Id
GRE_Total
GRE_AWA
Search for Criteria
Year of Joining
University Details
Recruiter ID
Number Of LCA
Cost Of Living
Term
Recruiter Details
Recruiter_ranking
Recruiter_Name
Recruiter
recruits from
University
University_ID
Cost of living
Delivery Mode
Recruiter ID
Average Salary
Duration
University Id
Term
Avg Fees
Major
Scholarship Id
Year of Joining
Location
University_Id
Professor
Scholarship
Offers
Avg pay scale
Professors
Course
Research
Id
University_ID
Scholarship Name
Scholarship Url
Id
Research Name
University_ID
Course_Name
University ID
Research Id

DATASET SELECTION:

The following kinds of data have been sourced from the internet via various scrapping methods:

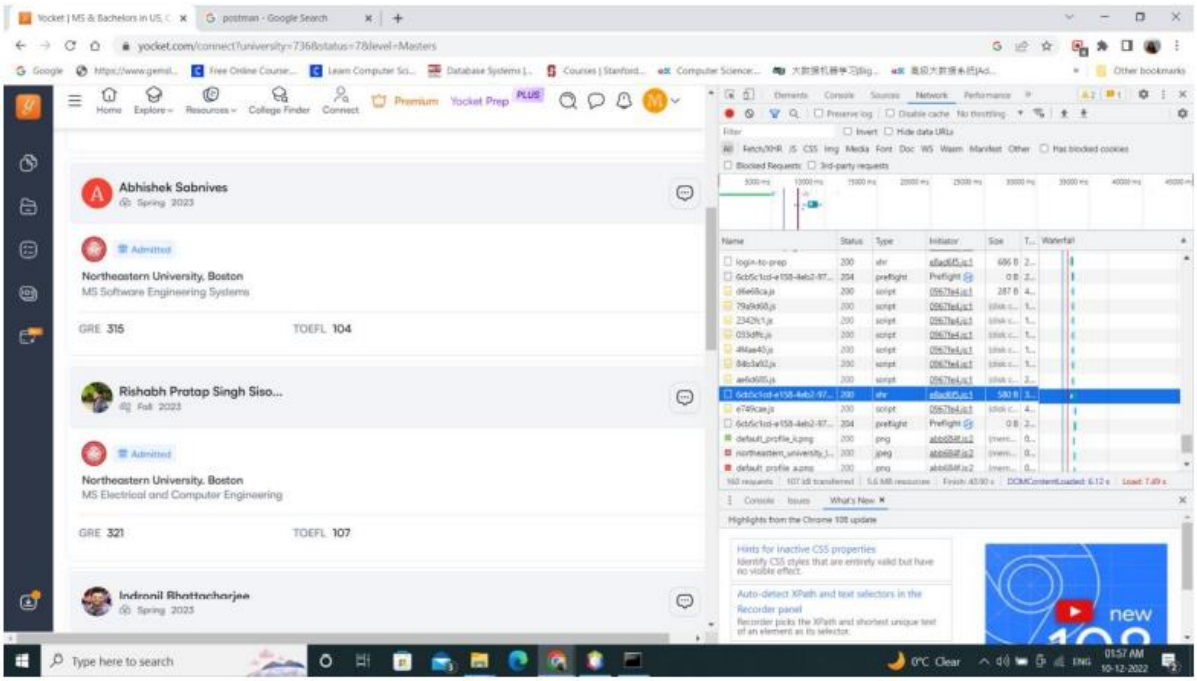
1. University Information:
    a. University Name
    b. Expected (Avg) Pay Scale post-graduation
    c. Delivery Mode for the course: Online/On-Campus
    d. Duration of the course
    e. Term: Fall/Spring/Summer/Winter
    f. Year of Joining
    g. Major
    h. Location of the University
    i. Cost of Living
    j. Average Fees of the University
    k. Expected GRE Score of University for Admission
    l. Expected TOEFL Score of the University for Admission
    m. Expected IELTS Score of the University for Admission
2. Student Information: This information would provide us with information of the past admitted students so that we can build an information system to predict results.
    a. Target University Name
    b. Acceptance Status
    c. Program Applied to : MS/Mtech/..
    d. Target Major
    e. Term applied in
    f. Year of Joining
    g. Following scores of the applicant
        i. GRE_Q
        ii. GRE_V
        iii. GRE_Total
        iv. GRE_AWA
        v. TOEFL Scores
    h. Following information about the undergrad colleges/course
        i. Undergrad University
        ii. Undergrad Major
        iii. CGPA
        iv. CGPA Scale Evaluation
    i. Work Experience
3. Scholarship Available in a University:
    a. Scholarship Name
    b. Scholarship URL
    c. University Name which provides the Scholarship

4. Research Opportunities available in the university:
    a. Research Name
    b. University Name
5. Recruitment Details: The purpose of this information is to have an estimate of the ROI a student would potentially get post the completion of the course. This table would feature details of the recruiters, their rankings, average package offered to the students and the university it hires maximum from
    a. Recruiter Name
    b. Recruiter Ranking
    c. Number of LCA
    d. Average Salary offered
    e. University the recruiter hires maximum from
6. Professor teaching in the University:
    a. University Name
    b. Professor Name
7. Courses available in the University:
    a. Course Available
    b. University Name

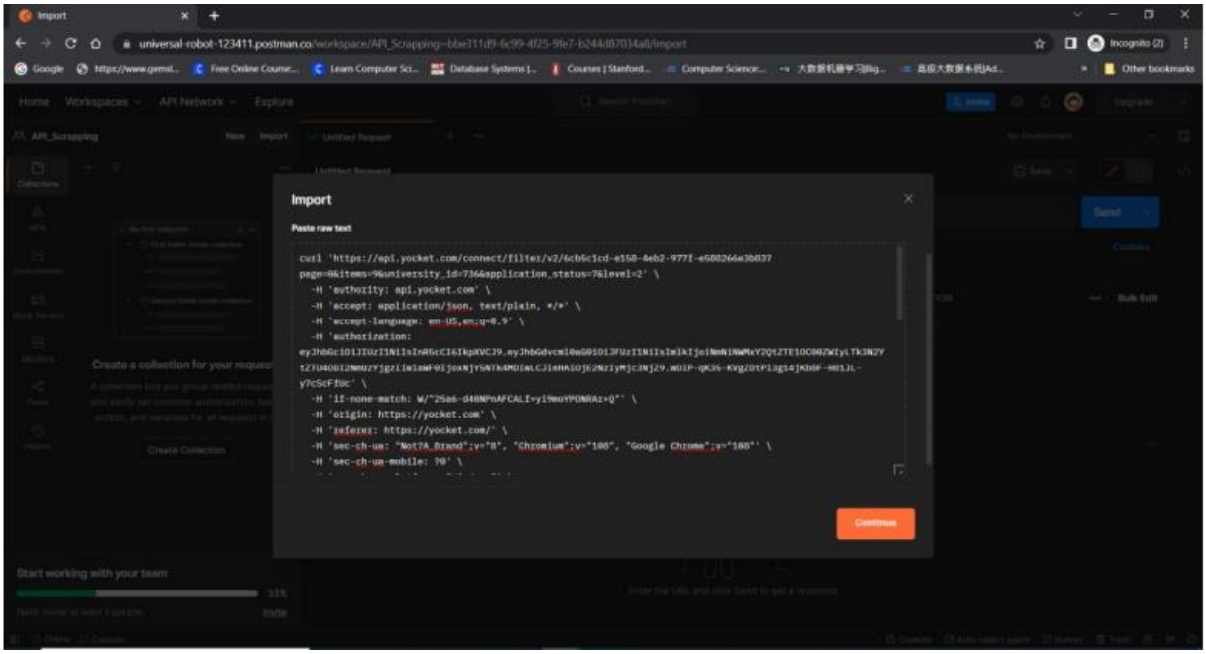
The methods used to scrape the data:

All the data scrapped and fetched are real-time and dynamic. We have also imported data from Kaggle which was scrapped from Edulix.com as its original source.

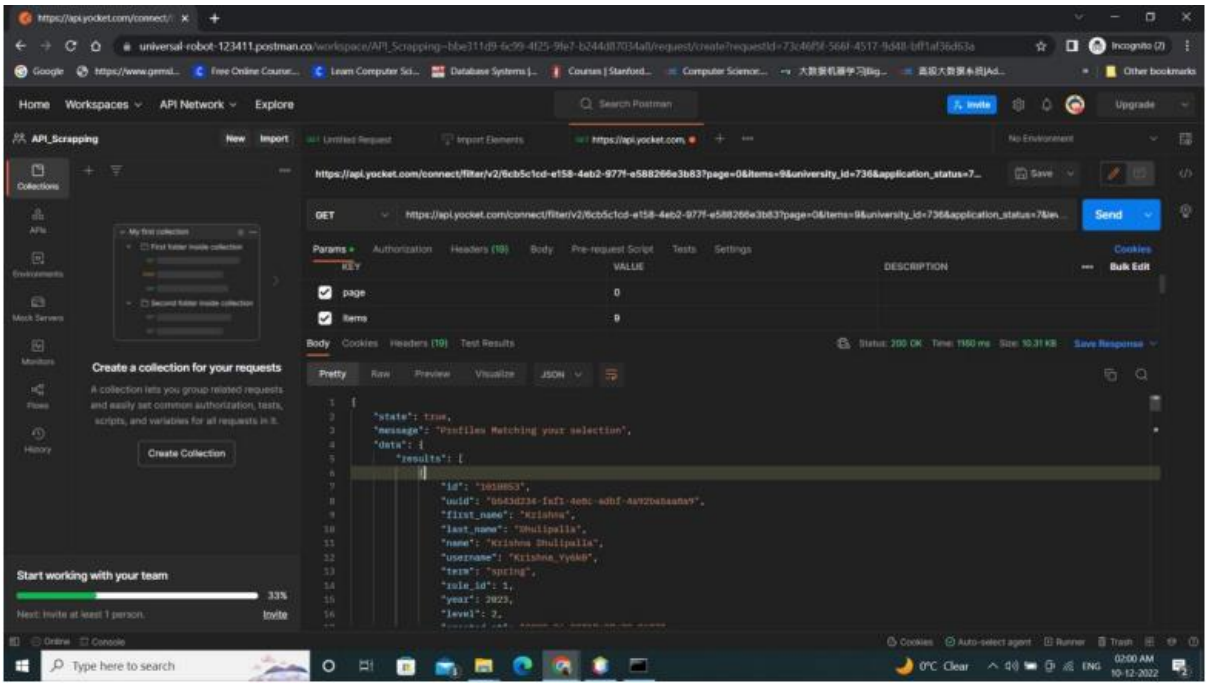
1. Scrapping through APIs:



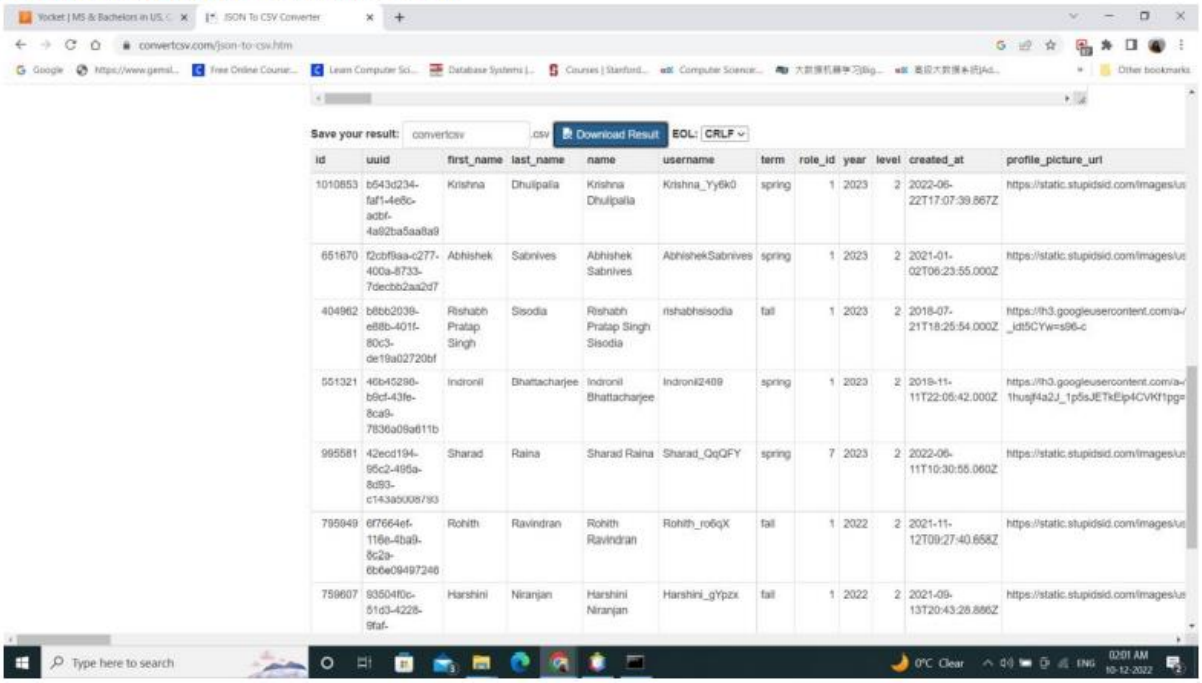
Finding the xhr type files for the API scrapping to import in Postman and send a get request.



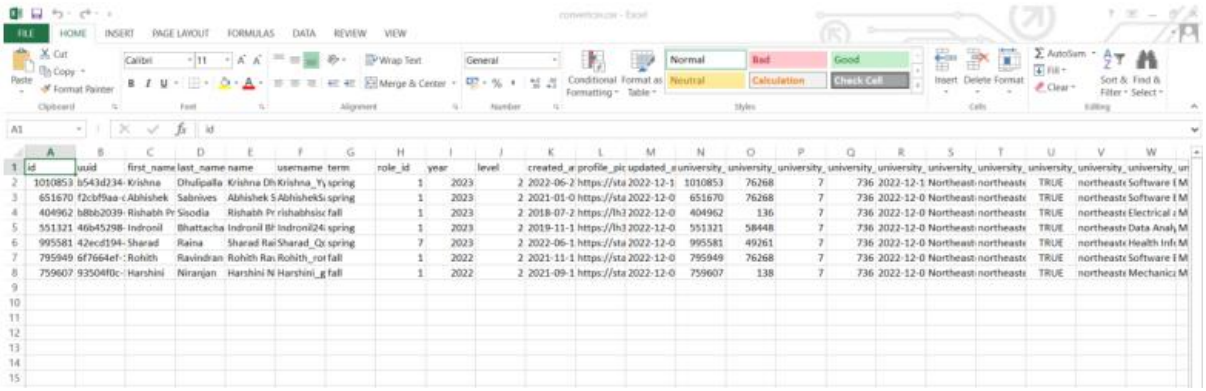
Importing the curl bash and fetching the results from Postman in JSON Format.



Converting from JSON to CSV.



Result:



2. Web Scrapping via Python:

In [ ]:
```
import pandas as pd
```

In [ ]:
```
df = pd.read_html("https://en.wikipedia.org/wiki/List_of_engineering_schools#United_States")
```

In [ ]:
```
df[6]
```

Out[ ]:

	State (city)[13]	University	School	Master's/doctoralprograms?
0	Alaska (Anchorage)	University of Alaska Anchorage	School of Engineering	Yes
1	Alaska (Fairbanks)	University of Alaska Fairbanks	College of Engineering and Mines	Yes
2	Alabama (Huntsville)	Alabama A&M University	College of Engineering, Technology, and Physic...	Yes
3	Alabama (Auburn)	Auburn University	Samuel Ginn College of Engineering	Yes
4	Alabama (Tuskegee)	Tuskegee University	College of Engineering	Yes
...	...	...	...	...
367	Wisconsin (Madison)	University of Wisconsin–Madison	College of Engineering	Yes
368	Wisconsin (Milwaukee)	University of Wisconsin–Milwaukee	College of Engineering and Applied Science	Yes
369	Wisconsin (Platteville)	University of Wisconsin–Platteville	NaN	NaN
370	Wisconsin (Menomonie)	University of Wisconsin–Stout	College of Science, Technology, Engineering an...	NaN
371	Wyoming (Laramie)	University of Wyoming	College of Engineering and Applied Science	Yes

372 rows × 4 columns

In [ ]:
```
df[6].to_excel('US_University.xlsx')
```

In [2]:
```
import pandas as pd
```

In [3]:
```
df = pd.read_html("https://www.myvisajobs.com/Reports/2022-H1B-Visa-Sponsor.aspx")
```

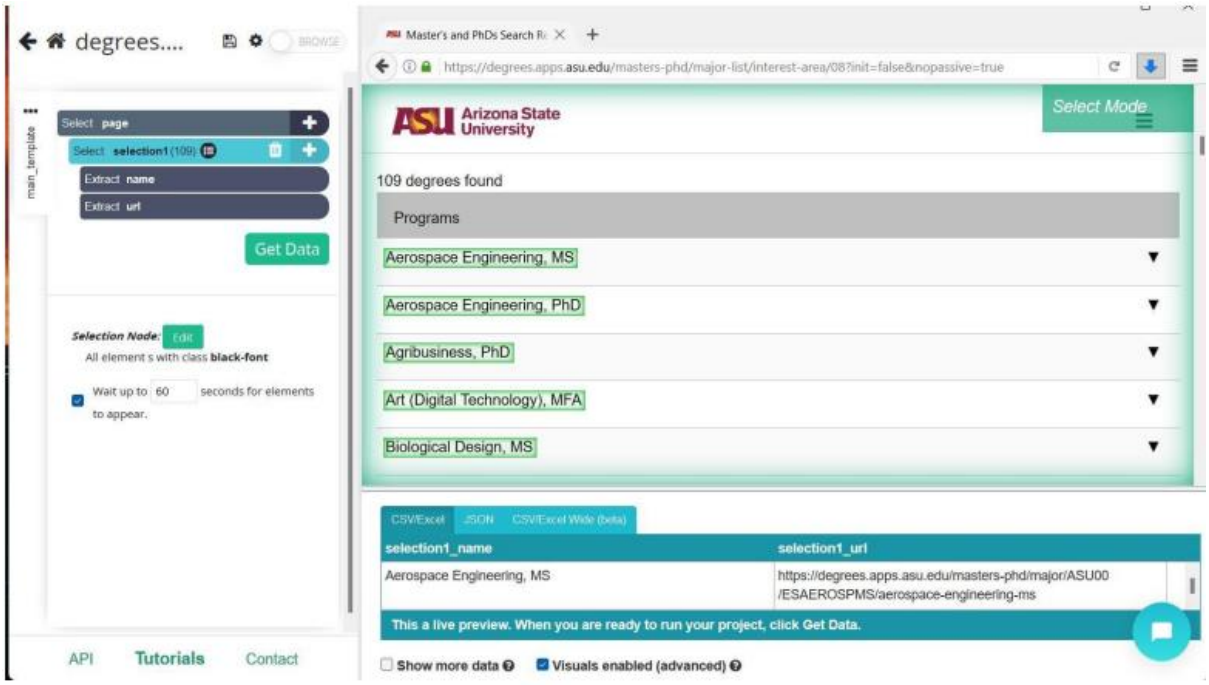
In [10]:
```
df[3]
```

Out[10]:

	0	1	2	3
0	Rank	H1B Visa Sponsor	Number of LCA *	Average Salary
1	1	Cognizant Technology Solutions	12681	$92,766
2	2	Amazon	11486	$126,163
3	3	Tata Consultancy Services	9822	$93,484
4	4	Google	9421	$156,793
5	5	Microsoft	7329	$146,569
6	6	Facebook	6090	$175,750
7	7	Ernst & Young	5797	$118,653
8	8	Infosys	5649	$92,689
9	9	Apple	4239	$168,416
10	10	Hcl America	4113	$99,754
11	11	Accenture	3830	$140,893
12	12	IBM	3800	$126,521

3. Scapping through tools like Parsehub:

Parsehub is free web scraping tool to turn any site into a spreadsheet or API:



4. Downloading the dataset from Kaggle: https://www.kaggle.com/datasets/nitishabharathi/university-recommendation

Context

For an aspiring graduate student, choosing which universities to apply to is a conundrum. Often, the students wonder if their profile is good enough for a certain university. This issue can be addressed by building a recommendation system based on various classification algorithms.

