

Homework 4

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Due 11:59PM June 5, 2018. **READ ALL DIRECTIONS VERY CAREFULLY!** Submit your code, tex files along with a generated PDF. **DO NOT SUBMIT DATA FILES!** For this homework you will be working in groups of two, a group of three will only be allowed with approval due to odd number of students. All programs will be evaluated on the CSIF. Upload your files as a tar gzip file (tgz). Only submit one homework per partner group. This specification is subject to change.

You are designing a database for a university called FakeU. As a trial you have been provided grade data from courses for departments ABC and DEF. The grade data is from Summer of 1989 until Summer of 2012. The data provided is in CSV format, and is only as complete as could be made possible. There may be errors, omissions or redundant data in the files. FakeU like UC Davis is on a quarter system, however they have recently transitioned to a single summer quarter instead of two summer sessions. This has corrupted some of their summer data as all summer session classes have now been grouped into a single summer quarter term. Each course has a course ID (CID), a term it was offered (TERM), a subject (SUBJ), a course number (CRSE), a section (SEC), and number of units (UNITS). Within a course there listings of meetings, the instructor of the meeting (INSTRUCTOR(S)), meeting type (TYPE), day of meeting (DAYS), time of meeting (TIME), meeting building (BUILD), and meeting room (ROOM) are also listed. For each student that takes the course there is a student seat (SEAT), a student ID (SID), the students surname (SURNAME), the students preferred name (PREFNAME), the students (LEVEL), the number of units the student is receiving (UNITS), the students class standing (CLASS), the students major (MAJOR), the grade the student received in the course (GRADE), the students registration status (STATUS), and the students e-mail address (EMAIL). There may be courses that are cross listed between the two departments (e.g. ABC 123 may be cross listed as DEF 456).

You **MUST** put each problem on a separate page with 1a on the second page, for example 1a will be on page 2 and 1b will be on page 3 (this template is already setup for this). You **MUST** put your name and student ID in the provided author section above. **FAILURE TO DO SO MAY RESULT IN NO CREDIT!** The data will be provided on Canvas, and the CSV files will also be on the CSIF in /home/cjnitta/ecs165a/Grades. All submissions will be compared with MOSS, including against past submissions.

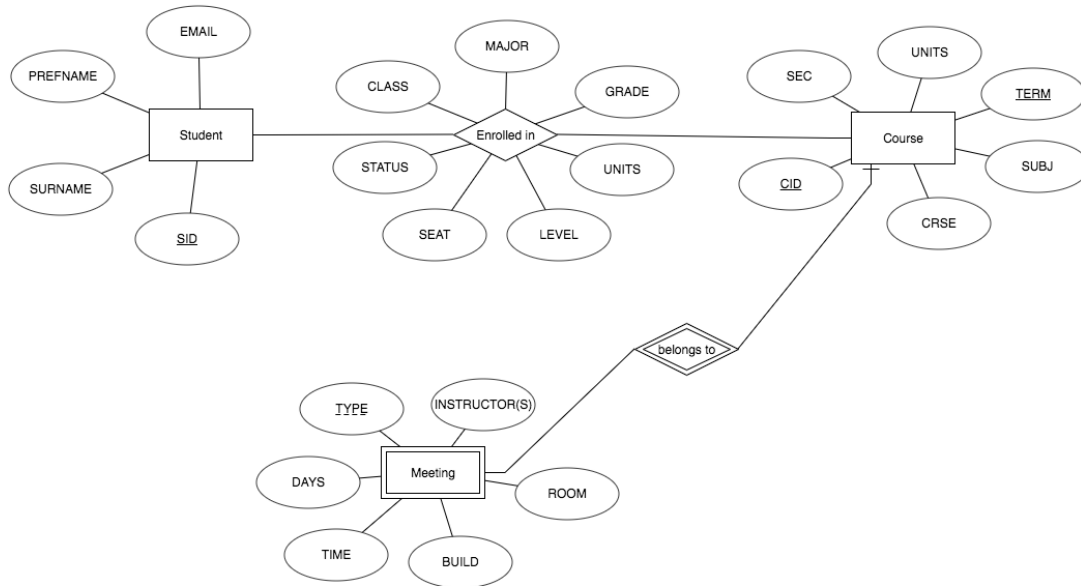
Some useful tips:

- When loading the tuples into the database, insert them in batches. Inserting one tuple at a time may cause the program to take on the order of tens of minutes or hours instead of a few minutes.
- Test a subset of the data first.

