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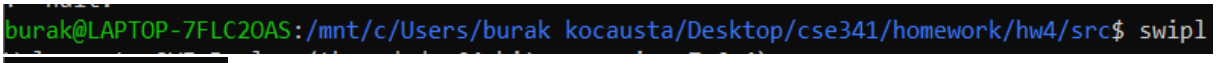
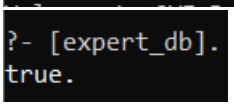
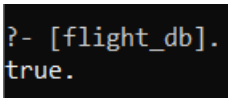
CSE 341 – HW4

How to run:

1- 

2- 

for loading expert database

3- 

for loading flight database

Part 1: expert_db

Explanation of Part 1

1- Student and Queries

- Students have id, course list, and handicap state.

student(ID, Courses, Handicap). : gives all students in the database

student(001, Courses, Handicap). : gives all information of student id with 001

student(ID, Courses, yes). : gives all students which are handicapped.

add_student(ID, Courses, Handicap). : adds a student to the database.

2- Course and Queries

- Courses have id, instructor, capacity, hours, room, and special requirements. Hours are held in an array; each element of that array means that this course is hold at that hour. (Example: [8, 9, 10] -> this course is held at 8:00, 9:00, 10:00)

course(ID, Instructor, Capacity, Hours, Room, Special_Requirements). : gives all courses in the database

If any of the parameters on that query is changed with a variable, it gives all specific courses for that variable.

course(ID, inst01, Capacity, Hours, Room, Special_Requirements). : gives all courses which are given by inst01.

3- Room and Queries

- Rooms have id, capacity, hours, equipment list. Hour's format is similar to the Course. It holds all hours, which means that room is available on that hour.

room(ID, Capacity, Hours, Equipments): gives all rooms.

occupancy(Room, Course, Hours): gives all occupied rooms, with their course, and hour information. It can be find out with providing variable to one of the parameters to listing all occupancy information for that situation.

4- Instructor and Queries

- Instructors have id, courses, and preferences list.

instructor(ID, Courses, Preferences): gives all instructors.

5- Other Queries

conflict(cse102, cse101): checks if there is a scheduling conflict between cse102, and cse101.

conflict(cse102, Course): lists all the courses which have a scheduling conflict with cse102.

available_rooms(cse102, z23): checks if z23 is available for cse102.

available_rooms(cse102, Room): gives all the rooms, that are available for cse102.

available_rooms(Course, Room): lists all the courses, and their available rooms.

enroll(012, cse222): returns true if 012 id student can be enrolled to the cse222.

enroll(012, Course): lists all the courses that 012 student can enroll(assign).

Test Part 1

List All Students

```
?- [expert_db].
true.

?- student(ID, Courses, Handicap).
ID = 1,
Courses = [cse222, cse496, cse102, cse341],
Handicap = no ;
ID = 2,
Courses = [cse101, cse102],
Handicap = yes ;
ID = 3,
Courses = [cse102, cse331, cse421],
Handicap = no ;
ID = 4,
Courses = [cse421, cse447, cse441],
Handicap = no ;
ID = 5,
Courses = [cse101, cse321, cse201],
Handicap = no ;
ID = 6,
Courses = [cse321, cse421, cse331],
Handicap = no ;
ID = 7,
Courses = [cse101, cse321, cse201, cse496, cse111],
Handicap = no ;
ID = 8,
Courses = [cse321, cse421, cse331, cse447, cse211],
Handicap = no ;
ID = 9,
Courses = [cse101, cse321, cse201, cse496, cse111, cse211],
Handicap = no ;
ID = 10,
Courses = [cse321, cse421, cse331, cse447, cse211, cse311],
Handicap = no ;
```

```
ID = 11,
Courses = [cse101, cse321, cse201],
Handicap = no ;
ID = 12,
Courses = [cse201, cse421, cse102],
Handicap = yes ;
ID = 13,
Courses = [cse101, cse321, cse201, cse496, cse111],
Handicap = no ;
ID = 14,
Courses = [cse321, cse421, cse331, cse447, cse211],
Handicap = no ;
ID = 15,
Courses = [cse101, cse321, cse201, cse496, cse111, cse211],
Handicap = no ;
ID = 16,
Courses = [cse321, cse421, cse331, cse447, cse211, cse311],
Handicap = no ;
ID = 17,
Courses = [cse101, cse321, cse201],
Handicap = no ;
ID = 18,
Courses = [cse321, cse421, cse331],
Handicap = no ;
ID = 19,
Courses = [cse101, cse321, cse201, cse496, cse111],
Handicap = no ;
ID = 20,
Courses = [cse447, cse211],
Handicap = no.
```