Content

Original.csv contains profiles of students with admits/rejects to 45 different universities in USA.
score.csv contains score conversion for GRE old to GRE new score mechanism.

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
major	researchEx	industryEx	toeflScore	program	departmen	greV	greQ	greA	termAndYe	ugCollege	cgpa	cgpaScale	univName	admit
Systems ar	0	18	112	MS	Instrumen	160	167	4.5	Fall - 2015	Dharamsin	8.5	10	Worcester	1
Manufactu	0	0		MS	0				Fall - 2013		0	0	Worcester	1
(MIS / MSI	0	66	94	MS	Computer	146	157	3	Fall - 2015	IET DAVV	78.28	100	Worcester	1
	0	0			0						0	0	Worcester	1
MIS	0	0	81	MS	computer	420	770	2.5	Fall - 2011	Pune Univ	57	100	Worcester	1
MIS	0	0	273	MS	CE	410	1010	600	Fall - 2006	Thadomal	52	100	Worcester	1
MIS	0	0	104	MS	Computer	150	161	4.5	Fall - 2015	University	62.2	100	Worcester	1
MIS-mana	0	0	95	MS	IT	147	156	3	Fall - 2012	MU	52	100	Worcester	1
MIS	0	0	101	MS	I.T	490	740	3	Fall - 2011	MU	64	100	Worcester	1
Computer	0	0	107	MS	Informatic	550	780	4.5	Fall - 2011	K J Somaiy	71.4	100	Worcester	1
MIS	0	0	94	MS	IT	420	680	3.5	Fall - 2012	RAIT	57.3	100	Worcester	1
Computer	0	0	99	MS	Electronic	490	780	3.5	Fall - 2011	RAIT	65	100	Worcester	1
Computer	0	0	99	MS	Electronic	490	780	3.5	Fall - 2011	Ramrao Ac	65	100	Worcester	1
Computer	0	0	99	MS	Electronic	490	780	3.5	Fall - 2011	Ramrao Ac	65	100	Worcester	1
MIS	0	0	91	MS	Computer	146	161	3	Fall - 2016	University	54.84	100	Worcester	1
(MIS / MSI	0	39	101	MS	CS	149	159	3	Fall - 2015	AITR RGPV	76.5	100	Worcester	1
Mechanica	0	0	96	MS	Mechanica	620	690	3	Spring - 20	University	70.5	100	Worcester	1
MIS	0	24	98	MS	Electronic	143	159	3	Fall - 2015	MU	55	100	Worcester	1
Computer	0	0	111	MS	Computer	156	159	3.5	Fall - 2014	RGPV	72.38	100	Worcester	1
Robotics	0	0	112	MS	Mechatror	154	161	3.5	Fall - 2014	SASTRA	7.8	10	Worcester	1

CREATING THE TABLES:

1. Pre-Normalization:
   The tables created before Normalization are as follows:

1. UNIVERSITY TABLE:

CREATE TABLE university(University_ID VARCHAR(255), University_Name VARCHAR(255), avg_pay_scale INT, Delivery_Mode VARCHAR(255), Duration VARCHAR(255), Term VARCHAR(255), Year_of_Joining INT, Major VARCHAR(255), Location VARCHAR(255), Cost_of_Living INT, GRE INT, TOEFL INT, IELTS FLOAT, PRIMARY KEY (University_ID));

```
In [14]: cursor.execute("describe university")
         for x in cursor:
             print(x)
```

```
('University_ID', 'varchar(255)', 'NO', 'PRI', None, '')
('University_Name', 'varchar(255)', 'YES', '', None, '')
('avg_pay_scale', 'varchar(255)', 'YES', '', None, '')
('Delivery_Mode', 'varchar(255)', 'YES', '', None, '')
('Duration', 'varchar(255)', 'YES', '', None, '')
('Term', 'varchar(255)', 'YES', '', None, '')
('Year_of_Joining', 'int', 'YES', '', None, '')
('Major', 'varchar(255)', 'YES', '', None, '')
('Location', 'varchar(255)', 'YES', '', None, '')
('Cost_of_Living', 'varchar(255)', 'YES', '', None, '')
('Avg_Fees', 'varchar(255)', 'YES', '', None, '')
('GRE', 'varchar(255)', 'YES', '', None, '')
('toefl', 'varchar(255)', 'YES', '', None, '')
('ielts', 'varchar(255)', 'YES', '', None, '')
```

```
In [19]: for i,row in University_df.iterrows():
             cursor.execute("INSERT INTO university values (%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s)", (int(row['University_ID']),row['U
         uni_recomm.commit()

         cursor.execute("SELECT * from university")
         records=cursor.fetchall()

         print(records)
         uni_recomm.commit()
```

```
(('1', 'Northeastern University', '100000', 'On-Campus', '2', 'Fall', 2022, 'MSIS', 'Boston', '9600', '54000', '310', '100',
'7.5'), ('10', 'Cleveland State University', '36100', 'On-Campus', '1.8', 'Fall', 2022, 'MSIS', 'Cleveland', '24693', '21702',
'295', '78', '6'), ('11', 'Cornell University', '113700', 'On-Campus', '2', 'Fall', 2022, 'MSCS', 'Ithaca', '19726', '29500',
```

2. SCHOLARSHIP TABLE:

CREATE TABLE Scholarship (Scholarship_ID INT, Scholarship_Name Varchar(255), Scholarship_URL Varchar (255), PRIMARY KEY (Scholarship_ID));

```
: for i,row in Scholarship_df.iterrows():
    cursor.execute("INSERT INTO Scholarship values (%s,%s,%s)", (int(row['Scholarship_ID']),row['scholarship_name'],row['scholars
uni_recomm.commit()

cursor.execute("SELECT * from Scholarship")
records=cursor.fetchall()

print(records)
uni_recomm.commit()
```

```
((1, 'Cornaro Scholarship', 'https://www.kappagammapi.org/cornaro-scholarship/'), (2, 'NCAA Postgraduate Scholarship Program',
'http://www.ncaa.org/ncaa-postgraduate-scholarship-program'), (3, 'Eiffel Excellence Scholarship Program', 'https://www.campusf
rance.org/en/eiffel-scholarship-program-of-excellence'), (4, 'Fulbright Foreign Student Program', 'https://us.fulbrightonline.o
rg/'), (5, 'Clarendon Scholarships at University of Oxford', 'http://www.ox.ac.uk/clarendon/'), (6, 'Gates Cambridge Scholarshi
p', 'https://www.gatescambridge.org/'), (7, 'Kate Neal Kinley Memorial Fellowship', 'http://faa.illinois.edu/alumni-friends/kat
e-neal-kinley-memorial-fellowship'), (8, 'Forte Fellows Program', 'http://www.fortefoundation.org/site/PageServer?pagename=mba_
fellows#.VPyCecZVvE8'), (9, 'Richard A. Freund International Scholarship', 'https://asq.org/about-asq/asq-awards/freundschola
r'), (10, 'Olivia James Traveling Fellowship', 'https://www.archaeological.org/grant/james-traveling-fellowship/'), (11, 'Helen
M. Woodruff Fellowship', 'https://www.archaeological.org/grant/woodruff-fellowship/'), (12, 'Anna C. and Oliver C. Colburn Fell
owship', 'https://www.archaeological.org/grant/colburn-fellowships/'), (13, 'Harriet and Leon Pomerance Fellowship', 'https://w
ww.archaeological.org/grant/pomerance-fellowship/'), (14, 'Kate B. and Hall J. Peterson Fellowships', 'https://www.americananti
quarian.org/short-termfellowship'), (15, 'The Legacy Fellowship', 'https://www.americanantiquarian.org/short-termfellowship'),
(16, 'American Antiquarian Society-American Society for 18th-Century Studies Fellowship', 'https://www.americanantiquarian.org/
short-termfellowship'), (17, 'Lapides Fellowship in Pre-1865 Juvenile Literature and Ephemera', 'https://www.americanantiquaria
n.org/short-termfellowship'), (18, 'Lou Hochberg Thesis and Dissertation Awards', 'http://www.orgonelab.org/hochberg.htm'), (1
```

3. RESEARCH TABLE:

CREATE TABLE Research(Research_ID Varchar(255), Research_Name VARCHAR(255), University_ID Varchar(255), PRIMARY KEY (Research_ID), FOREIGN KEY (University_ID) REFERENCES university(University_ID));

```
for i,row in Research_df.iterrows():
    cursor.execute("INSERT INTO research values (%s,%s,%s)", (int(row['Research_ID']),row['Research_Name'],row['University_ID']))
uni_recomm.commit()

cursor.execute("SELECT * from research")
records=cursor.fetchall()

print(records)
uni_recomm.commit()
```

4. COURSE TABLE:

CREATE TABLE Course (ID INT, University_ID VARCHAR(255), University_Name VARCHAR(255), Course_Name VARCHAR(255), PRIMARY KEY (ID), FOREIGN KEY (University_ID) REFERENCES university(University_ID));

```
for i,row in Course_df.iterrows():
    cursor.execute("INSERT INTO course values (%s,%s,%s)", (int(row['ID']),row['University_ID'],row['Course_Name']))
uni_recomm.commit()

cursor.execute("SELECT * from course")
records=cursor.fetchall()

print(records)
uni_recomm.commit()
```

```
((1, '1', 'Northeastern University', '3-D Animation'), (2, '1', 'Northeastern University', 'Accounting'), (3, '1', 'Northeast
ern University', 'Accounting and Business Administration (MS/MBA)'), (4, '1', 'Northeastern University', 'Accounting and Fina
ncial Decision Making'), (5, '1', 'Northeastern University', 'Adult-Gerontology Acute Care Nursing'), (6, '1', 'Northeastern
University', 'Adult-Gerontology Acute Care Nursing (CAGS)'), (7, '1', 'Northeastern University', 'Adult-Gerontology Primary C
are Nursing (CAGS)'), (8, '1', 'Northeastern University', 'Advanced and Intelligent Manufacturing'), (9, '1', 'Northeastern U
niversity', 'Agile Project Management'), (10, '1', 'Northeastern University', 'Analytics'), (11, '1', 'Northeastern Universit
y', 'Applied Analytics'), (12, '1', 'Northeastern University', 'master-of-sports-leadership-boston-267'), (13, '1', 'Northeas
tern University', 'master-of-sports-leadership-online-268'), (14, '1', 'Northeastern University', 'master-of-sports-leadershi
p-charlotte-14376'), (15, '1', 'Northeastern University', 'graduate-certificate-in-supply-chain-engineering-management-1443
0'), (16, '1', 'Northeastern University', 'graduate-certificate-in-supply-chain-management-boston-14306'), (17, '1', 'Northea
stern University', 'graduate-certificate-in-supply-chain-management-online-14307'), (18, '1', 'Northeastern University', 'gra
duate-certificate-in-sustainability-and-business-18881'), (19, '1', 'Northeastern University', 'graduate-certificate-in-susta
inability-and-climate-change-policy-18771'), (20, '1', 'Northeastern University', 'graduate-certificate-in-sustainability-eng
ineering-19153'), (21, '1', 'Northeastern University', 'master-of-science-in-sustainable-building-systems-5284'), (22, '1',
'Northeastern University', 'graduate-certificate-in-sustainable-energy-systems-14426'), (23, '1', 'Northeastern University',
'master-of-design-in-sustainable-urban-environments-one-year-program-5232'), (24, '1', 'Northeastern University', 'master-of-
design-in-sustainable-urban-environments-two-year-program-5233'), (25, '1', 'Northeastern University', 'graduate-certificate-
in-technology-systems-management-14362'), (26, '1', 'Northeastern University', 'master-of-science-in-telecommunication-networ
ks-17108'), (27, '1', 'Northeastern University', 'transitional-doctor-of-physical-therapy-online-243'), (28, '1', 'Northeaste
```

5. PROFESSOR TABLE:

CREATE TABLE Professor (ID INT, University_ID VARCHAR(255), Professor_Names VARCHAR(255), PRIMARY KEY (ID), FOREIGN KEY (University_ID) REFERENCES university(University_ID));

```
for i,row in Professor_df.iterrows():
    cursor.execute("INSERT INTO Professor values (%s,%s,%s)", (int(row['ID']),row['University_ID'],row['Professors']))
uni_recomm.commit()

cursor.execute("SELECT * from Professor")
records=cursor.fetchall()

print(records)
uni_recomm.commit()
```

6. STUDENT TABLE:

CREATE TABLE Student (student_id INT, University_Name varchar(255), University_ID varchar(255), Acceptance VARCHAR(255), Program VARCHAR(255), Target_Major VARCHAR(255), Term VARCHAR(255), Year_of_Joining INT, GRE_Q INT, GRE_V INT, GRE_Total INT, GRE_AWA INT, TOEFL INT, Undergrad_University VARCHAR(255), Undergrad_Major VARCHAR(255), CGPA Float, CGPA_Scale Float, Work_Ex INT, PRIMARY KEY (student_id), FOREIGN KEY (University_ID) REFERENCES University (University_ID));

```
for i,row in Student_df.iterrows():
    cursor.execute("INSERT INTO student values (%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s,%s)", (int(row['Student_ID'])
uni_recomm.commit()

cursor.execute("SELECT * from student")
records=cursor.fetchall()

print(records)
uni_recomm.commit()
```

```
((1, 'Northeastern University', '1', 'Admit', 'MS', 'Computer Science', 'Fall ', '2012', '157', '142', '299', '3.5', '97', 'U
niversity of Mumbai', 'Computer Engineering', '64.37', '100', '0'), (2, 'Northeastern University', '1', 'Admit', 'MS', 'Indus
trial Engineering', 'Fall ', '2011', 'None', 'None', '0', 'None', 'None', 'None', '0', '0', '0', '0'), (3, 'Northeastern Univ
ersity', '1', 'Admit', 'MS', 'Industrial Engineering', 'Fall ', '2011', '770', '460', '1230', '3', '105', 'fr.c.r.c.e.(bandr
a)', 'production engineering', '75.36', '100', '0'), (4, 'Northeastern University', '1', 'Admit', 'MS', 'Computer Science',
'Fall ', '2013', '159', '152', '311', '3', '94', 'None', 'CS', '3.3', '10', '0'), (5, 'Northeastern University', '1', 'Admi
t', 'MS', 'Management Information System', 'Fall ', '2014', '158', '144', '302', '3', '100', 'Apeejay College of Engineerin
g', 'ECE', '66.4', '100', '0'), (6, 'Northeastern University', '1', 'Admit', 'MS', 'Computer Science', 'Fall ', '2013', '16
2', '155', '317', '4', 'None', 'RNSIT', 'CS', '72', '100', '0'), (7, 'Northeastern University', '1', 'Admit', 'MS', 'Computer
Science', 'Fall ', '2013', '160', '154', '314', '3.5', '108', 'Sri Bhagawan Mahaveer Jain College of Engineering', 'Informati
on Science', '73', '100', '0'), (8, 'Northeastern University', '1', 'Admit', 'MS', 'Comp Science/Comp Networks/Comp Engg', 'F
all ', '2012', '760', '650', '1410', '3.5', '104', 'Sardar Patel College of Engineering', 'Computer Engineering', '75.9', '10
0', '0'), (9, 'Northeastern University', '1', 'Admit', 'MS', 'Computer Engineering / Computer Networking / Computer Science',
'Fall ', '2015', '164', '152', '316', 'None', '97', 'None', '0', '8.52', '10', '56'), (10, 'Northeastern University', '1', 'A
dmit', 'MS', 'MIS', 'Fall ', '2011', '760', '680', '1440', '4', '111', 'Fr CRIT Mumbai University', 'Mechanical Engineering',
'54.6', '100', '0'), (11, 'Northeastern University', '1', 'Admit', 'MS', 'Information Security', 'Fall ', '2009', '740', '54
0', '1280', '5', '113', 'VTU', 'CS', '67', '100', '0'), (12, 'Northeastern University', '1', 'Admit', 'MS', '(MIS / MSIM / MS
IS / MSIT)', 'Fall ', '2015', '157', '146', '303', '3', '94', 'IET DAVV', 'Computer Engineering', '78.28', '100', '66'), (13,
'Northeastern University', '1', 'Admit', 'MS', 'Electronics and Communication', 'Fall ', '2012', '780', '590', '1370', '3.5',
```

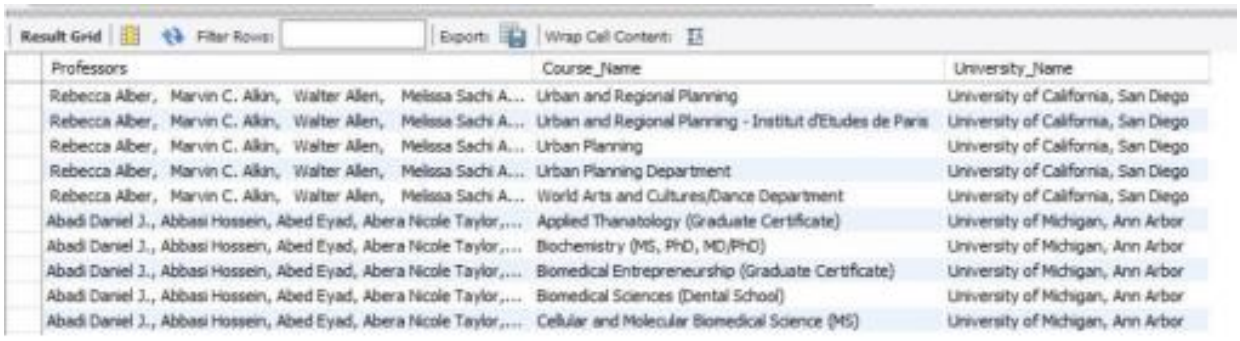
7. RECRUITER TABLE:

CREATE TABLE Recruiter(Recruiter_ID Varchar(255), Recruiter_Name Varchar(255), Recruiter_Ranking INT, Number_of_LCA INT, Average_Salary INT, Max_Hiring_from_University Varchar(255), University_ID Varchar(255), PRIMARY KEY (Recruiter_ID), FOREIGN KEY (University_ID) REFERENCES university(University_ID));

```
for i,row in Recruiter_df.iterrows():
    cursor.execute("INSERT INTO recruiter values (%s,%s,%s,%s,%s,%s,%s)", (int(row['Recruiter_ID']),row['Recruiter_Name'],row['Re
uni_recomm.commit()

cursor.execute("SELECT * from recruiter")
records=cursor.fetchall()

print(records)
uni_recomm.commit()
```

```
(('1', 'Cognizant Technology Solutions', 1, 12681, '$92,766', 'Texas A&M University', '32'), ('10', 'Hcl America', 10, 4113,
'$99,754', 'San Jose State University', '25'), ('11', 'Accenture', 11, 3830, '$140,893', 'New York University', '20'), ('12',
'IBM', 12, 3800, '$126,521', 'Carnegie Mellon University', '59'), ('13', 'Deloitte Consulting', 13, 3756, '$119,341', 'Universi
ty of Illinois Urbana Champaign', '41'), ('14', 'Intel', 14, 3367, '$127,627', 'Stanford University', '26'), ('15', 'Capgemin
i', 15, 3325, '$102,410', 'Northeastern University', '1'), ('16', 'Wal-Mart Associates', 16, 3218, '$133,510', 'University of C
alifornia Los Angeles', '35'), ('17', 'Jpmorgan Chase', 17, 2987, '$133,103', 'University of Phoenix\xa0', '60'), ('18', 'Wipr
o', 18, 2858, '$80,871', 'University of Texas, Austin', '50'), ('19', 'Tekorg', 19, 2755, '$80,529', 'University of Illinois Ch
icago', '62'), ('2', 'Amazon', 2, 11486, '$126,163', 'Ohio State University', '65'), ('20', 'Compunnel Software Group', 20, 223
1, '$108,016', 'Georgia Institute of\xa0Technology', '14'), ('21', 'Qualcomm Technologies', 21, 2167, '$152,754', 'Stanford Uni
versity', '26'), ('22', 'Salesforce.Com', 22, 2164, '$141,276', 'University of Illinois, Urbana Champaign', '41'), ('23', 'Tech
Mahindra', 23, 2107, '$94,298', 'Rochester Institute of Technology', '23'), ('24', 'Cisco Systems', 24, 2013, '$145,750', 'Univ
ersity of southern California', '48'), ('25', 'Goldman Sachs &', 25, 1579, '$134,689', 'Harvard University', '15'), ('3', 'Tata
Consultancy Services', 3, 9822, '$93,484', 'Indiana University Bloomington', '17'), ('4', 'Google', 4, 9421, '$156,793', 'Stanf
ord University', '26'), ('5', 'Microsoft', 5, 7329, '$146,569', 'University of Washington', '65'), ('6', 'Facebook', 6, 6090,
'$175,750', 'University of California, Berkeley', '58'), ('7', 'Ernst & Young', 7, 5797, '$118,653', 'University of Southern Ca
lifornia', '48'), ('8', 'Infosys', 8, 5649, '$92,689', 'University of Texas Dallas', '51'), ('9', 'Apple', 9, 4239, '$168,416',
```

As seen below: the tables had multi-valued rows and there was a transitive dependency in the tables.