Part 1

You will be creating a database schema for your grade data.

- Provide an ER diagram for your database schema. Only include images generated from vector based programs.



- b. Provide a description of the tables in your schema, and their attributes. Make sure you describe how you will store the instructor, student, building, course, etc. information.

The relations are the following:

Course(CID, TERM, SUBJ, CRSE, SEC, UNITS)
Meeting(CID, TERM, INSTRUCTOR(S), TYPE, DAYS, TIME, BUILD, ROOM)
Enrolled(CID, TERM, SID, SEAT, LEVEL, UNITS, CLASS, MAJOR, GRADE, STATUS)
Student(SID, SURNAME, PREFNAME, EMAIL)

In the schema we will have four tables: Course, Student, Meeting, and Enrolled.

Course:

We have the following attributes: CID, TERM, SUBJ, CRSE, SEC, UNITS. CID, CRSE, and SEC are INT data types. TERM, SUBJ, and UNITS are VARCHAR data types. The key is $\{CID, TERM\}$.

Meeting:

We have the following attributes: CID, TERM, INSTRUCTOR(S), TYPE, DAYS, TIME, BUILD, and ROOM. CID is a INT data type. The other attributes are stored as VARCHAR. The key is $\{CID, TERM, TYPE\}$.

Enrolled:

We have the following attributes: CID, TERM, SID, SEAT, LEVEL, UNITS, CLASS, MAJOR, GRADE, and STATUS. CID, SID, and SEAT are of type INT. UNITS is of type DECIMAL. The rest are of type VARCHAR. The key is $\{CID, TERM, SID\}$.

Student:

We have the following attributes: SID, SURNAME, PREFNAME, and EMAIL. SID is stored as an INT data type. SURNAME, PREFNAME, and EMAIL are stored as VARCHAR data types. The key is $\{SID\}$.

- c. What are the functional (and multivalued) dependencies that you expect to hold for each relation if any. If you don't expect any to hold, describe why not.
The FD's that should hold are the following:

Student:

$SID \rightarrow PREFNAME \ SURNAME \ EMAIL$

Course:

$CID \ TERM \rightarrow SEC \ UNITS \ SUBJ \ CRSE$

Enrolled:

$CID \ TERM \ SID \rightarrow SEAT \ LEVEL \ UNITS \ CLASS \ MAJOR \ GRADE \ STATUS$

Meeting:

$CID \ TERM \ TYPE \rightarrow INSTRUCTOR(S) \ DAYS \ TIME \ BUILD \ ROOM$

The MD's that should hold are the following:

Student:

$SID \twoheadrightarrow PREFNAME \ SURNAME \ EMAIL$

$SID \twoheadrightarrow PREFNAME$

$SID \twoheadrightarrow SURNAME \ EMAIL$

$SID \twoheadrightarrow SURNAME$

$SID \twoheadrightarrow PREFNAME \ EMAIL$

$SID \twoheadrightarrow EMAIL$

$SID \twoheadrightarrow SURNAME \ PREFNAME$

Course:

$CID \ TERM \twoheadrightarrow SEC \ UNITS \ SUBJ \ CRSE$

$CID \ TERM \twoheadrightarrow SEC$

$CID \ TERM \twoheadrightarrow UNITS \ SUBJ \ CRSE$

$CID \ TERM \twoheadrightarrow UNITS$

$CID \ TERM \twoheadrightarrow SEC \ SUBJ \ CRSE$

$CID \ TERM \twoheadrightarrow SUBJ$

$CID \ TERM \twoheadrightarrow SEC \ UNITS \ CRSE$

$CID \ TERM \twoheadrightarrow CRSE$

$CID \ TERM \twoheadrightarrow SEC \ SUBJ \ UNITS$

Enrolled:

$CID \ TERM \ SID \twoheadrightarrow SEAT \ LEVEL \ UNITS \ CLASS \ MAJOR \ GRADE \ STATUS$

$CID \ TERM \ SID \twoheadrightarrow SEAT$

$CID \ TERM \ SID \twoheadrightarrow LEVEL \ UNITS \ CLASS \ MAJOR \ GRADE \ STATUS$

$CID \ TERM \ SID \twoheadrightarrow LEVEL$

$CID \ TERM \ SID \twoheadrightarrow SEAT \ UNITS \ CLASS \ MAJOR \ GRADE \ STATUS$

$CID \ TERM \ SID \twoheadrightarrow UNITS$

$CID \ TERM \ SID \twoheadrightarrow SEAT \ LEVEL \ CLASS \ MAJOR \ GRADE \ STATUS$

$CID \ TERM \ SID \twoheadrightarrow CLASS$

$CID \ TERM \ SID \twoheadrightarrow SEAT \ LEVEL \ UNITS \ MAJOR \ GRADE \ STATUS$

$CID \ TERM \ SID \twoheadrightarrow MAJOR$

$CID \ TERM \ SID \twoheadrightarrow SEAT \ LEVEL \ UNITS \ CLASS \ GRADE \ STATUS$

$CID \ TERM \ SID \twoheadrightarrow GRADE$

CID TERM SID → SEAT LEVEL UNITS CLASS MAJOR STATUS
CID TERM SID → STATUS
CID TERM SID → SEAT LEVEL UNITS CLASS MAJOR GRADE

Meeting:

CID TERM TYPE → INSTRUCTOR(S) DAYS TIME BUILD ROOM
CID TERM TYPE → INSTRUCTOR(S)
CID TERM TYPE → DAYS TIME BUILD ROOM
CID TERM TYPE → DAYS
CID TERM TYPE → INSTRUCTOR(S) TIME BUILD ROOM
CID TERM TYPE → TIME
CID TERM TYPE → INSTRUCTOR(S) DAYS BUILD ROOM
CID TERM TYPE → INSTRUCTOR(S) DAYS TIME BUILD R

*CIDTERMINSTRUCTORTYPEDAYSTIME → ROOMBUILD
TYPE → ROOM
TYPE → BUILD*

Part 2

Write a program to load the grade data into a PostgreSQL database called FakeUData that follows your schema. You **MUST** use the database called FakeUData, and should assume it will already be created for you without any tables or data in it. You may **NOT** hardcode usernames in your code, use the USER environmental variable instead if user is needed. Your program can be written in C++ or python, you may **NOT** use standalone SQL or text files that hold your queries. You may **NOT** use shell calls to implement your program. All your queries need to be in your code. If you choose to make a C++ program, you must include a makefile and call the program loadfakeu. Include a readme file with descriptions of any issues/problems. If you choose to make a python program you must specify which version of python you used, and must provide a loadfakeu bash script to launch your python program. The loadfakeu program **MUST** be able to take one optional argument (the directory where the CSV data files will be located). If the argument is omitted, the default is the current working directory. Scripts that require greater than 10 minutes to load all of the data may lose points.

Part 3

Write another program to query your database to calculate the following values, put the results in your write up, some may be best described with a chart instead of raw values. Name your program queryfakeu, it must output the data values for the following queries. The query program does not have to do everything in the SQL queries, but should limit the amount of data transfered. For example it is acceptable to have one SQL query for each unit number (1 - 20) for 3a, but it would be unacceptable to pull all student data on a per student basis and calculate the results.

- a. Calculate the percent of students that attempt 1 - 20 units of ABC or DEF per quarter for every unit increment (e.g. 1, 2, 3, ...).

```
units, percent
(1, 12.181803682578057)
(2, 2.6949890244567842)
(3, 7.75633034916078)
(4, 64.56725300830615)
(5, 6.164351939292445)
(6, 0.3408084547358524)
(7, 0.36892934940001765)
(8, 0.5275815610873973)
(9, 0.17628023520819955)
(10, 0.3382901656614496)
(11, 1.406464448053992)
(12, 1.4060447332082584)
(13, 0.0)
(14, 0.0)
(15, 0.0)
(16, 0.0)
(17, 0.0)
(18, 0.0)
(19, 0.0)
(20, 0.0)
```