Professors	Course_Name	University_Name
Rebecca Alber, Marvin C. Alkin, Walter Allen, Melissa Sachi A....	Urban and Regional Planning	University of California, San Diego
Rebecca Alber, Marvin C. Alkin, Walter Allen, Melissa Sachi A....	Urban and Regional Planning - Institut d'Etudes de Paris	University of California, San Diego
Rebecca Alber, Marvin C. Alkin, Walter Allen, Melissa Sachi A....	Urban Planning	University of California, San Diego
Rebecca Alber, Marvin C. Alkin, Walter Allen, Melissa Sachi A....	Urban Planning Department	University of California, San Diego
Rebecca Alber, Marvin C. Alkin, Walter Allen, Melissa Sachi A....	World Arts and Cultures/Dance Department	University of California, San Diego
Abadi Daniel J., Abbasi Hossein, Abed Eyad, Abera Nicole Taylor,....	Applied Thanatology (Graduate Certificate)	University of Michigan, Ann Arbor
Abadi Daniel J., Abbasi Hossein, Abed Eyad, Abera Nicole Taylor,....	Biochemistry (MS, PhD, MD/PhD)	University of Michigan, Ann Arbor
Abadi Daniel J., Abbasi Hossein, Abed Eyad, Abera Nicole Taylor,....	Biomedical Entrepreneurship (Graduate Certificate)	University of Michigan, Ann Arbor
Abadi Daniel J., Abbasi Hossein, Abed Eyad, Abera Nicole Taylor,....	Biomedical Sciences (Dental School)	University of Michigan, Ann Arbor
Abadi Daniel J., Abbasi Hossein, Abed Eyad, Abera Nicole Taylor,....	Cellular and Molecular Biomedical Science (MS)	University of Michigan, Ann Arbor

student_id	Target_University	Target_Major	Year_of_Joining	GRE_Total	TOEFL	University_GRE_Cutoff	University_TOEFL_cutoff	accepta
22	Northeastern University	Computer Science	2016	323	116	310	100	Admit
147	Northeastern University	MIS	2016	307	91	310	100	Admit
255	Northeastern University	MIS	2016	306	100	310	100	Admit
377	Northeastern University	Industrial Engineering	2016	321	111	310	100	Admit
405	Northeastern University	Computer Science	2016	321	101	310	100	Admit
446	Northeastern University	Computer Science	2016	315	98	310	100	Admit
585	Northeastern University	Engineering Management	2016	319	108	310	100	Admit
654	Northeastern University	Computer Science	2016	314	110	310	100	Admit
724	Northeastern University	Engineering Management	2016	310	106	310	100	Admit
937	Northeastern University	Computer Engineering	2016	323	None	310	100	Admit
954	Northeastern University	Computer Science	2016	314	112	310	100	Admit

Therefore, we followed the rules of Normalization as follows:

1. **First normal form (1NF)**
   - Each table has a primary key: minimal set of attributes which can uniquely identify a record
   - The values in each column of a table are atomic (No multi-value attributes allowed).
   - There are no repeating groups: two columns do not store similar information in the same table
2. **Second normal form (2NF)**
   - All requirements for 1st NF must be met.
   - No partial dependencies.

- No calculated data

3. **Third normal form (3NF)**
   - All requirements for 2nd NF must be met.
   - Eliminate fields that do not directly depend on the primary key; that is no transitive dependencies

CREATE STATEMENTS:

1. **University_Details:**
   CREATE TABLE University_Details
   (University_ID varchar(255),
   University_Name varchar(255),
   PRIMARY KEY (University_ID),
   FOREIGN KEY (University_ID) REFERENCES university(University_ID)
   );
2. **Student Table:**
   CREATE TABLE Student
   (student_ID int,
   University_ID Varchar(255),
   Acceptance varchar(255),
   Program varchar(255),
   Target_Major Varchar(255),
   Term varchar(255),
   Year_of_Joining varchar(255),
   PRIMARY KEY (student_ID),
   FOREIGN KEY (University_ID) REFERENCES university(University_ID)
   );
3. **Student_Score:**
   CREATE TABLE Student_Score
   (student_ID int,
   GRE_Q varchar(255),
   GRE_V varchar(255),
   GRE_Total varchar(255),
   GRE_AWA varchar(255),
   TOEFL varchar(255),
   Work_Ex varchar(255),
   PRIMARY KEY (student_ID),
   FOREIGN KEY (student_ID) REFERENCES student(student_ID)
   );
4. **Recruiter_Details:**
   CREATE TABLE Recruiter_Details
   (Recruiter_ID varchar(255),
   Recruiter_Name varchar(255),
   PRIMARY KEY (Recruiter_ID),
   FOREIGN KEY (Recruiter_ID) REFERENCES recruiter(Recruiter_ID)
   );
5. **Scholarship:**
   CREATE TABLE Scholarship

(Scholarship_ID int,
Scholarship_Name varchar(255),
Scholarship_URL longtext,
University_ID varchar(255),
PRIMARY KEY (Scholarship _ID),
FOREIGN KEY (University _ID) REFERENCES university(University _ID)
);

6. **Student_Undergrad:**
   CREATE TABLE Student_Undergrad
   (student_ID int,
   Undergrad_University Varchar(255),
   Undergrad_Major varchar(255),
   CGPA varchar(255),
   CGPA_Scale Varchar(255),
   PRIMARY KEY (student_ID),
   FOREIGN KEY (student_ID) REFERENCES student(student_ID)
   );
7. **University_Admit_Requirement:**
   CREATE TABLE University_Admit_Requirement
   (University_ID VARCHAR(255),
   GRE Varchar(255),
   toefl varchar(255),
   ielts varchar(255),
   PRIMARY KEY (University_ID),
   FOREIGN KEY (University_ID) REFERENCES university(University_ID)
   );
   The rest of the create statements are same as before. Please find the table description below:

8. **Course**

	Field	Type	Null	Key	Default	Extra
▶	ID	int	NO	PRI	NULL	
	University_ID	varchar(255)	YES	MUL	NULL	
	Course_Name	varchar(255)	YES		NULL	

9. **Professor:**

	Field	Type	Null	Key	Default	Extra
▶	ID	int	NO	PRI	NULL	
	University_ID	varchar(255)	YES	MUL	NULL	
	Professors	longtext	YES		NULL	

10. **Recruiter:**

	Field	Type	Null	Key	Default	Extra
▶	Recruiter_ID	varchar(255)	NO	PRI	NULL	
	Recruiter_Ranking	int	YES		NULL	
	Number_of_LCA	int	YES		NULL	
	Average_Salary	varchar(255)	YES		NULL	
	University_ID	varchar(255)	YES	MUL	NULL	

11. **Research**

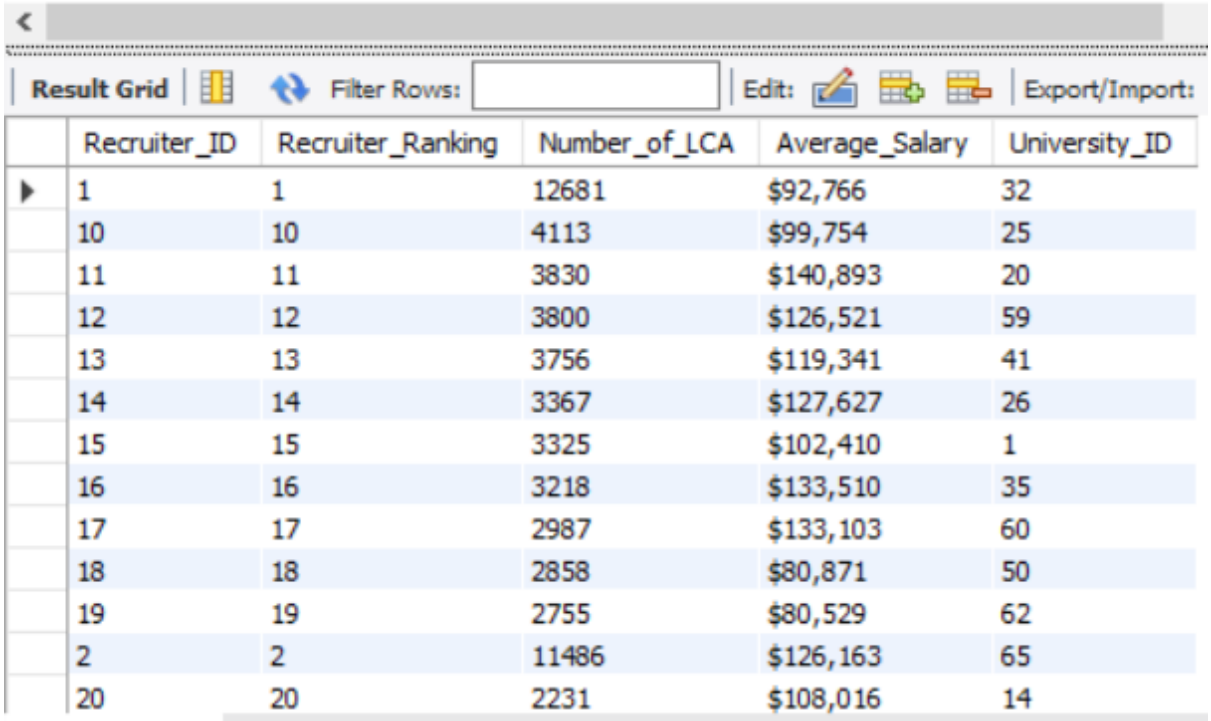
	Field	Type	Null	Key	Default	Extra
▶	Research_ID	varchar(255)	NO	PRI	NULL	
	Research_Name	longtext	YES		NULL	
	University_ID	varchar(255)	YES	MUL	NULL	

12. **University**

	Field	Type	Null	Key	Default	Extra
▶	University_ID	varchar(255)	NO	PRI	NULL	
	avg_pay_scale	varchar(255)	YES		NULL	
	Duration	varchar(255)	YES		NULL	
	Term	varchar(255)	YES		NULL	
	Year_of_Joining	int	YES		NULL	
	Major	varchar(255)	YES		NULL	
	Avg_Fees	varchar(255)	YES		NULL	

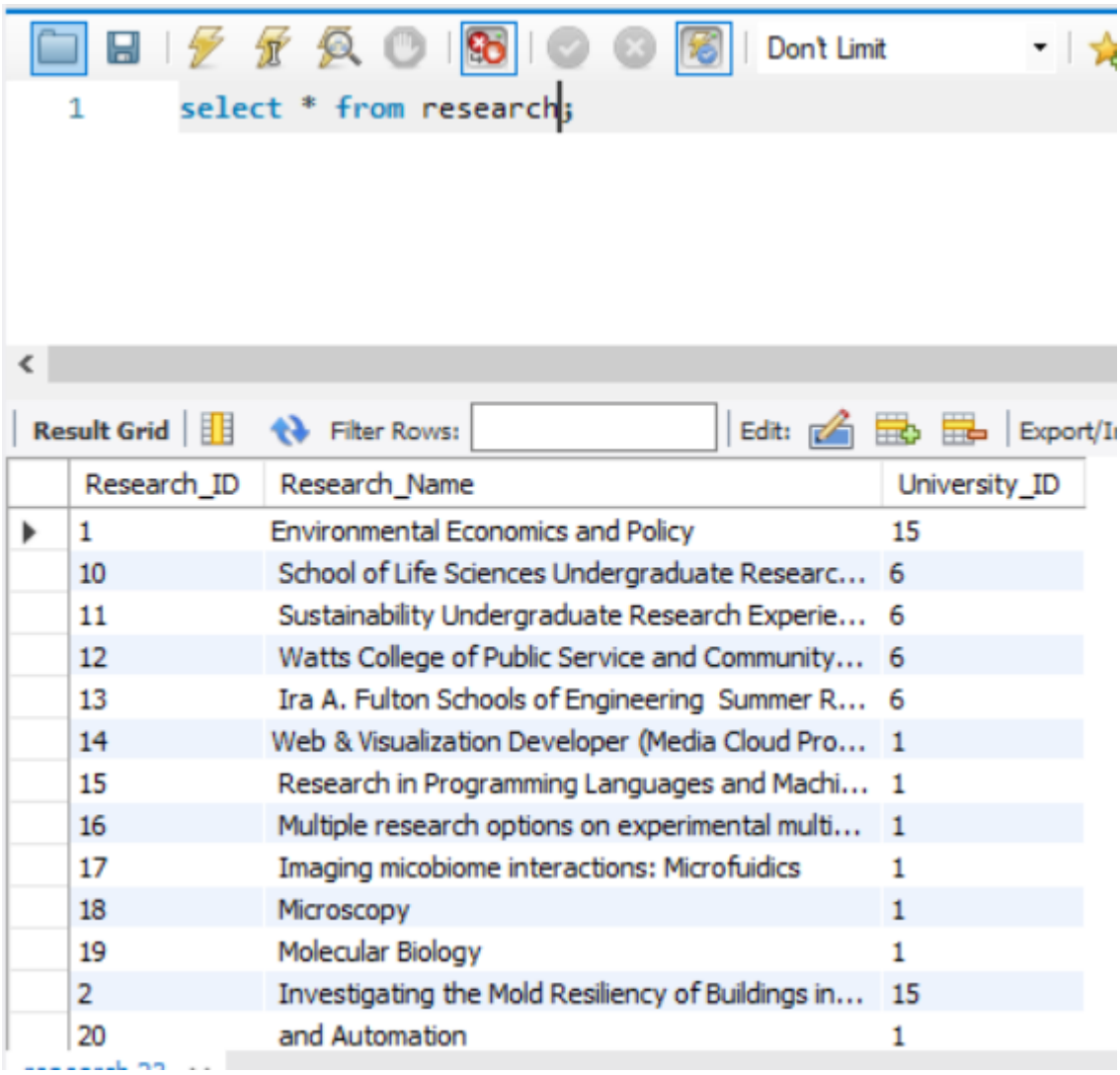
After Inserting in the new table:

```
1    select * from recruiter;
```

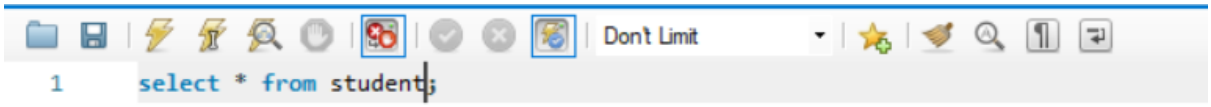


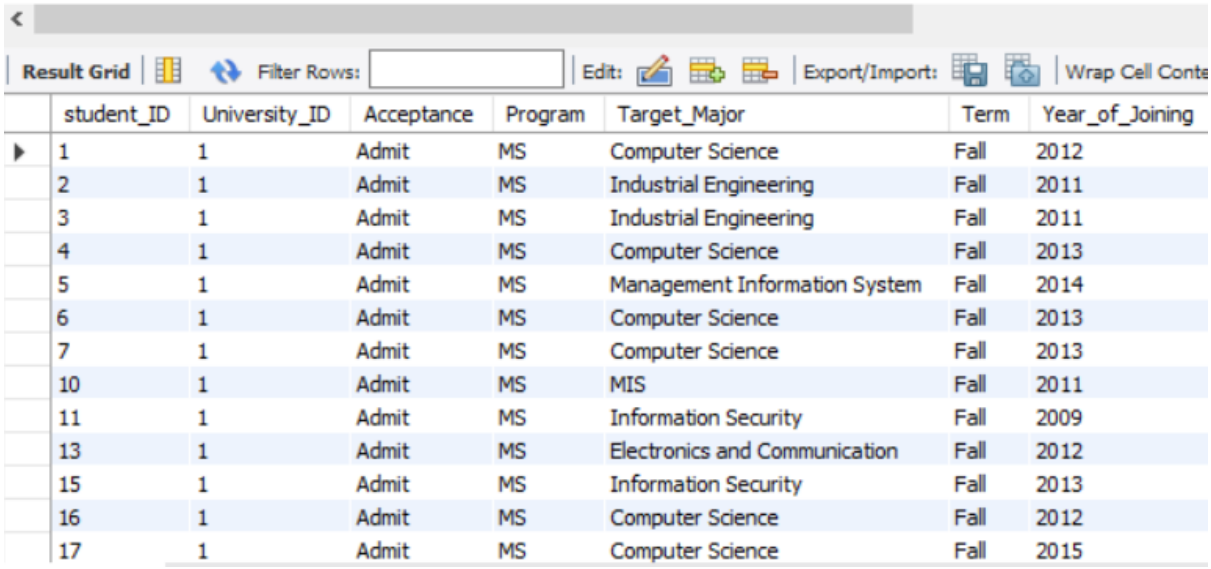
Result Grid | Filter Rows: | Edit: | Export/Import:

Recruiter_ID	Recruiter_Ranking	Number_of_LCA	Average_Salary	University_ID
1	1	12681	$92,766	32
10	10	4113	$99,754	25
11	11	3830	$140,893	20
12	12	3800	$126,521	59
13	13	3756	$119,341	41
14	14	3367	$127,627	26
15	15	3325	$102,410	1
16	16	3218	$133,510	35
17	17	2987	$133,103	60
18	18	2858	$80,871	50
19	19	2755	$80,529	62
2	2	11486	$126,163	65
20	20	2231	$108,016	14