- b. Find the easiest and hardest instructors based upon the grades of all the students they have taught in their courses. Provide their name and the average grade they assigned. (Ignore P/NP, S/NS grades)

```
('EASIEST PROFESSOR:', 'Donaldson, Matthew C.', 'AVG GRADE =', 'A')  
( 'HARDEST PROFESSOR:', 'White, Jose E.', 'AVG GRADE =', 'F')
```


- c. Calculate the average GPA for the students that take each number of units from part a. Assume that the grades have standard grade points ($A+ = 4.0$, $A = 4.0$, $A- = 3.7$, $B+ = 3.3...$).

```
units, avg_gpa
(1, 3.4460335195530725)
(2, 3.4527367506516073)
(3, 3.2978867570106)
(4, 2.8106758472706037)
(5, 2.6782091136553188)
(6, 0)
(7, 0)
(8, 0)
(9, 0)
(10, 0)
(11, 0)
(12, 0)
(13, 0)
(14, 0)
(15, 0)
(16, 0)
(17, 0)
(18, 0)
(19, 0)
(20, 0)
```

- d. Find the courses with the highest and lowest pass rates. Assume that F, NP, and NS are not passing grades.

Courses with the highest pass rate:

subj, course, pass_rate

('ABC', 110, 1.0)
('ABC', 111, 1.0)
('ABC', 114, 1.0)
('ABC', 215, 1.0)
('ABC', 223, 1.0)
('ABC', 225, 1.0)
('ABC', 231, 1.0)
('ABC', 233, 1.0)
('ABC', 244, 1.0)
('ABC', 249, 1.0)
('ABC', 250, 1.0)
('ABC', 252, 1.0)
('ABC', 255, 1.0)
('ABC', 259, 1.0)
('ABC', 260, 1.0)
('ABC', 302, 1.0)
('ABC', 303, 1.0)
('ABC', 311, 1.0)
('ABC', 313, 1.0)
('ABC', 315, 1.0)
('ABC', 317, 1.0)
('ABC', 318, 1.0)
('ABC', 321, 1.0)
('ABC', 323, 1.0)
('ABC', 326, 1.0)
('ABC', 327, 1.0)
('ABC', 328, 1.0)
('ABC', 333, 1.0)
('ABC', 334, 1.0)
('ABC', 340, 1.0)
('ABC', 341, 1.0)
('ABC', 342, 1.0)
('ABC', 343, 1.0)
('ABC', 345, 1.0)
('ABC', 346, 1.0)
('ABC', 349, 1.0)
('ABC', 351, 1.0)
('ABC', 352, 1.0)
('ABC', 353, 1.0)
('ABC', 357, 1.0)
('ABC', 358, 1.0)
('ABC', 359, 1.0)
('ABC', 361, 1.0)
('ABC', 362, 1.0)
('ABC', 364, 1.0)
('ABC', 368, 1.0)
('ABC', 369, 1.0)
('ABC', 372, 1.0)