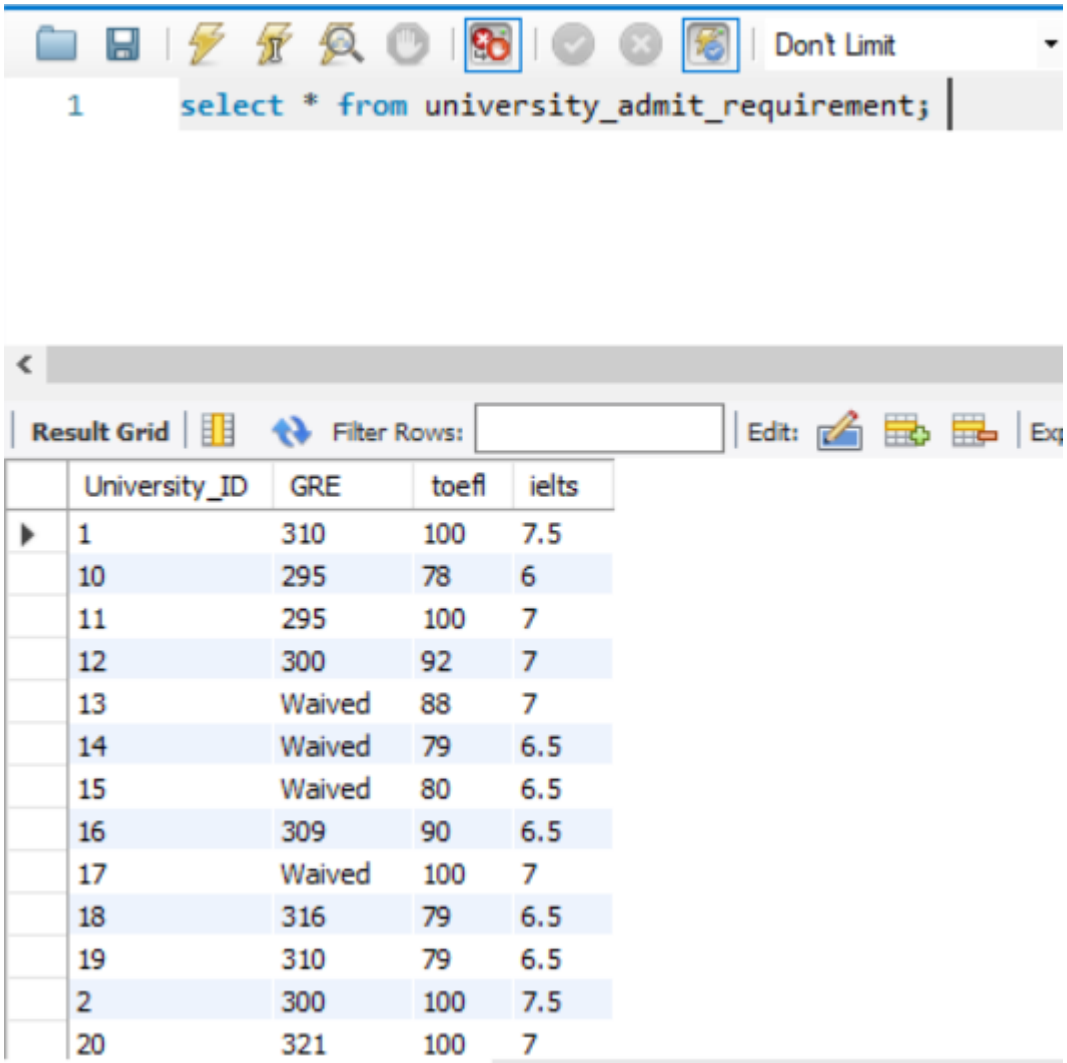
Research_ID	Research_Name	University_ID
1	Environmental Economics and Policy	15
10	School of Life Sciences Undergraduate Researc...	6
11	Sustainability Undergraduate Research Experie...	6
12	Watts College of Public Service and Community...	6
13	Ira A. Fulton Schools of Engineering Summer R...	6
14	Web & Visualization Developer (Media Cloud Pro...	1
15	Research in Programming Languages and Machi...	1
16	Multiple research options on experimental multi...	1
17	Imaging micobiome interactions: Microfuidics	1
18	Microscopy	1
19	Molecular Biology	1
2	Investigating the Mold Resiliency of Buildings in...	15
20	and Automation	1





Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Conte

student_ID	University_ID	Acceptance	Program	Target_Major	Term	Year_of_Joining
1	1	Admit	MS	Computer Science	Fall	2012
2	1	Admit	MS	Industrial Engineering	Fall	2011
3	1	Admit	MS	Industrial Engineering	Fall	2011
4	1	Admit	MS	Computer Science	Fall	2013
5	1	Admit	MS	Management Information System	Fall	2014
6	1	Admit	MS	Computer Science	Fall	2013
7	1	Admit	MS	Computer Science	Fall	2013
10	1	Admit	MS	MIS	Fall	2011
11	1	Admit	MS	Information Security	Fall	2009
13	1	Admit	MS	Electronics and Communication	Fall	2012
15	1	Admit	MS	Information Security	Fall	2013
16	1	Admit	MS	Computer Science	Fall	2012
17	1	Admit	MS	Computer Science	Fall	2015



University_ID	GRE	toefl	ielts
1	310	100	7.5
10	295	78	6
11	295	100	7
12	300	92	7
13	Waived	88	7
14	Waived	79	6.5
15	Waived	80	6.5
16	309	90	6.5
17	Waived	100	7
18	316	79	6.5
19	310	79	6.5
2	300	100	7.5
20	321	100	7

DATA CLEANING EXAMPLES:

- Standardizing the data

```
In [64]: cursor.execute("update student_undergrad set CGPA = CGPA/10 where CGPA_Scale = 100")
         records=cursor.fetchall()

         print(records)
         uni_recomm.commit()
```

```
()
```

```
In [65]: cursor.execute("update student_undergrad set CGPA_Scale = 10 where CGPA_Scale = 100")
         records=cursor.fetchall()

         print(records)
         uni_recomm.commit()
```

```
()
```

- Altering the dataset to suit the table

```
In [167]: cursor.execute("ALTER Table University drop column University_Name")
          for x in cursor:
              print(x)
```

```
In [168]: cursor.execute("select * from university")
          for x in cursor:
              print(x)
```

```
cursor.execute("ALTER Table recruiter drop column Recruiter_Name")
for x in cursor:
    print(x)
```

```
cursor.execute("select * from recruiter")
for x in cursor:
    print(x)
```

```
cursor.execute("ALTER Table Student drop column University_Name")
for x in cursor:
    print(x)
```

```
cursor.execute("select * from recruiter")
for x in cursor:
    print(x)
```

In [217]:
```
cursor.execute("delete from student where Target_Major like '%/%'")
```

Out[217]:
```
467
```

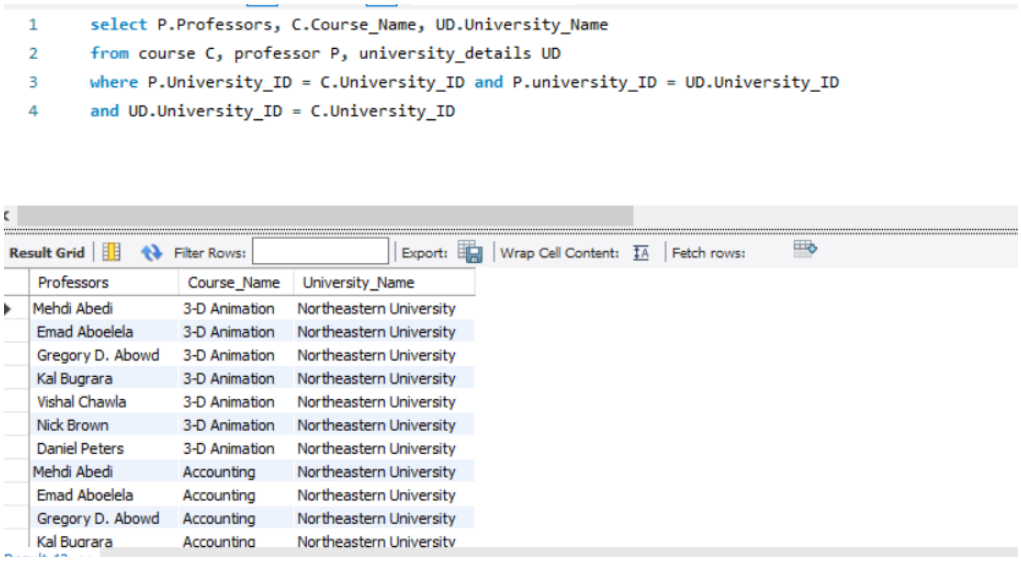
In [220]:
```
cursor.execute("SELECT * from student")
records=cursor.fetchall()

print(records)
uni_recomm.commit()
```

USECASES w.r.t New Tables:

1. **Display the list of all the courses offered by a university along with the list of all the professors present in the university.**
   Description: This query returns a list of professors along with their university ID and the courses offered by that university
   Actor: Student
   Precondition: The student must select a professor
   Steps:
   Actor Action: The student views the professor teaching a particular course from a university
   System Response: The system displays a list of all the professors from a university along with the professors
   Postcondition: A list is generated of all the professors at a university along with their courses

SQL Query:

```
select P.Professors, C.Course_Name, UD.University_Name
from course C, professor P, university_details UD
where P.University_ID = C.University_ID and P.university_ID = UD.University_ID
and UD.University_ID = C.University_ID
```



Result Grid | Filter Rows: | Export: | Wrap Cell Content: | Fetch rows:

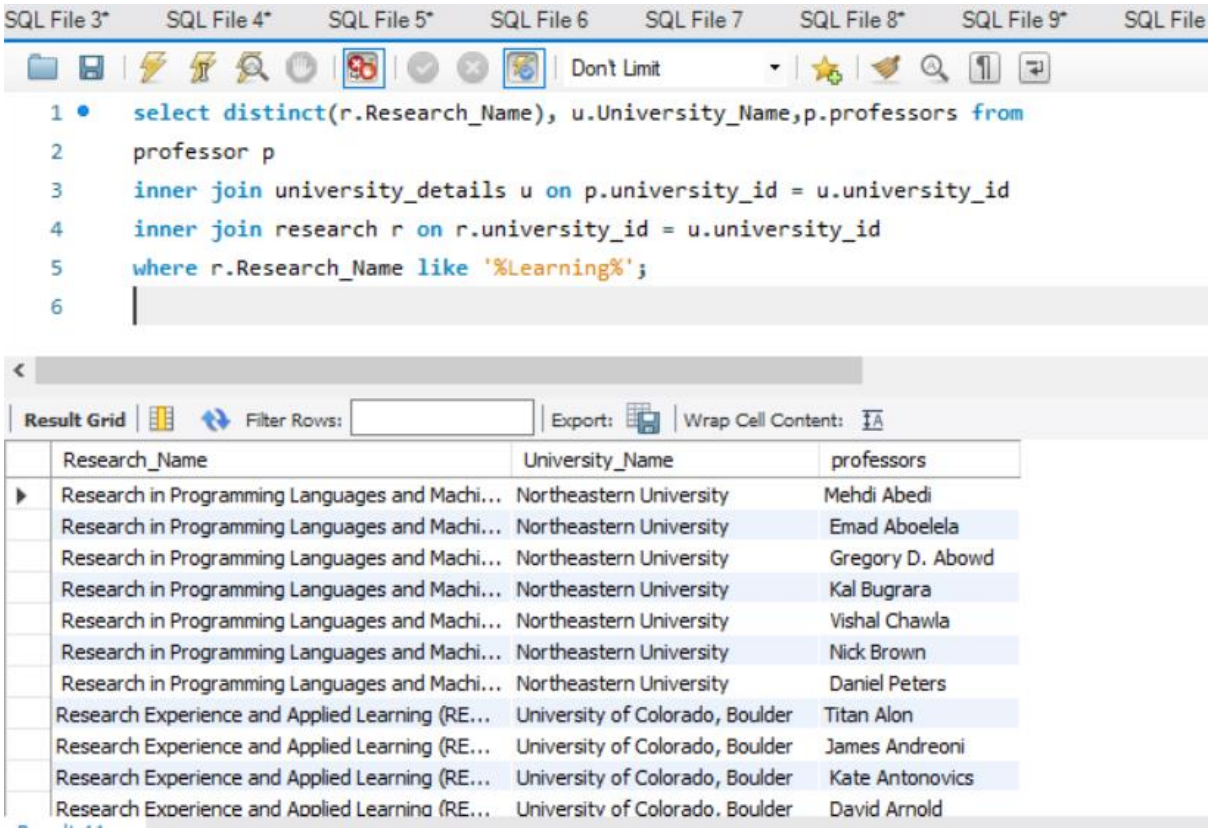
Professors	Course_Name	University_Name
Mehdi Abedi	3-D Animation	Northeastern University
Emad Aboelela	3-D Animation	Northeastern University
Gregory D. Abowd	3-D Animation	Northeastern University
Kal Bugrara	3-D Animation	Northeastern University
Vishal Chawla	3-D Animation	Northeastern University
Nick Brown	3-D Animation	Northeastern University
Daniel Peters	3-D Animation	Northeastern University
Mehdi Abedi	Accounting	Northeastern University
Emad Aboelela	Accounting	Northeastern University
Gregory D. Abowd	Accounting	Northeastern University
Kal Bugrara	Accounting	Northeastern University

2. **Search for a distinct research opportunity (for example – Machine Learning) available in a particular university along with the list of all the professors of that university.**
   Description: This query returns a list of ongoing research in a university under a professor
   Actor: Student
   Precondition: The student must select research opportunities
   Steps:
   Actor Action: The student views the ongoing research from a university

System Response: The system displays all the ongoing research from a university under the professor
Postcondition: The system generates a list of ongoing research

SQL Query:

```
select distinct(r.Research_Name), u.University_Name,p.professors from
professor p
inner join university_details u on p.university_id = u.university_id
inner join research r on r.university_id = u.university_id
where r.Research_Name like '%Learning%';
```



Research_Name	University_Name	professors
Research in Programming Languages and Machi...	Northeastern University	Mehdi Abedi
Research in Programming Languages and Machi...	Northeastern University	Emad Aboelela
Research in Programming Languages and Machi...	Northeastern University	Gregory D. Abowd
Research in Programming Languages and Machi...	Northeastern University	Kal Bugrara
Research in Programming Languages and Machi...	Northeastern University	Vishal Chawla
Research in Programming Languages and Machi...	Northeastern University	Nick Brown
Research in Programming Languages and Machi...	Northeastern University	Daniel Peters
Research Experience and Applied Learning (RE...	University of Colorado, Boulder	Titan Alon
Research Experience and Applied Learning (RE...	University of Colorado, Boulder	James Andreoni
Research Experience and Applied Learning (RE...	University of Colorado, Boulder	Kate Antonovics
Research Experience and Applied Learning (RE...	University of Colorado, Boulder	David Arnold

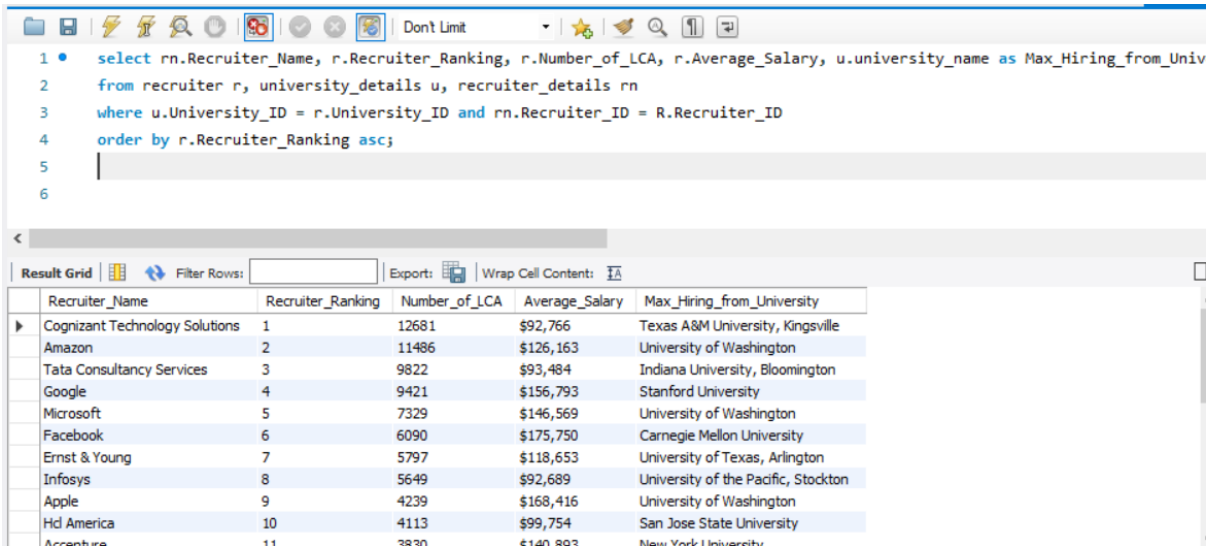
3. **Display the recruiter ranking along with the average salary and the university from which it hires the maximum number of students**

Description: Display a list of recruiters along with the average salary that they offer and the maximum number of students they hire from a particular university
Actor: Student
Precondition: The student must select a list of top recruiters
Steps:
Actor Action: The student views the recruiters along with the average package

System Response: The system displays a list of all the recruiters and the university from which they hire the maximum number of students
Postcondition: The system generates a list of recruiters

SQL Query:

```
select rn.Recruiter_Name, r.Recruiter_Ranking, r.Number_of_LCA,
r.Average_Salary, u.university_name as Max_Hiring_from_University
from recruiter r, university_details u, recruiter_details rn
where u.University_ID = r.University_ID and rn.Recruiter_ID = R.Recruiter_ID
order by r.Recruiter_Ranking asc;
```



```
1  select rn.Recruiter_Name, r.Recruiter_Ranking, r.Number_of_LCA, r.Average_Salary, u.university_name as Max_Hiring_from_Univ
2  from recruiter r, university_details u, recruiter_details rn
3  where u.University_ID = r.University_ID and rn.Recruiter_ID = R.Recruiter_ID
4  order by r.Recruiter_Ranking asc;
5
6
```

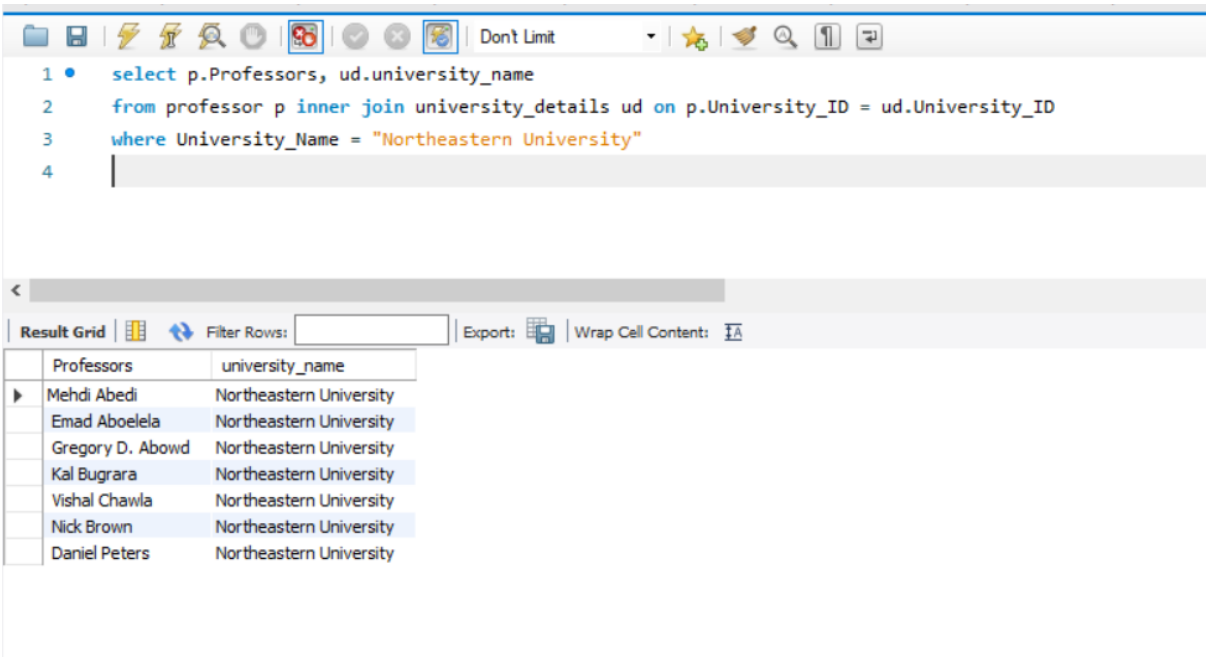
Result Grid | Filter Rows: | Export: | Wrap Cell Content:

Recruiter_Name	Recruiter_Ranking	Number_of_LCA	Average_Salary	Max_Hiring_from_University
Cognizant Technology Solutions	1	12681	$92,766	Texas A&M University, Kingsville
Amazon	2	11486	$126,163	University of Washington
Tata Consultancy Services	3	9822	$93,484	Indiana University, Bloomington
Google	4	9421	$156,793	Stanford University
Microsoft	5	7329	$146,569	University of Washington
Facebook	6	6090	$175,750	Carnegie Mellon University
Ernst & Young	7	5797	$118,653	University of Texas, Arlington
Infosys	8	5649	$92,689	University of the Pacific, Stockton
Apple	9	4239	$168,416	University of Washington
Hcl America	10	4113	$99,754	San Jose State University