('ABC', 373, 1.0)
('ABC', 374, 1.0)
('ABC', 377, 1.0)
('DEF', 105, 1.0)
('DEF', 213, 1.0)
('DEF', 216, 1.0)
('DEF', 217, 1.0)
('DEF', 218, 1.0)
('DEF', 224, 1.0)
('DEF', 236, 1.0)
('DEF', 237, 1.0)
('DEF', 240, 1.0)
('DEF', 255, 1.0)
('DEF', 260, 1.0)
('DEF', 272, 1.0)
('DEF', 278, 1.0)
('DEF', 282, 1.0)
('DEF', 287, 1.0)
('DEF', 288, 1.0)
('DEF', 293, 1.0)
('DEF', 295, 1.0)
('DEF', 298, 1.0)
('DEF', 302, 1.0)
('DEF', 303, 1.0)
('DEF', 304, 1.0)
('DEF', 305, 1.0)
('DEF', 306, 1.0)
('DEF', 307, 1.0)
('DEF', 310, 1.0)
('DEF', 313, 1.0)
('DEF', 314, 1.0)
('DEF', 316, 1.0)
('DEF', 319, 1.0)
('DEF', 320, 1.0)
('DEF', 322, 1.0)
('DEF', 323, 1.0)
('DEF', 324, 1.0)
('DEF', 325, 1.0)
('DEF', 328, 1.0)
('DEF', 329, 1.0)
('DEF', 332, 1.0)
('DEF', 333, 1.0)
('DEF', 337, 1.0)
('DEF', 338, 1.0)
('DEF', 339, 1.0)
('DEF', 341, 1.0)
('DEF', 343, 1.0)
('DEF', 345, 1.0)
('DEF', 348, 1.0)
('DEF', 349, 1.0)
('DEF', 351, 1.0)
('DEF', 352, 1.0)
('DEF', 353, 1.0)
('DEF', 354, 1.0)

```
('DEF', 355, 1.0)
('DEF', 362, 1.0)
('DEF', 363, 1.0)
('DEF', 364, 1.0)
('DEF', 365, 1.0)
('DEF', 366, 1.0)
('DEF', 368, 1.0)
('DEF', 369, 1.0)
('DEF', 375, 1.0)
('DEF', 376, 1.0)
('DEF', 378, 1.0)
('DEF', 380, 1.0)
('DEF', 381, 1.0)
('DEF', 382, 1.0)
('DEF', 386, 1.0)
('DEF', 387, 1.0)
('DEF', 388, 1.0)
('DEF', 390, 1.0)
('DEF', 393, 1.0)
('DEF', 397, 1.0)
('DEF', 398, 1.0)
('DEF', 401, 1.0)
('DEF', 403, 1.0)
('DEF', 404, 1.0)
('DEF', 408, 1.0)
('DEF', 410, 1.0)
('DEF', 411, 1.0)
('DEF', 412, 1.0)
('DEF', 414, 1.0)
('DEF', 419, 1.0)
('DEF', 420, 1.0)
('DEF', 422, 1.0)
('DEF', 423, 1.0)
('DEF', 424, 1.0)
('DEF', 425, 1.0)
```

Courses with the lowest pass rate:

```
subj, course, pass_rate
```

```
('DEF', 290, 0.2)
```

- e. Find the list of courses that must be cross listed as they have the same meeting times during the normal quarters. Only list the pair once, put the course name/number string in alphabetically order of the pairs.

CID	SUBJ	CRSE	CID	SUBJ	CRSE
(10203, 'ABC', 101, 53432, 'DEF', 427)					
(10287, 'ABC', 105, 26153, 'DEF', 248)					
(10463, 'ABC', 105, 60070, 'DEF', 426)					
(10508, 'ABC', 101, 18909, 'DEF', 250)					
(10753, 'ABC', 108, 19318, 'DEF', 259)					
(10862, 'ABC', 105, 68968, 'DEF', 417)					
(10862, 'ABC', 234, 68968, 'DEF', 417)					
(10895, 'ABC', 105, 92684, 'DEF', 415)					
(10919, 'ABC', 101, 34391, 'DEF', 417)					
(10938, 'ABC', 251, 29212, 'DEF', 240)					
(11159, 'ABC', 108, 51162, 'DEF', 426)					
(11280, 'ABC', 105, 76252, 'DEF', 417)					
(11280, 'ABC', 230, 76252, 'DEF', 417)					
(11329, 'ABC', 101, 21880, 'DEF', 228)					
(11439, 'ABC', 106, 23956, 'DEF', 426)					
(11439, 'ABC', 106, 97206, 'DEF', 226)					
(11627, 'ABC', 108, 60099, 'DEF', 285)					
(11627, 'ABC', 108, 86488, 'DEF', 426)					
(11733, 'ABC', 216, 67422, 'DEF', 254)					
(11733, 'ABC', 216, 97732, 'DEF', 254)					
(11751, 'ABC', 106, 41489, 'DEF', 417)					
(11759, 'ABC', 101, 53700, 'DEF', 201)					
(11830, 'ABC', 371, 12617, 'DEF', 258)					
(11830, 'ABC', 371, 15809, 'DEF', 258)					
(11830, 'ABC', 371, 21915, 'DEF', 258)					
(11830, 'ABC', 371, 27972, 'DEF', 258)					
(11830, 'ABC', 371, 31725, 'DEF', 258)					
(11830, 'ABC', 371, 53884, 'DEF', 258)					
(11919, 'ABC', 103, 95714, 'DEF', 219)					
(11955, 'ABC', 105, 48912, 'DEF', 342)					
(12041, 'ABC', 232, 26751, 'DEF', 223)					
(12041, 'ABC', 376, 26751, 'DEF', 223)					
(12561, 'ABC', 216, 80785, 'DEF', 254)					
(12561, 'ABC', 216, 87587, 'DEF', 254)					
(12745, 'ABC', 108, 75358, 'DEF', 285)					
(12993, 'ABC', 337, 74029, 'DEF', 381)					
(13123, 'ABC', 106, 69690, 'DEF', 417)					
(13476, 'ABC', 105, 55162, 'DEF', 253)					
(13508, 'ABC', 108, 14216, 'DEF', 286)					
(13509, 'ABC', 101, 75242, 'DEF', 240)					
(13516, 'ABC', 101, 28565, 'DEF', 417)					
(13529, 'ABC', 103, 60825, 'DEF', 417)					
(13586, 'ABC', 376, 21880, 'DEF', 228)					
(13795, 'ABC', 221, 36037, 'DEF', 258)					
(13795, 'ABC', 221, 36037, 'DEF', 417)					
(13829, 'ABC', 105, 53192, 'DEF', 426)					
(14536, 'ABC', 216, 16260, 'DEF', 254)					