4. **Display the list of all the professors that teach under a particular university.**
Description: The student views the professors from a particular university
Actor: Student
Precondition: The student must select a university
Steps:
Actor Action: The student views the professor from a particular university
System Response: The system generates a list of professors from a university
Postcondition: The system generates all the professors

SQL Query:

```
select p.Professors, ud.university_name
from professor p inner join university_details ud on p.University_ID =
ud.University_ID
where University_Name = "Northeastern University"
```

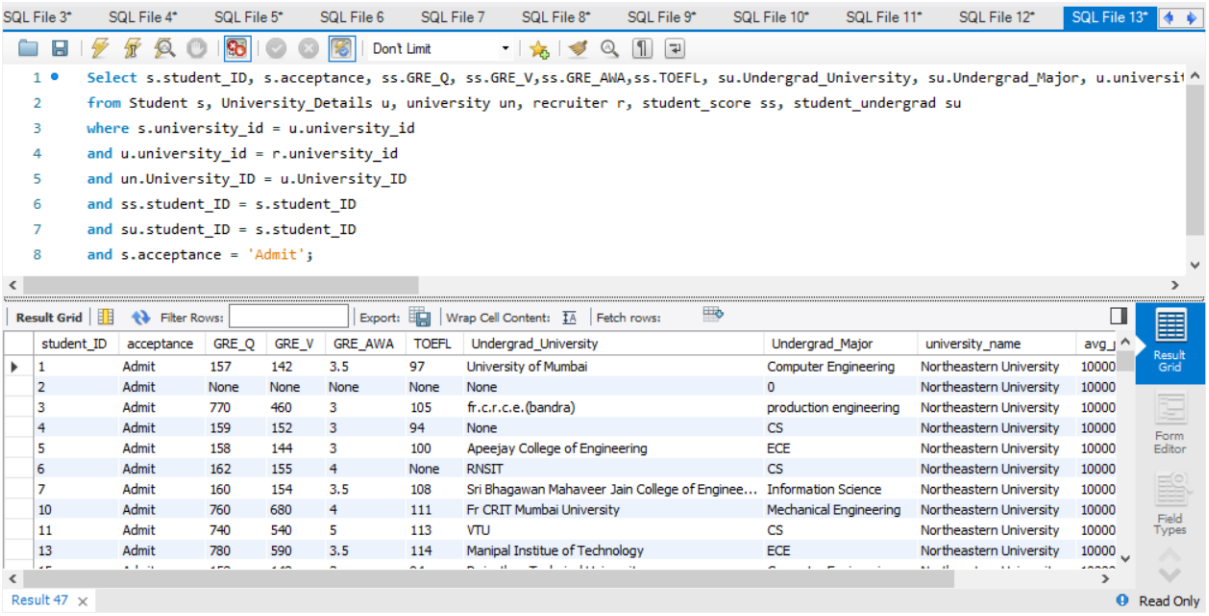


5. **Display the conditions on which a student is admitted to a university along with their graduate major, and average pay scale after graduation**

   Description: Displays the entire academics of a student based on admit
   Actor: Student
   Precondition: The student must select a student ID
   Steps:
   Actor Action: The student selects a student ID and views the entire academic
   System Response: The system generates a list of all the admitted students
   Postcondition: A list is generated with all the amidst

   SQL Query:

```
Select s.student_ID, s.acceptance, ss.GRE_Q,
ss.GRE_V,ss.GRE_AWA,ss.TOEFL, su.Undergrad_University,
su.Undergrad_Major, u.university_name, un.avg_pay_scale, r.university_id
from Student s, University_Details u, university un, recruiter r, student_score
ss, student_undergrad su
where s.university_id = u.university_id
and u.university_id = r.university_id
and un.University_ID = u.University_ID
and ss.student_ID = s.student_ID
and su.student_ID = s.student_ID
and s.acceptance = 'Admit';
```



6. **Display the list of a specific course offered by all the universities.**

Description: This query returns a value of all the universities that provide a particular course

Actor: Student

Precondition: The student must select a course

Steps:

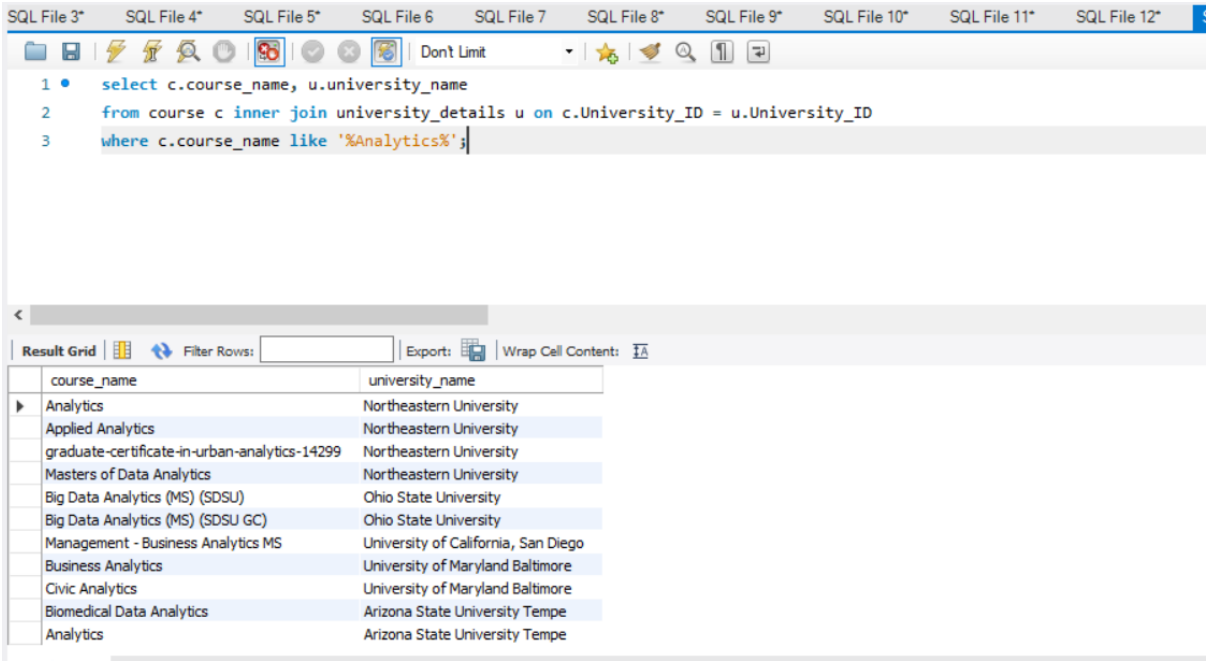
Actor Action: The student selects a particular course that he wishes to be enrolled for

System Response: The system displays a list of all the universities that provide that particular course

Postcondition: A list of all the universities that offer analytics courses is displayed

SQL Query:

```
select c.course_name, u.university_name
from course c inner join university_details u on c.University_ID = u.University_ID
where c.course_name like '%Analytics%';
```

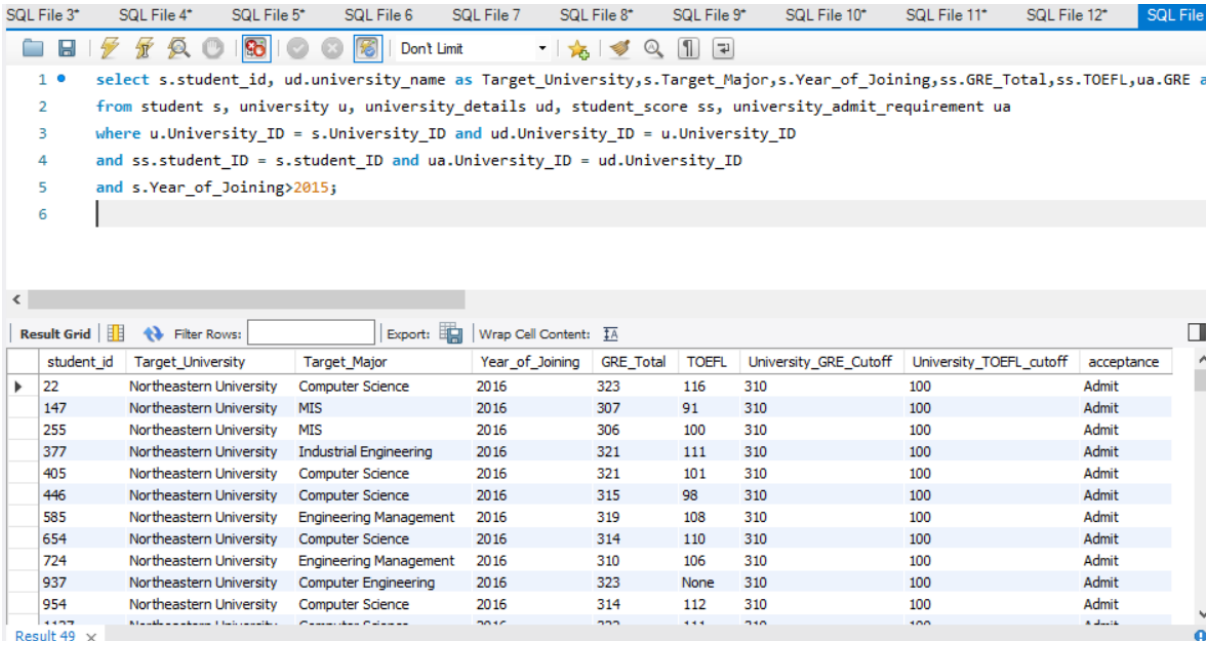


7. **Display the data about previous admits where the year of joining >= 2015**

   Description: To view a list of all the previous admits to a university after 2015
   Actor: The student
   Precondition: The student must select a year
   Steps:
   Actor Action: The student selects the year and displays the admits
   System Response: The system displays a list of all the previous admits
   Postcondition: The list is displayed with all the previous admits

   SQL Query:

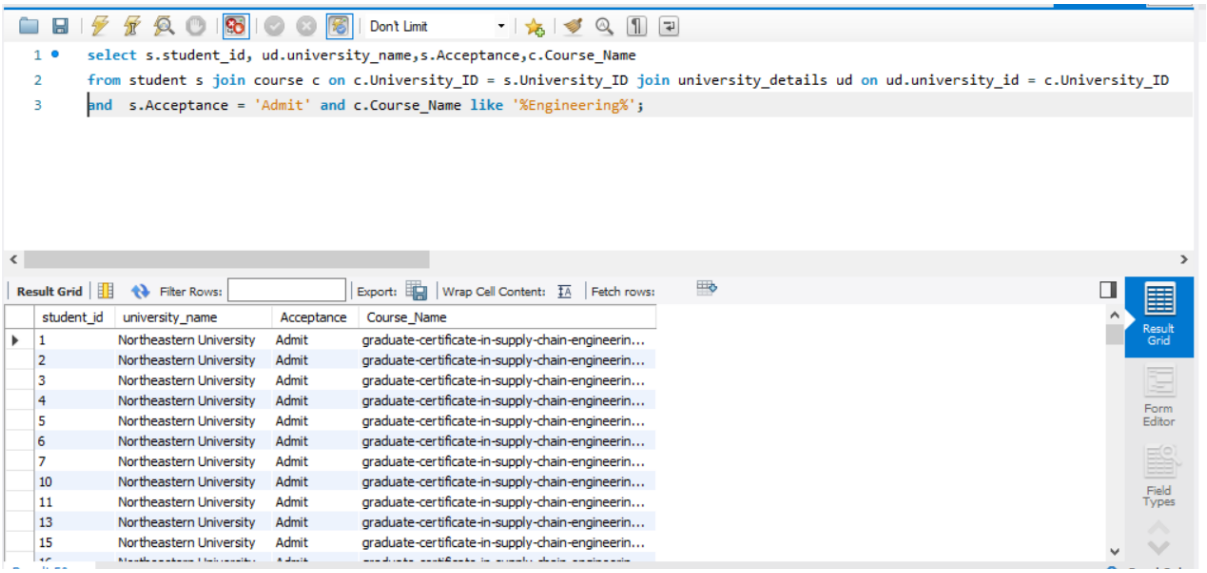
```
select s.student_id, ud.university_name as
Target_University,s.Target_Major,s.Year_of_Joining,ss.GRE_Total,ss.TOEFL
,ua.GRE as University_GRE_Cutoff,ua.TOEFL as
University_TOEFL_cutoff,s.acceptance
from student s, university u, university_details ud, student_score ss,
university_admit_requirement ua
where u.University_ID = s.University_ID and ud.University_ID =
u.University_ID
and ss.student_ID = s.student_ID and ua.University_ID = ud.University_ID
and s.Year_of_Joining>2015;
```



student_id	Target_University	Target_Major	Year_of_Joining	GRE_Total	TOEFL	University_GRE_Cutoff	University_TOEFL_cutoff	acceptance
22	Northeastern University	Computer Science	2016	323	116	310	100	Admit
147	Northeastern University	MIS	2016	307	91	310	100	Admit
255	Northeastern University	MIS	2016	306	100	310	100	Admit
377	Northeastern University	Industrial Engineering	2016	321	111	310	100	Admit
405	Northeastern University	Computer Science	2016	321	101	310	100	Admit
446	Northeastern University	Computer Science	2016	315	98	310	100	Admit
585	Northeastern University	Engineering Management	2016	319	108	310	100	Admit
654	Northeastern University	Computer Science	2016	314	110	310	100	Admit
724	Northeastern University	Engineering Management	2016	310	106	310	100	Admit
937	Northeastern University	Computer Engineering	2016	323	None	310	100	Admit
954	Northeastern University	Computer Science	2016	314	112	310	100	Admit

8. **Display the list of courses choices based on specifications a student can select from post getting the admit.**
   Description: To view a list of all the possible choices student has
   Actor: Student
   Precondition: The student must select a course name for acceptance
   Steps:
   Actor Action: The student must select a course name
   System Response: A list is displayed with all the possible admits a student has from a university
   Postcondition: A list is displayed with all possible universities

   SQL Query:
   select s.student_id, ud.university_name,s.Acceptance,c.Course_Name from student s join course c on c.University_ID = s.University_ID join university_details ud on ud.university_id = c.University_ID and s.Acceptance = 'Admit' and c.Course_Name like '%Engineering%';



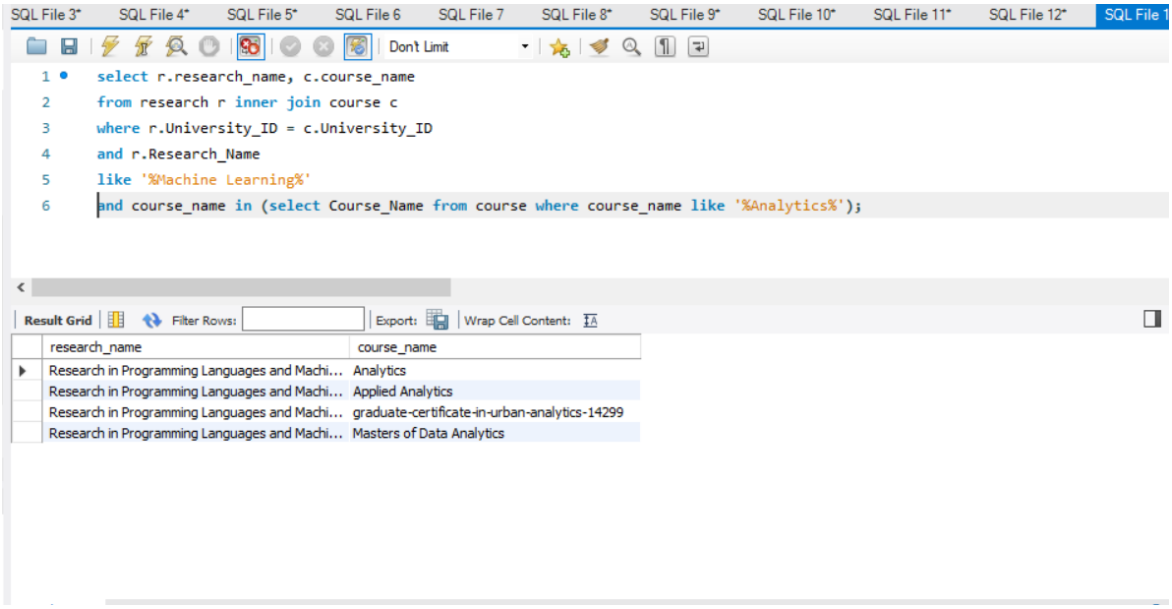
```
select s.student_id, ud.university_name,s.Acceptance,c.Course_Name
from student s join course c on c.University_ID = s.University_ID join university_details ud on ud.university_id = c.University_ID
and  s.Acceptance = 'Admit' and c.Course_Name like '%Engineering%';
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content: | Fetch rows:

student_id	university_name	Acceptance	Course_Name
1	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
2	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
3	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
4	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
5	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
6	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
7	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
10	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
11	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
13	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
15	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...

9. **Display the list of desired research opportunities available in a university based on the course selection of a student.**
   Description: To view the list of all the research in a particular course
   Actor: Student
   Precondition: The student must select a research domain say Machine Learning
   Steps:
   Actor Action: The student must select a domain for research
   System Response: The system displays a list of all the research in a particular course
   Postcondition: A list is displayed with all the research going on in a course

   SQL Query:
   select r.research_name, c.course_name from research r inner join course c where r.University_ID = c.University_ID and r.Research_Name like '%Machine Learning%' and course_name in (select Course_Name from course where course_name like '%Analytics%');



10. **Display the list of research opportunities available in an university based on the location of the university.**
    Description: To display a list of research going in a particular location in which the university exists
    Actor: Student
    Precondition: The student must select a location
    Steps:
    Actor Action: The student selects a location to look for research
    System Response: The system displays a list of universities in that location where research is going on
    Postcondition: A list is displayed with the research going in a particular location in which the university exists
    SQL Query:
    select r.research_name, ud.university_name
    from research r, university_details ud, university u
    where r.university_id = ud.university_id
    and u.Location = "Boston";

SQL File 3* SQL File 4* SQL File 5* SQL File 6 SQL File 7 SQL File 8* SQL File 9* SQ

Don't Limit

```
1  select r.research_name, ud.university_name
2  from research r, university_details ud, university u
3  where r.university_id = ud.university_id
4  and u.Location = "Boston";
5
6
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

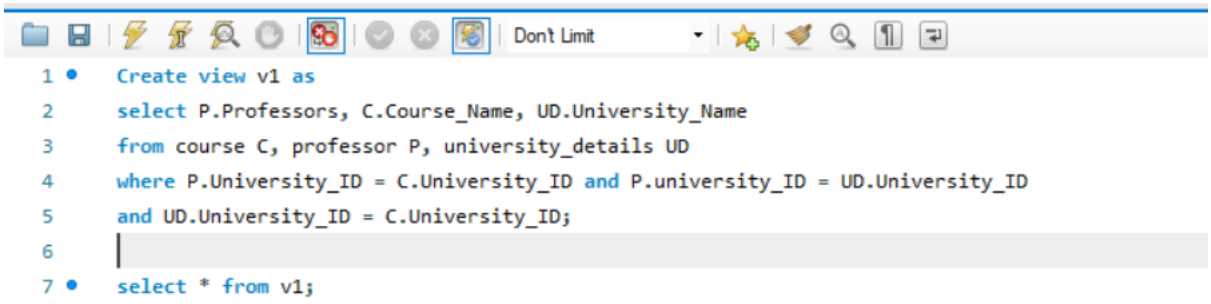
research_name	university_name
New College Undergraduate Inquiry and Resea...	Arizona State University Tempe
Fulton Undergraduate Research Initiative (FURI)	Arizona State University Tempe
Climate Dynamics	Harvard University
Modeling of Atmospheric Chemistry	Harvard University
Aging and Climate Change in China	Harvard University
Office of Research Advancement	University of Texas, Arlington
Office for the Protection of Research Subjects	University of Texas, Arlington
Institutional Animal Care and Use Committee	University of Texas, Arlington
Department of Contracts and Grants	University of Texas, Arlington
Department of Animal Resources	University of Texas, Arlington
Targeted detection of allergies in Quinoa Flour ...	University of Maryland College...

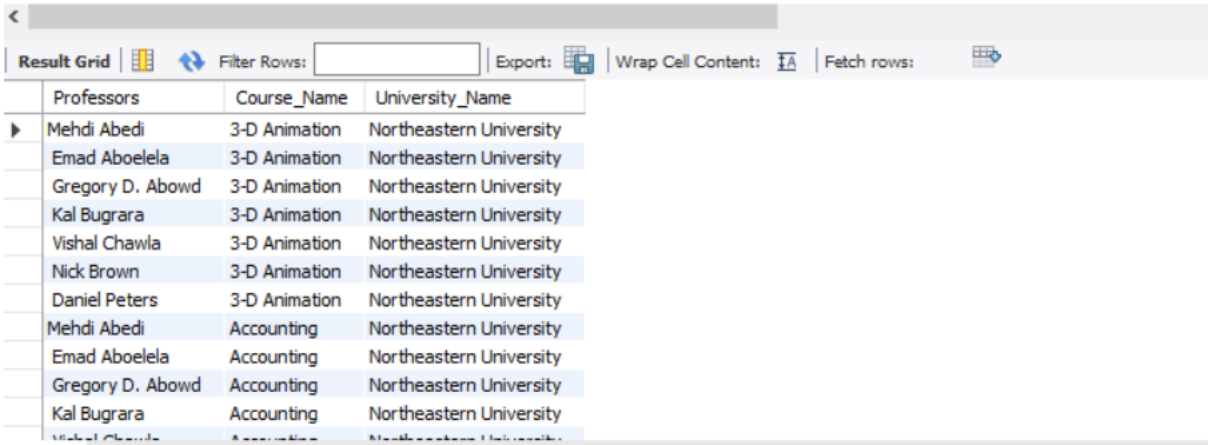
VIEWS w.r.t New Tables:

1. **Display the list of all the courses offered by a university along with the list of all the professors present in the university.**
   Description: This query returns a list of professors along with their university ID and the courses offered by that university
   Actor: Student
   Precondition: The student must select a professor
   Steps:
   Actor Action: The student views the professor teaching a particular course from a university
   System Response: The system displays a list of all the professors from a university along with the professors
   Postcondition: A list is generated of all the professors at a university along with their courses

SQL Query:

Create view v1 as
select P.Professors, C.Course_Name, UD.University_Name
from course C, professor P, university_details UD
where P.University_ID = C.University_ID and P.university_ID = UD.University_ID
and UD.University_ID = C.University_ID



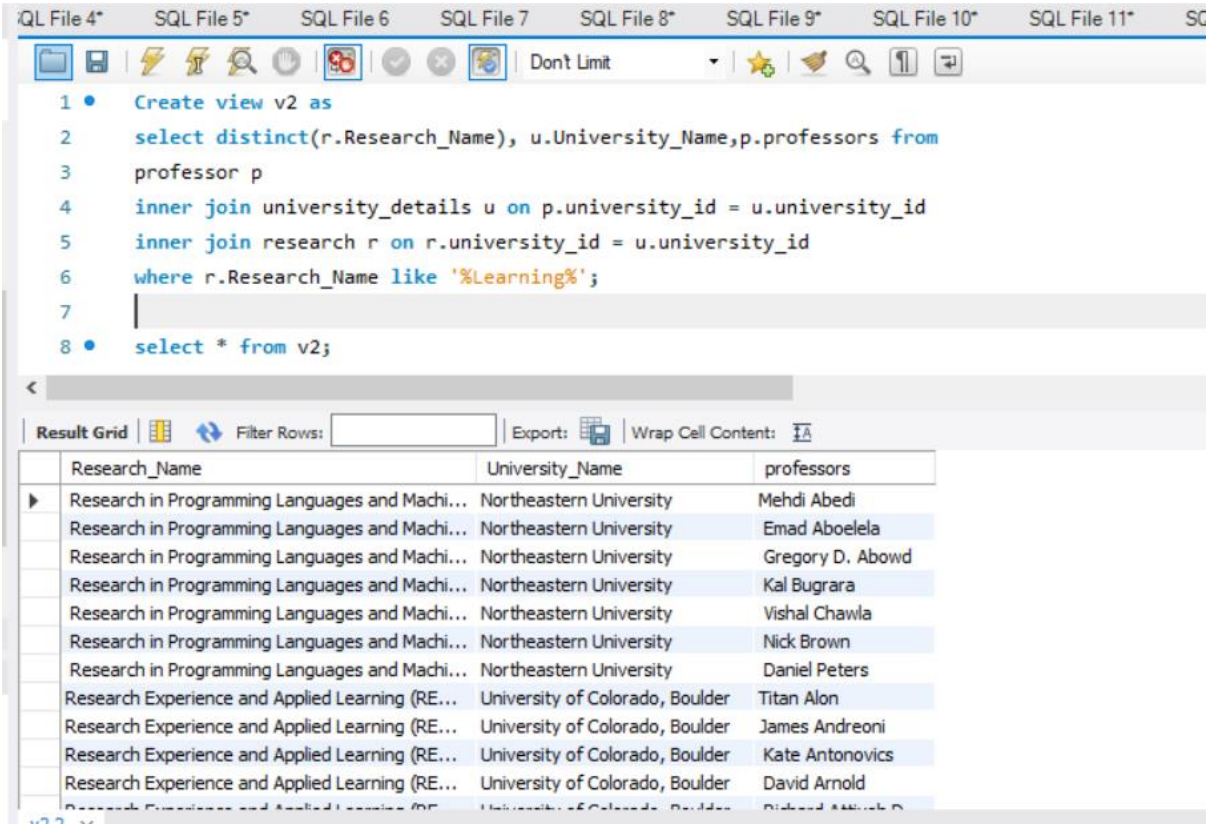


Professors	Course_Name	University_Name
Mehdi Abedi	3-D Animation	Northeastern University
Emad Aboelela	3-D Animation	Northeastern University
Gregory D. Abowd	3-D Animation	Northeastern University
Kal Bugrara	3-D Animation	Northeastern University
Vishal Chawla	3-D Animation	Northeastern University
Nick Brown	3-D Animation	Northeastern University
Daniel Peters	3-D Animation	Northeastern University
Mehdi Abedi	Accounting	Northeastern University
Emad Aboelela	Accounting	Northeastern University
Gregory D. Abowd	Accounting	Northeastern University
Kal Bugrara	Accounting	Northeastern University

2. **Search for a distinct research opportunity (for example – Machine Learning) available in a particular university along with the list of all the professors of that university.**
   Description: This query returns a list of ongoing research in a university under a professor
   Actor: Student
   Precondition: The student must select research opportunities
   Steps:
   Actor Action: The student views the ongoing research from a university
   System Response: The system displays all the ongoing research from a university under the professor
   Postcondition: The system generates a list of ongoing research

   SQL Query:

```
Create view v2 as
select distinct(r.Research_Name), u.University_Name,p.professors from
professor p
inner join university_details u on p.university_id = u.university_id
inner join research r on r.university_id = u.university_id
where r.Research_Name like '%Learning%';
```

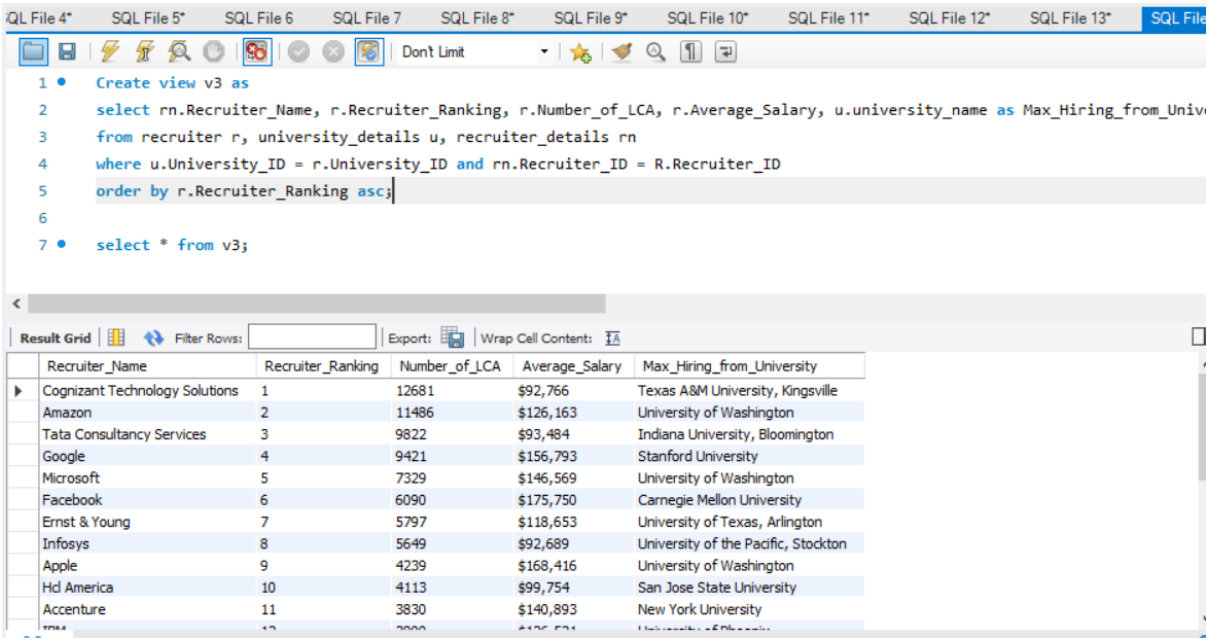


3. **Display the recruiter ranking along with the average salary and the university from which it hires the maximum number of students**

Description: Display a list of recruiters along with the average salary that they offer and the maximum number of students they hire from a particular university
Actor: Student
Precondition: The student must select a list of top recruiters
Steps:
Actor Action: The student views the recruiters along with the average package
System Response: The system displays a list of all the recruiters and the university from which they hire the maximum number of students
Postcondition: The system generates a list of recruiters

SQL Query:

```
Create view v3 as
select rn.Recruiter_Name, r.Recruiter_Ranking, r.Number_of_LCA,
r.Average_Salary, u.university_name as Max_Hiring_from_University
from recruiter r, university_details u, recruiter_details rn
where u.University_ID = r.University_ID and rn.Recruiter_ID = R.Recruiter_ID
order by r.Recruiter_Ranking asc;
```

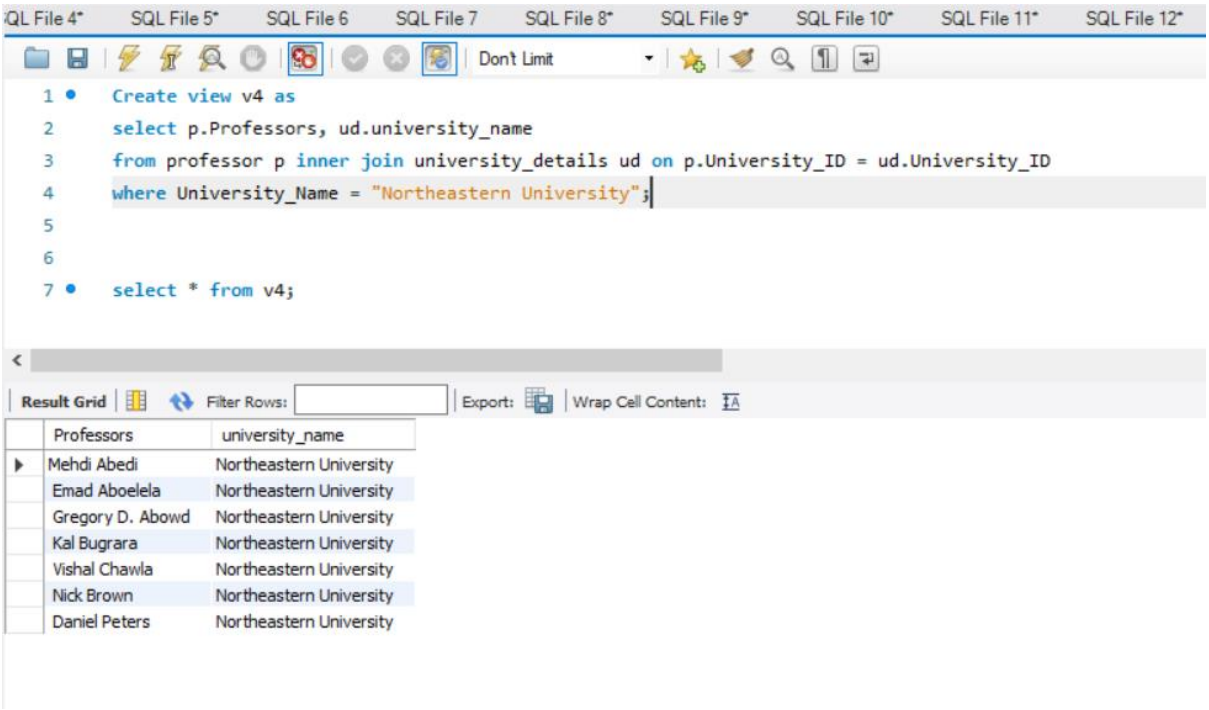


Recruiter_Name	Recruiter_Ranking	Number_of_LCA	Average_Salary	Max_Hiring_from_University
Cognizant Technology Solutions	1	12681	$92,766	Texas A&M University, Kingsville
Amazon	2	11486	$126,163	University of Washington
Tata Consultancy Services	3	9822	$93,484	Indiana University, Bloomington
Google	4	9421	$156,793	Stanford University
Microsoft	5	7329	$146,569	University of Washington
Facebook	6	6090	$175,750	Carnegie Mellon University
Ernst & Young	7	5797	$118,653	University of Texas, Arlington
Infosys	8	5649	$92,689	University of the Pacific, Stockton
Apple	9	4239	$168,416	University of Washington
Hcl America	10	4113	$99,754	San Jose State University
Accenture	11	3830	$140,893	New York University

4. **Display the list of all the professors that teach under a particular university.**
Description: The student views the professors from a particular university
Actor: Student
Precondition: The student must select a university
Steps:

Actor Action: The student views the professor from a particular university
System Response: The system generates a list of professors from a university
Postcondition: The system generates all the professors

SQL Query:
Create view v4 as
select p.Professors, ud.university_name
from professor p inner join university_details ud on p.University_ID = ud.University_ID
where University_Name = "Northeastern University"

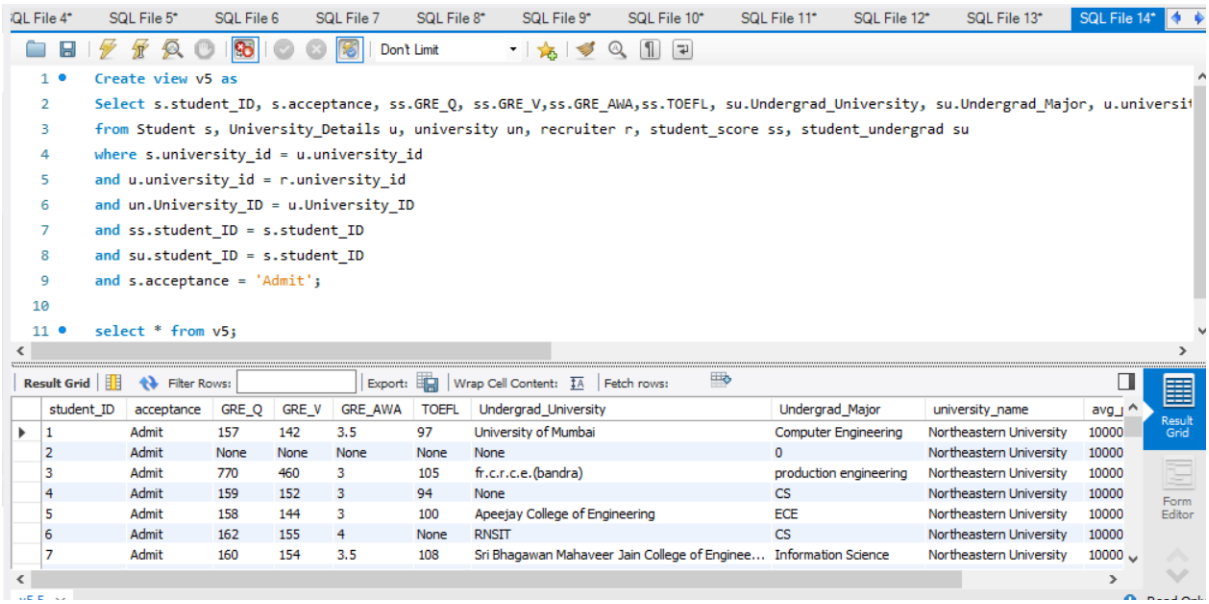


5. **Display the conditions on which a student is admitted to a university along with their graduate major, and average pay scale after graduation**

Description: Displays the entire academics of a student based on admit
Actor: Student
Precondition: The student must select a student ID
Steps:
Actor Action: The student selects a student ID and views the entire academic
System Response: The system generates a list of all the admitted students
Postcondition: A list is generated with all the amidst

SQL Query:
Create view v5 as

Select s.student_ID, s.acceptance, ss.GRE_Q,
ss.GRE_V,ss.GRE_AWA,ss.TOEFL, su.Undergrad_University,
su.Undergrad_Major, u.university_name, un.avg_pay_scale, r.university_id
from Student s, University_Details u, university un, recruiter r, student_score
ss, student_undergrad su
where s.university_id = u.university_id
and u.university_id = r.university_id
and un.University_ID = u.University_ID
and ss.student_ID = s.student_ID
and su.student_ID = s.student_ID
and s.acceptance = 'Admit';



6. **Display the list of a specific course offered by all the universities.**

Description: This query returns a value of all the universities that provide a particular course

Actor: Student

Precondition: The student must select a course

Steps:

Actor Action: The student selects a particular course that he wishes to be enrolled for

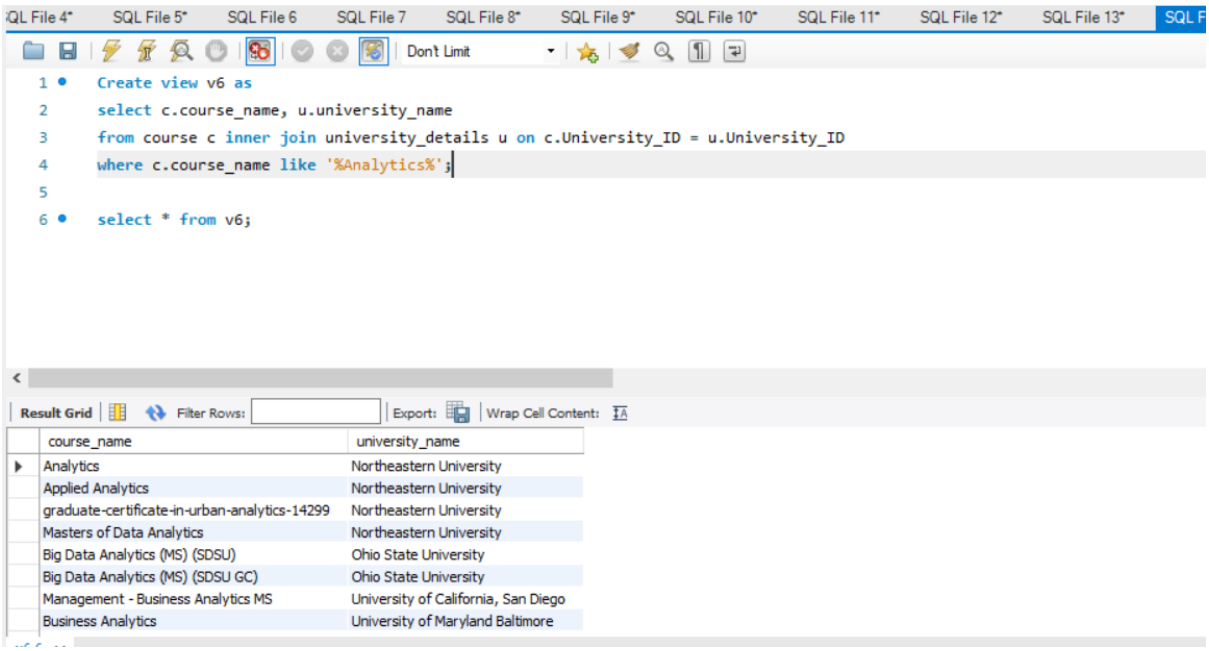
System Response: The system displays a list of all the universities that provide that particular course