(14556, 'ABC', 221, 76609, 'DEF', 300)
(14610, 'ABC', 105, 90336, 'DEF', 285)
(14821, 'ABC', 204, 25874, 'DEF', 417)
(14912, 'ABC', 105, 61036, 'DEF', 417)
(15549, 'ABC', 367, 56207, 'DEF', 259)
(15549, 'ABC', 367, 64604, 'DEF', 259)
(15622, 'ABC', 101, 43059, 'DEF', 381)
(15626, 'ABC', 101, 52410, 'DEF', 426)
(16350, 'ABC', 376, 18888, 'DEF', 258)
(16358, 'ABC', 101, 51747, 'DEF', 201)
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(17373, 'ABC', 106, 41489, 'DEF', 417)
(17462, 'ABC', 105, 52018, 'DEF', 219)
(18423, 'ABC', 101, 24301, 'DEF', 285)
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(18553, 'ABC', 105, 32992, 'DEF', 252)
(18553, 'ABC', 105, 87936, 'DEF', 252)
(18572, 'ABC', 101, 28947, 'DEF', 235)
(18759, 'ABC', 101, 58057, 'DEF', 286)
(18977, 'ABC', 216, 27222, 'DEF', 254)
(19608, 'ABC', 356, 58269, 'DEF', 258)
(19713, 'ABC', 101, 58057, 'DEF', 286)
(19813, 'ABC', 103, 72055, 'DEF', 417)
(19841, 'ABC', 216, 73107, 'DEF', 254)
(20288, 'ABC', 106, 52929, 'DEF', 234)
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(21217, 'ABC', 105, 36037, 'DEF', 417)
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(21564, 'ABC', 106, 34952, 'DEF', 426)
(22134, 'ABC', 101, 52410, 'DEF', 426)
(22134, 'ABC', 108, 52410, 'DEF', 426)
(22484, 'ABC', 218, 37206, 'DEF', 255)
(23267, 'ABC', 261, 50663, 'DEF', 258)
(23267, 'ABC', 261, 58522, 'DEF', 258)
(23267, 'ABC', 261, 67190, 'DEF', 258)
(23267, 'ABC', 261, 73317, 'DEF', 258)
(23267, 'ABC', 261, 87760, 'DEF', 258)
(23267, 'ABC', 261, 90376, 'DEF', 258)
(23520, 'ABC', 103, 66670, 'DEF', 259)
(23574, 'ABC', 105, 61036, 'DEF', 417)
(23582, 'ABC', 103, 36037, 'DEF', 258)
(23582, 'ABC', 103, 36037, 'DEF', 417)