Postcondition: A list of all the universities that offer analytics courses is displayed

SQL Query:

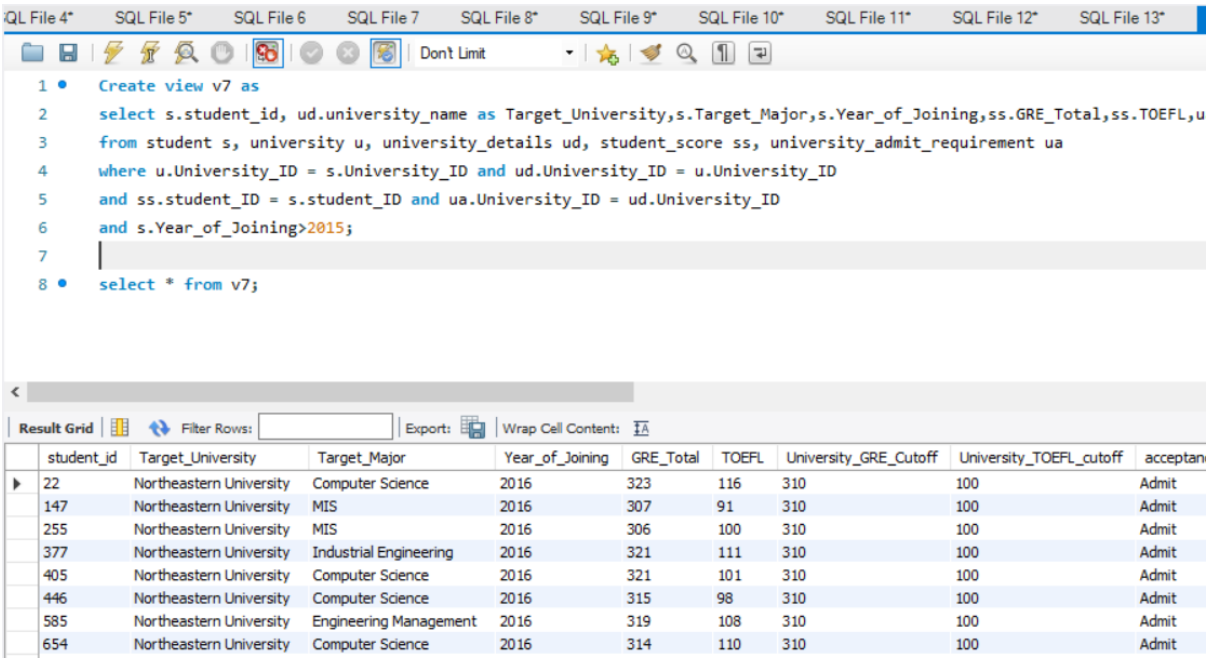
Create view v6 as
select c.course_name, u.university_name

from course c inner join university_details u on c.University_ID = u.University_ID
where c.course_name like '%Analytics%';



7. **Display the data about previous admits where the year of joining >= 2015**
   Description: To view a list of all the previous admits to a university after 2015
   Actor: The student
   Precondition: The student must select a year
   Steps:
   Actor Action: The student selects the year and displays the admits
   System Response: The system displays a list of all the previous admits
   Postcondition: The list is displayed with all the previous admits

   SQL Query:
   Create view v7 as
   select s.student_id, ud.university_name as
   Target_University,s.Target_Major,s.Year_of_Joining,ss.GRE_Total,ss.TOEFL
   ,ua.GRE as University_GRE_Cutoff,ua.TOEFL as
   University_TOEFL_cutoff,s.acceptance
   from student s, university u, university_details ud, student_score ss,
   university_admit_requirement ua
   where u.University_ID = s.University_ID and ud.University_ID =
   u.University_ID
   and ss.student_ID = s.student_ID and ua.University_ID = ud.University_ID
   and s.Year_of_Joining>2015;

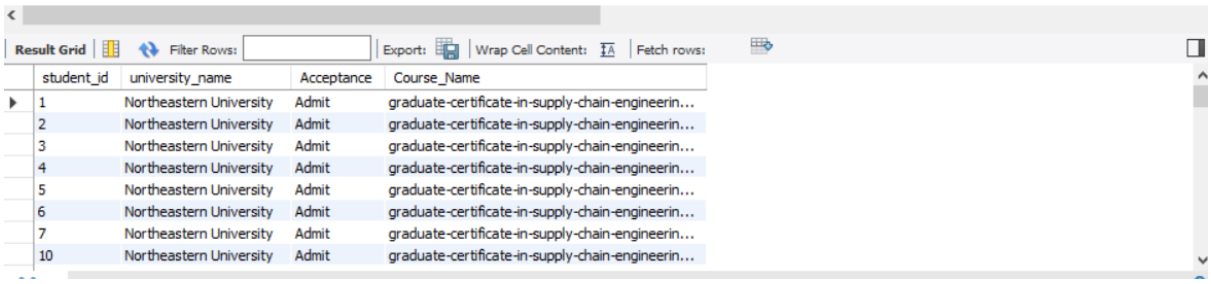


student_id	Target_University	Target_Major	Year_of_Joining	GRE_Total	TOEFL	University_GRE_Cutoff	University_TOEFL_cutoff	acceptan
22	Northeastern University	Computer Science	2016	323	116	310	100	Admit
147	Northeastern University	MIS	2016	307	91	310	100	Admit
255	Northeastern University	MIS	2016	306	100	310	100	Admit
377	Northeastern University	Industrial Engineering	2016	321	111	310	100	Admit
405	Northeastern University	Computer Science	2016	321	101	310	100	Admit
446	Northeastern University	Computer Science	2016	315	98	310	100	Admit
585	Northeastern University	Engineering Management	2016	319	108	310	100	Admit
654	Northeastern University	Computer Science	2016	314	110	310	100	Admit

8. **Display the list of courses choices based on specifications a student can select from post getting the admit.**
   Description: To view a list of all the possible choices student has
   Actor: Student
   Precondition: The student must select a course name for acceptance
   Steps:
   Actor Action: The student must select a course name
   System Response: A list is displayed with all the possible admits a student has from a university
   Postcondition: A list is displayed with all possible universities

   SQL Query:
   Create view v8 as
   select s.student_id, ud.university_name,s.Acceptance,c.Course_Name from student s join course c on c.University_ID = s.University_ID join university_details ud on ud.university_id = c.University_ID and s.Acceptance = 'Admit' and c.Course_Name like '%Engineering%';

```
1   Create view v8 as
2   select s.student_id, ud.university_name,s.Acceptance,c.Course_Name from student s join course c on c.University_ID = s.Unive
3
4 • select * from v8;
```

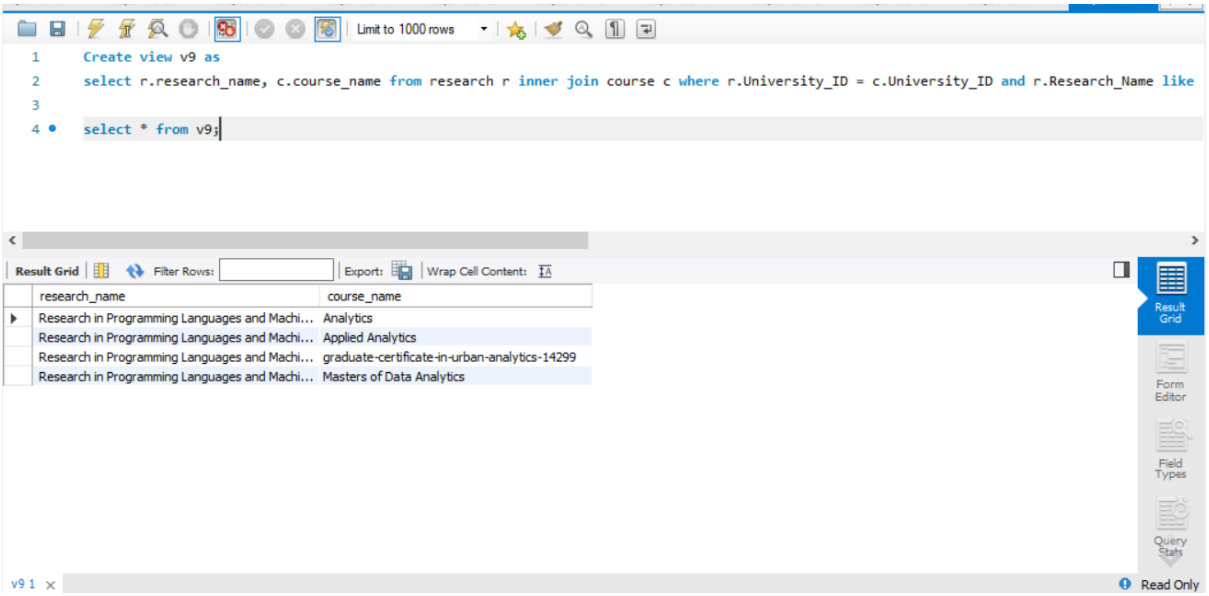


Result Grid | Filter Rows: | Export: | Wrap Cell Content: | Fetch rows:

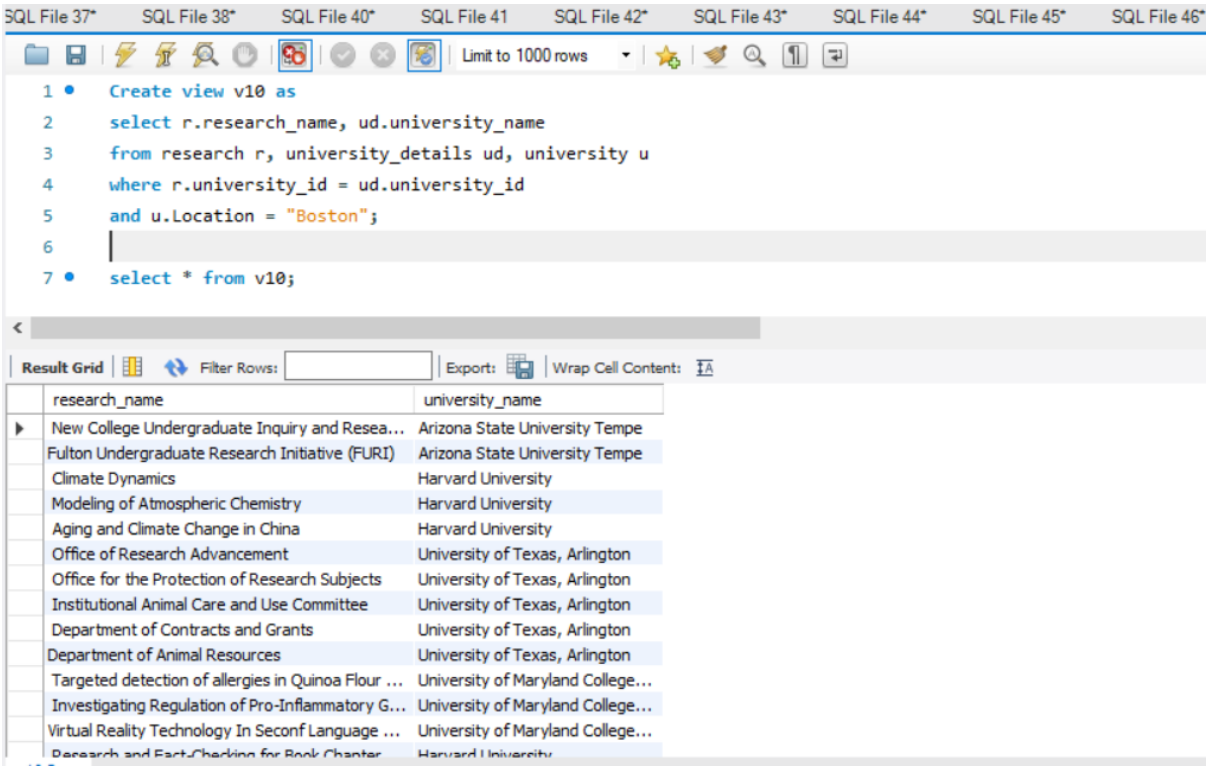
student_id	university_name	Acceptance	Course_Name
1	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
2	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
3	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
4	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
5	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
6	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
7	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...
10	Northeastern University	Admit	graduate-certificate-in-supply-chain-engineerin...

9. **Display the list of desired research opportunities available in a university based on the course selection of a student.**
   Description: To view the list of all the research in a particular course
   Actor: Student
   Precondition: The student must select a research domain say Machine Learning
   Steps:
   Actor Action: The student must select a domain for research
   System Response: The system displays a list of all the research in a particular course
   Postcondition: A list is displayed with all the research going on in a course

   SQL Query:
   Create view v9 as
   select r.research_name, c.course_name from research r inner join course c where r.University_ID = c.University_ID and r.Research_Name like '%Machine Learning%' and course_name in (select Course_Name from course where course_name like '%Analytics%');



10. **Display the list of research opportunities available in an university based on the location of the university.**
    Description: To display a list of research going in a particular location in which the university exists
    Actor: Student
    Precondition: The student must select a location
    Steps:
    Actor Action: The student selects a location to look for research
    System Response: The system displays a list of universities in that location where research is going on
    Postcondition: A list is displayed with the research going in a particular location in which the university exists
    SQL Query:
    Create view v10 as
    select r.research_name, ud.university_name
    from research r, university_details ud, university u
    where r.university_id = ud.university_id
    and u.Location = "Boston";


SQL File 37*
SQL File 38*
SQL File 40*
SQL File 41
SQL File 42*
SQL File 43*
SQL File 44*
SQL File 45*
SQL File 46*
Limit to 1000 rows
1 • Create view v10 as
2 select r.research_name, ud.university_name
3 from research r, university_details ud, university u
4 where r.university_id = ud.university_id
5 and u.Location = "Boston";
6
7 • select * from v10;
Result Grid
Filter Rows:
Export:
Wrap Cell Content:
research_name
university_name
New College Undergraduate Inquiry and Resea...
Arizona State University Tempe
Fulton Undergraduate Research Initiative (FURI)
Arizona State University Tempe
Climate Dynamics
Harvard University
Modeling of Atmospheric Chemistry
Harvard University
Aging and Climate Change in China
Harvard University
Office of Research Advancement
University of Texas, Arlington
Office for the Protection of Research Subjects
University of Texas, Arlington
Institutional Animal Care and Use Committee
University of Texas, Arlington
Department of Contracts and Grants
University of Texas, Arlington
Department of Animal Resources
University of Texas, Arlington
Targeted detection of allergies in Quinoa Flour ...
University of Maryland College...
Investigating Regulation of Pro-Inflammatory G...
University of Maryland College...
Virtual Reality Technology In Seconf Language ...
University of Maryland College...

SAMPLE OUTPUT FROM ALL THE TABLES:

1. Course:

```
1   select * from course;
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

ID	University_ID	Course_Name
6	1	Adult-Gerontology Acute Care Nursing (CAGS)
7	1	Adult-Gerontology Primary Care Nursing (CAGS)
8	1	Advanced and Intelligent Manufacturing
9	1	Agile Project Management
10	1	Analytics
11	1	Applied Analytics
12	1	master-of-sports-leadership-boston-267
13	1	master-of-sports-leadership-online-268
14	1	master-of-sports-leadership-charlotte-14376
15	1	graduate-certificate-in-supply-chain-engineerin...
16	1	graduate-certificate-in-supply-chain-manageme...
17	1	graduate-certificate-in-supply-chain-manageme...
18	1	graduate-certificate-in-sustainability-and-busin...

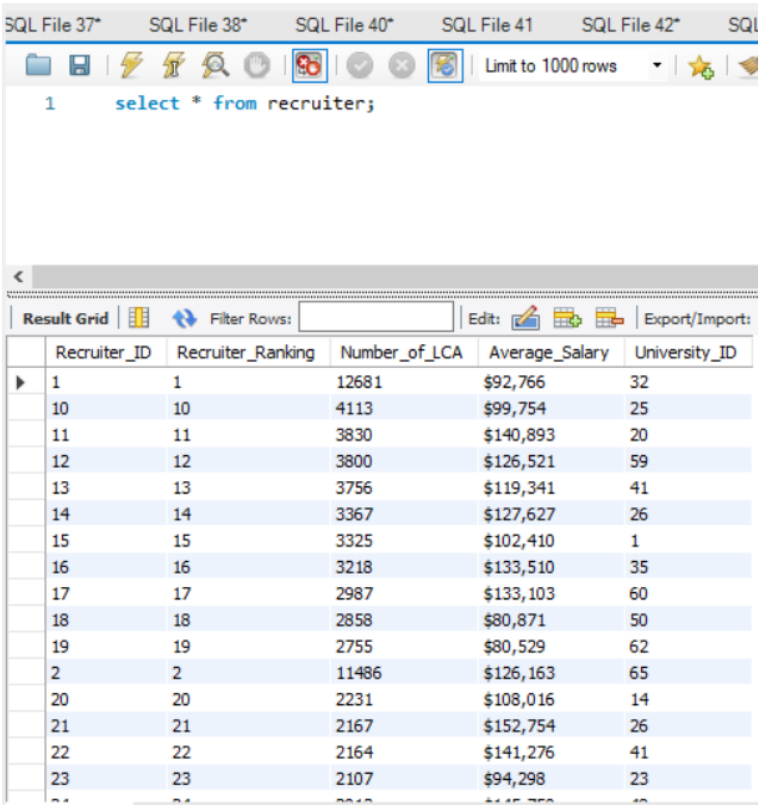
2. Professor:

```
1   select * from professor;
```

Result Grid | Filter Rows: | Edit:

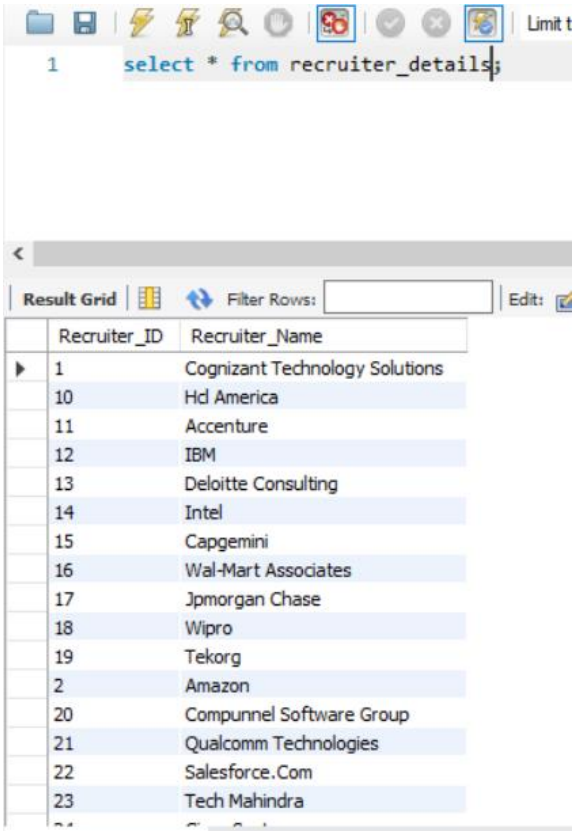
ID	University_ID	Professors
1	58	Pieter Abbeel
2	58	Rediet Abebe
3	58	Ahmed Alaa
4	58	Elad Alon
5	58	Venkat Anantharam
6	58	Gopala Krishna Anumanchipalli
7	58	Mekhail Anwar
8	58	Murat Arcak Ana Claudia Arias
9	58	David Attwood
10	58	Babak Ayazifar
11	36	Titan Alon
12	36	James Andreoni
13	36	Kate Antonovics

3. Recruiter



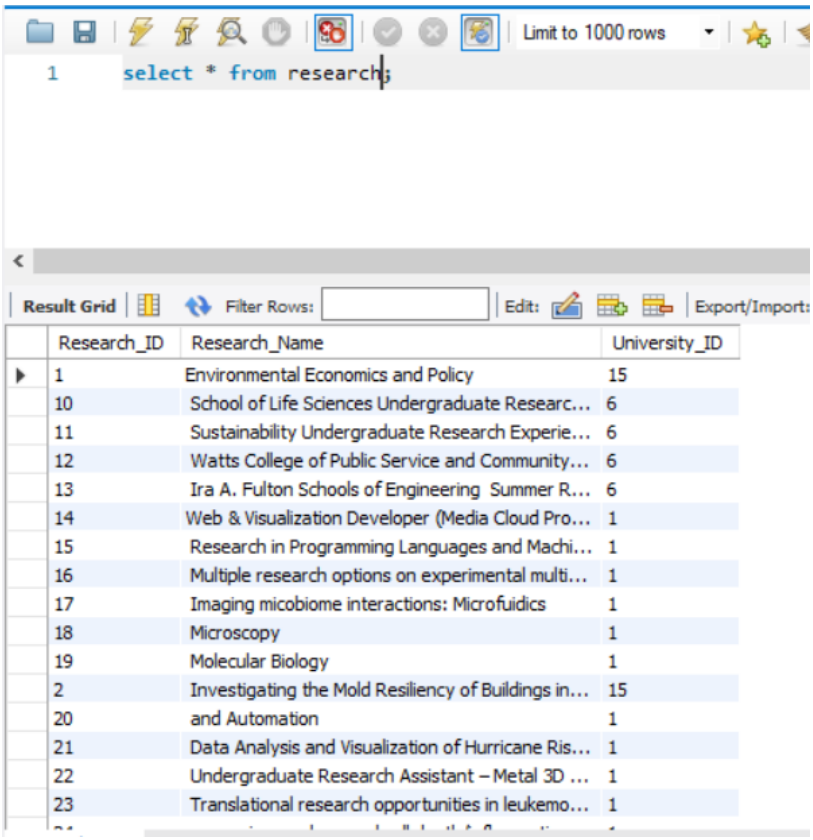
Recruiter_ID	Recruiter_Ranking	Number_of_LCA	Average_Salary	University_ID
1	1	12681	$92,766	32
10	10	4113	$99,754	25
11	11	3830	$140,893	20
12	12	3800	$126,521	59
13	13	3756	$119,341	41
14	14	3367	$127,627	26
15	15	3325	$102,410	1
16	16	3218	$133,510	35
17	17	2987	$133,103	60
18	18	2858	$80,871	50
19	19	2755	$80,529	62
2	2	11486	$126,163	65
20	20	2231	$108,016	14
21	21	2167	$152,754	26
22	22	2164	$141,276	41
23	23	2107	$94,298	23

4. Recruiter_Details



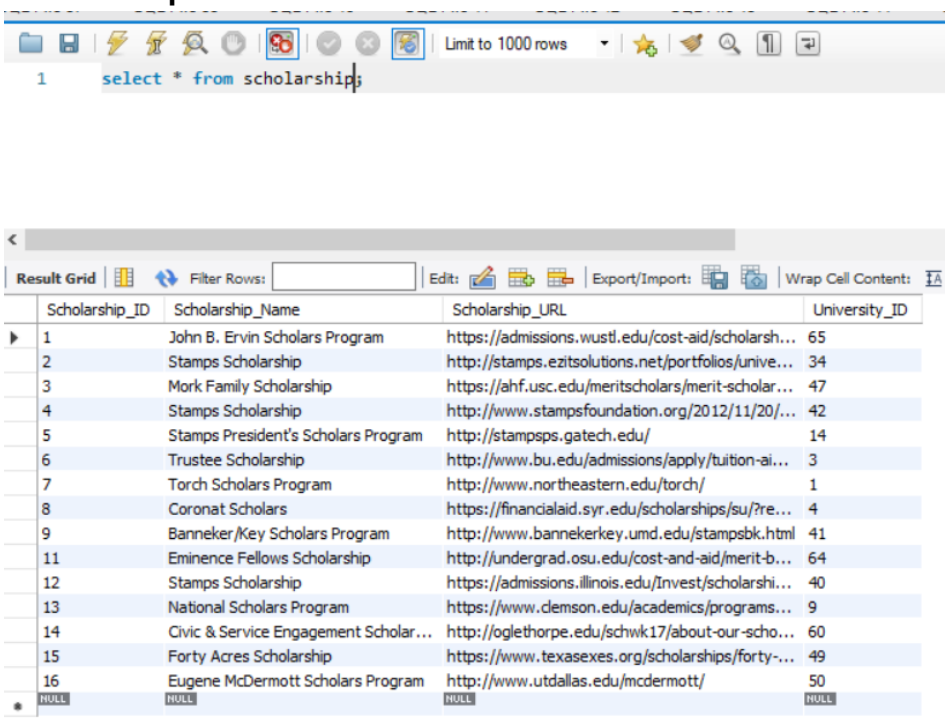
Recruiter_ID	Recruiter_Name
1	Cognizant Technology Solutions
10	Hcl America
11	Accenture
12	IBM
13	Deloitte Consulting
14	Intel
15	Capgemini
16	Wal-Mart Associates
17	Jpmorgan Chase
18	Wipro
19	Tekorg
2	Amazon
20	Compunnel Software Group
21	Qualcomm Technologies
22	Salesforce.Com
23	Tech Mahindra

5. **Research**



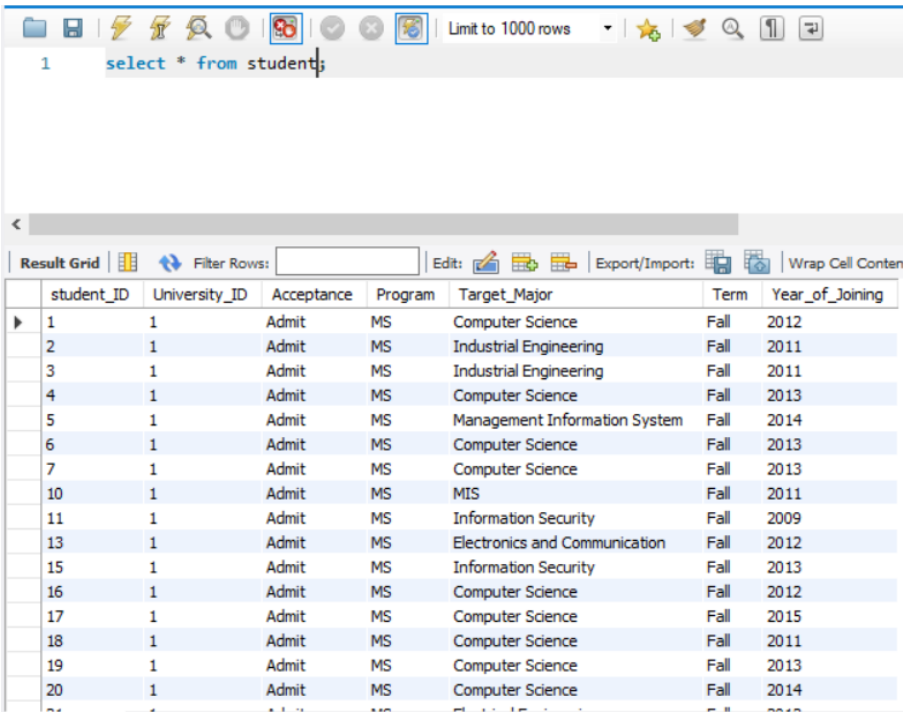
Research_ID	Research_Name	University_ID
1	Environmental Economics and Policy	15
10	School of Life Sciences Undergraduate Researc...	6
11	Sustainability Undergraduate Research Experie...	6
12	Watts College of Public Service and Community...	6
13	Ira A. Fulton Schools of Engineering Summer R...	6
14	Web & Visualization Developer (Media Cloud Pro...	1
15	Research in Programming Languages and Machi...	1
16	Multiple research options on experimental multi...	1
17	Imaging micobiome interactions: Microfuidics	1
18	Microscopy	1
19	Molecular Biology	1
2	Investigating the Mold Resiliency of Buildings in...	15
20	and Automation	1
21	Data Analysis and Visualization of Hurricane Ris...	1
22	Undergraduate Research Assistant – Metal 3D ...	1
23	Translational research opportunities in leukemo...	1

6. **Scholarship**



Scholarship_ID	Scholarship_Name	Scholarship_URL	University_ID
1	John B. Ervin Scholars Program	https://admissions.wustl.edu/cost-aid/scholarsh...	65
2	Stamps Scholarship	http://stamps.ezitsolutions.net/portfolios/unive...	34
3	Mork Family Scholarship	https://ahf.usc.edu/meritscholars/merit-scholar...	47
4	Stamps Scholarship	http://www.stampsfoundation.org/2012/11/20/...	42
5	Stamps President's Scholars Program	http://stampsps.gatech.edu/	14
6	Trustee Scholarship	http://www.bu.edu/admissions/apply/tuition-ai...	3
7	Torch Scholars Program	http://www.northeastern.edu/torch/	1
8	Coronat Scholars	https://financialaid.syr.edu/scholarships/su/?re...	4
9	Banneker/Key Scholars Program	http://www.bannekerkey.umd.edu/stampsbk.html	41
11	Eminence Fellows Scholarship	http://undergrad.osu.edu/cost-and-aid/merit-b...	64
12	Stamps Scholarship	https://admissions.illinois.edu/Invest/scholarshi...	40
13	National Scholars Program	https://www.clemson.edu/academics/programs...	9
14	Civic & Service Engagement Scholar...	http://oglethorpe.edu/schwk17/about-our-scho...	60
15	Forty Acres Scholarship	https://www.texasexes.org/scholarships/forty-...	49
16	Eugene McDermott Scholars Program	http://www.utdallas.edu/mcdermott/	50
NULL	NULL	NULL	NULL

7. **Student**

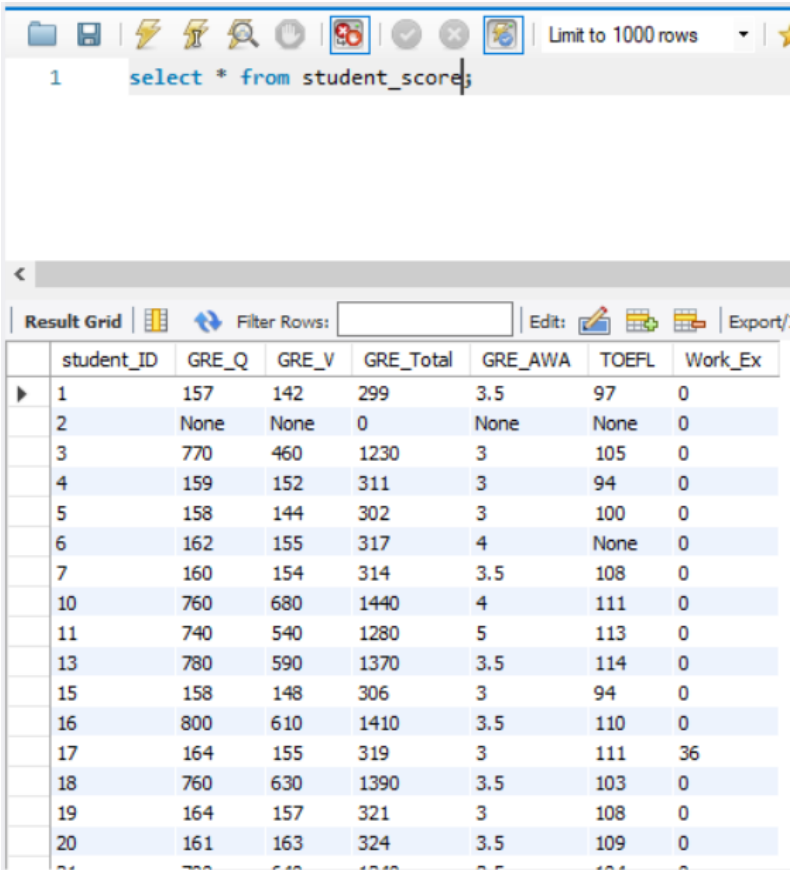


```
1   select * from student;
```

Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Conten

student_ID	University_ID	Acceptance	Program	Target_Major	Term	Year_of_Joining
1	1	Admit	MS	Computer Science	Fall	2012
2	1	Admit	MS	Industrial Engineering	Fall	2011
3	1	Admit	MS	Industrial Engineering	Fall	2011
4	1	Admit	MS	Computer Science	Fall	2013
5	1	Admit	MS	Management Information System	Fall	2014
6	1	Admit	MS	Computer Science	Fall	2013
7	1	Admit	MS	Computer Science	Fall	2013
10	1	Admit	MS	MIS	Fall	2011
11	1	Admit	MS	Information Security	Fall	2009
13	1	Admit	MS	Electronics and Communication	Fall	2012
15	1	Admit	MS	Information Security	Fall	2013
16	1	Admit	MS	Computer Science	Fall	2012
17	1	Admit	MS	Computer Science	Fall	2015
18	1	Admit	MS	Computer Science	Fall	2011
19	1	Admit	MS	Computer Science	Fall	2013
20	1	Admit	MS	Computer Science	Fall	2014

8. **Student_Score**

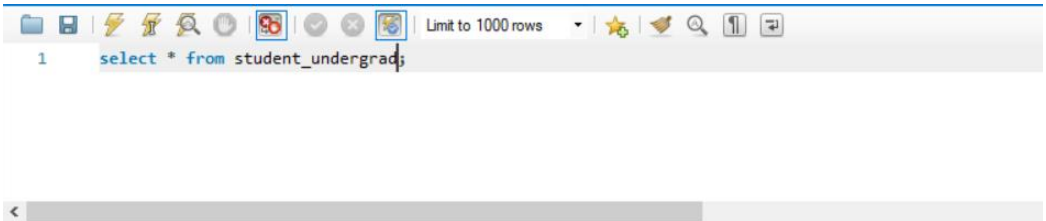


```
1   select * from student_score;
```

Result Grid | Filter Rows: | Edit: | Export/

student_ID	GRE_Q	GRE_V	GRE_Total	GRE_AWA	TOEFL	Work_Ex
1	157	142	299	3.5	97	0
2	None	None	0	None	None	0
3	770	460	1230	3	105	0
4	159	152	311	3	94	0
5	158	144	302	3	100	0
6	162	155	317	4	None	0
7	160	154	314	3.5	108	0
10	760	680	1440	4	111	0
11	740	540	1280	5	113	0
13	780	590	1370	3.5	114	0
15	158	148	306	3	94	0
16	800	610	1410	3.5	110	0
17	164	155	319	3	111	36
18	760	630	1390	3.5	103	0
19	164	157	321	3	108	0
20	161	163	324	3.5	109	0

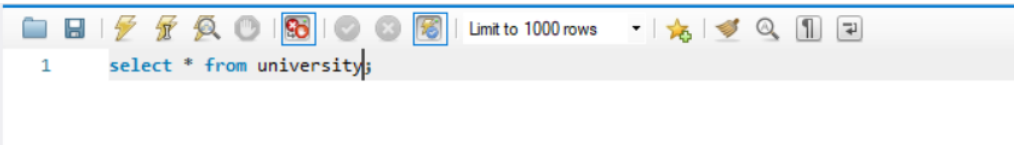
9. Student_Undergrad



Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content: | Fetch rows:

student_ID	Undergrad_University	Undergrad_Major	CGPA	CGPA_Scale
29	MU	IT	5.7	10
30	Jaypee Institute of Information Technology	Electroincs and Teleco...	8.8	10
31	Jai Narain Vyas University Jodhpur	Electrical Engineering	6.7	10
32	University of Mumbai	Computer	6.4	10
33	Anna University	Information Technology	7.12	10
34	JNTU	ece	7.1	10

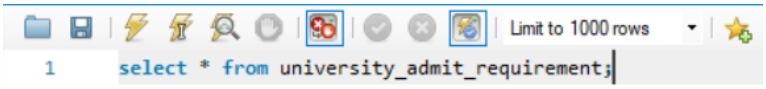
10. University

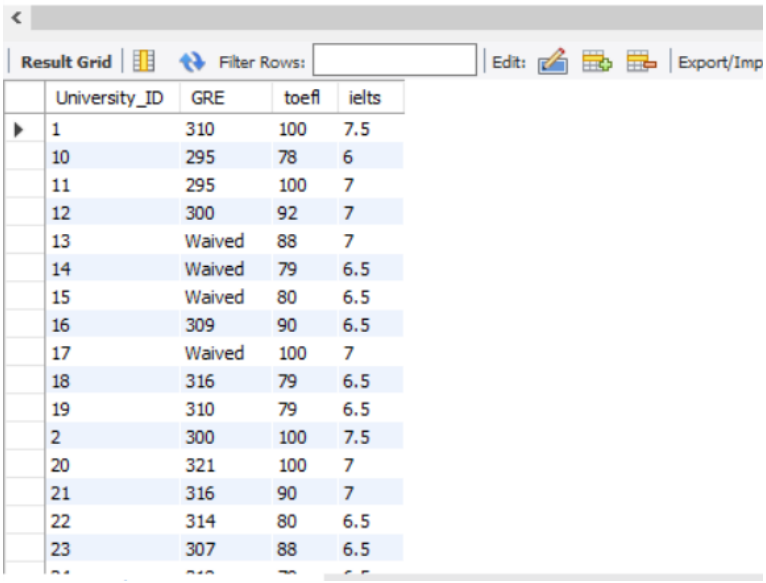


Result Grid | Filter Rows: | Edit: | Export/Import: | Wrap Cell Content:

University_ID	avg_pay_scale	Duration	Term	Year_of_Joining	Major	Avg_Fees	Location	Cost_of_Living
1	100000	2	Fall	2022	MSIS	54000	Boston	9600
10	36100	1.8	Fall	2022	MSIS	21702	Cleveland	24693
11	113700	2	Fall	2022	MSCS	29500	Ithaca	19726
12	24249	2	Fall	2022	MSCS	16860	Canada	16776
13	56200	2	Fall	2022	MSCS	22110	Virginia	59782
14	94000	2	Fall	2022	MSCS	18225	Atlanta	55672
15	128900	1.8	Fall	2022	MSCS	89952	Boston	83463
16	68647	2	Fall	2022	MSCS	26336	Chicago	12600
17	136000	1.8	Fall	2023	MSCS	24375	Indiana	38680
18	60156	2	Fall	2022	MSCS	23790	Iowa	35004
19	45700	2	Fall	2023	MSCS	14385	Kansas	15046
2	90000	2	Fall	2022	MSCS	60000	Texas	7800
20	83000	2	Fall	2022	MSCS	35982	New York	40000
21	71128	2	Fall	2022	MCE	29145	New York	83250
22	30000	2	Fall	2022	MSDA	28155	Pennsylv...	30000
23	56197	1	Fall	2023	MSBA	54176	New York	72128

11. University Admit Requirement





University_ID	GRE	toefl	ielts
1	310	100	7.5
10	295	78	6
11	295	100	7
12	300	92	7
13	Waived	88	7
14	Waived	79	6.5
15	Waived	80	6.5
16	309	90	6.5
17	Waived	100	7
18	316	79	6.5
19	310	79	6.5
2	300	100	7.5
20	321	100	7
21	316	90	7
22	314	80	6.5
23	307	88	6.5

12. University Details

University_ID	University_Name
1	Northeastern University
10	Cleveland State University
11	Cornell University
12	Dalhousie University
13	George Mason University
14	Georgia Institute of Technology
15	Harvard University
16	Illinios Institute of Technology, Chicago
17	Indiana University, Bloomington
18	Iowa State University
19	Kansas State University
2	University of Texas, San Antonio
20	New York University
21	NYU Tandon School of Engineering
22	Pennsylvania State University
23	Rochester Institute of Technology