(23622, 'ABC', 101, 36514, 'DEF', 244)
(23622, 'ABC', 101, 36514, 'DEF', 426)
(23925, 'ABC', 103, 61831, 'DEF', 426)
(23925, 'ABC', 256, 61831, 'DEF', 426)
(24126, 'ABC', 261, 59876, 'DEF', 220)
(24150, 'ABC', 104, 57815, 'DEF', 417)
(24150, 'ABC', 221, 57815, 'DEF', 417)
(24449, 'ABC', 103, 60339, 'DEF', 304)
(24524, 'ABC', 108, 52018, 'DEF', 219)
(24631, 'ABC', 101, 32755, 'DEF', 426)
(24686, 'ABC', 108, 54504, 'DEF', 426)
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(24686, 'ABC', 261, 54504, 'DEF', 426)
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(27096, 'ABC', 106, 93977, 'DEF', 238)
(27208, 'ABC', 101, 43059, 'DEF', 381)
(27535, 'ABC', 103, 60825, 'DEF', 417)
(27725, 'ABC', 216, 96190, 'DEF', 254)
(27807, 'ABC', 106, 32482, 'DEF', 426)
(27966, 'ABC', 105, 38306, 'DEF', 417)
(28049, 'ABC', 201, 87716, 'DEF', 103)
(28117, 'ABC', 216, 63190, 'DEF', 254)
(28138, 'ABC', 105, 98470, 'DEF', 357)
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(28751, 'ABC', 103, 60684, 'DEF', 285)
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(28947, 'ABC', 101, 56956, 'DEF', 214)
(28947, 'ABC', 101, 90967, 'DEF', 235)
(29162, 'ABC', 209, 36420, 'DEF', 300)
(29162, 'ABC', 378, 36420, 'DEF', 300)
(29214, 'ABC', 103, 88384, 'DEF', 379)
(29358, 'ABC', 103, 57572, 'DEF', 285)
(29358, 'ABC', 220, 57572, 'DEF', 285)
(29525, 'ABC', 106, 65085, 'DEF', 252)
(29750, 'ABC', 378, 99335, 'DEF', 258)
(29809, 'ABC', 105, 76252, 'DEF', 417)
(30182, 'ABC', 105, 36037, 'DEF', 258)
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(30688, 'ABC', 107, 51162, 'DEF', 426)
(30853, 'ABC', 101, 53432, 'DEF', 427)
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(31165, 'ABC', 103, 90041, 'DEF', 417)
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(32508, 'ABC', 106, 56956, 'DEF', 214)
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- f. Find the major that performs the best/worst on average in ABC courses. Repeat the analysis for DEF courses as well.

ABC	
Best Major	
	O100
	O113
	O139
	O151
	O167
	O169
	O171
	O176
	O179
	O193
	O207
	O255
	O264
	O275
Worst Major	
	O152
	O263
	O279
	O281

DEF	
Best Major	
	O122
	O145
	O149
	O168
	O184
	O187
	O194
	O195
	O206
	O234
	O255
	O264
	O269
	OT63
Best Major	
	O196
	O279
	OT96

- g. Find the top 5 majors that students transfer from into ABC. What is the percent of students from each of those majors compared to overall transfers?

Major	Percent
DEF2	18.0890126754959
OT16	12.4117546751549
DEF1	12.2992099130336
OT35	5.6977206843631
OT26	4.85192974478486

- h. Find the top 5 majors that students transfer to from ABC. What is the percent of students to each of those majors compared to overall transfers out?

Major	Percent
DEF1	0.303
DEF2	0.134
OTH8	0.100
O174	0.0408
OT35	0.0323

Part 4

Extra credit: The Efficient XML Interchange (EXI) is a format for the compact representation of XML information. The CSV files provided for this assignment have been consolidated into a single EXI file (HW4Grades.exi) that is available in the resources section of Canvas. Implement a separate program that it can load the database from the EXI file. You may **NOT** use shell calls, or creation of external temporary files for this part. Name your program or bash script loadfakeuexi.

Part 5

Extra credit: Additional queries/query program.

- a. Find the courses that appear to be prerequisites for ABC 203, ABC 210, and ABC 222. For this problem list the courses that the X% of students have taken for every 5% increment from 50% - 100% prior to taking the course. (Add this output to your query program.)

- b. Write a program that will find an open room for course expansion. The program must prompt for term, CID, and number students to add. The room(s) returned should be ordered from best to worst fit with up to 5 results. Assume that each room capacity is the maximum number of students listed for any particular meeting in the data files (don't forget that lectures may be split across multiple CIDs). Name this program findroomfakeu.