List all handicapped students

```
?- student(ID, Courses, yes).
ID = 2,
Courses = [cse101, cse102] ;
ID = 12,
Courses = [cse201, cse421, cse102].
```

get 001 id student information

```
?- student(001, Courses, Handicap).
Courses = [cse222, cse496, cse102, cse341],
Handicap = no.
```

add student

```
?- add_student(021, [cse102, cse101], no).
true.

?- student(021, Courses, Handicapped).
Courses = [cse102, cse101],
Handicapped = no.
```

list all instructors

```
?- instructor(ID, Courses, Preferences).
ID = inst01,
Courses = [cse222, cse496],
Preferences = [projector] ;
ID = inst02,
Courses = [cse102, cse341],
Preferences = [projector, handicapped] ;
ID = inst03,
Courses = [cse101, cse321],
Preferences = [smartboard] ;
ID = inst04,
Courses = [cse201, cse421],
Preferences = [smartboard, handicapped] ;
ID = inst05,
Courses = [cse331, cse447],
Preferences = [] ;
ID = inst06,
Courses = [cse311, cse441],
Preferences = [smartboard] ;
ID = inst07,
Courses = [cse201],
Preferences = [projector] ;
ID = inst08,
Courses = [cse421],
Preferences = [smartboard] ;
ID = inst09,
Courses = [cse331],
Preferences = [] ;
ID = inst10,
Courses = [cse447],
Preferences = [] ;
ID = inst11,
Courses = [cse311],
Preferences = [smartboard] ;
ID = inst12,
Courses = [cse441],
Preferences = [projector] ;
ID = inst13,
Courses = [cse111],
Preferences = [smartboard] ;
ID = inst14,
Courses = [cse211],
Preferences = [] ;
ID = inst15,
Courses = [cse361],
Preferences = [projector].
```

List all courses

```
?- course(ID, Instructor, Capacity, Hours, Room, Special_Requirements).
ID = cse222,
Instructor = inst01,
Capacity = 70,
Hours = [8, 9],
Room = z23,
Special_Requirements = [projector, smartboard] ;
ID = cse496,
Instructor = inst02,
Capacity = 50,
Hours = [9, 10],
Room = z10,
Special_Requirements = [] ;
ID = cse102,
Instructor = inst03,
Capacity = 60,
Hours = [10, 11],
Room = z23,
Special_Requirements = [smartboard] ;
ID = cse341,
Instructor = inst04,
Capacity = 50,
Hours = [12, 13],
Room = z06,
Special_Requirements = [] ;
```

```
ID = cse101,
Instructor = inst05,
Capacity = 60,
Hours = [11, 12],
Room = z23,
Special_Requirements = [projector] ;
ID = cse321,
Instructor = inst06,
Capacity = 50,
Hours = [15, 16, 17],
Room = z23,
Special_Requirements = [smartboard] ;
ID = cse201,
Instructor = inst07,
Capacity = 60,
Hours = [11, 12],
Room = z10,
Special_Requirements = [projector] ;
ID = cse421,
Instructor = inst08,
Capacity = 50,
Hours = [8, 9, 10],
Room = z11,
Special_Requirements = [smartboard] ;
ID = cse331,
Instructor = inst09,
Capacity = 60,
Hours = [9, 10, 11],
Room = z06,
Special_Requirements = [] ;
```

```
Special_Requirements = [] ;
ID = cse447,
Instructor = inst10,
Capacity = 50,
Hours = [14, 15],
Room = z07,
Special_Requirements = [] ;
ID = cse311,
Instructor = inst11,
Capacity = 60,
Hours = [13, 14],
Room = z23,
Special_Requirements = [smartboard] ;
ID = cse441,
Instructor = inst12,
Capacity = 50,
Hours = [16, 17],
Room = z10,
Special_Requirements = [projector] ;
ID = cse111,
Instructor = inst13,
Capacity = 60,
Hours = [11, 12],
Room = z11,
Special_Requirements = [smartboard] ;
ID = cse211,
Instructor = inst14,
Capacity = 50,
Hours = [12, 13, 14],
Room = z06,
Special_Requirements = [] ;
ID = cse361,
Instructor = inst15,
Capacity = 60,
Hours = [11, 12, 13],
Room = z07,
Special_Requirements = [projector].
```

add course

```
?- add_course(cse215, inst01, 30, [8, 9, 10], z23, [handicapped]).
true.

?- course(cse215, Instructor, Capacity, Hours, Room, Special_Requirements).
Instructor = inst01,
Capacity = 30,
Hours = [8, 9, 10],
Room = z23,
Special_Requirements = [handicapped].
```

List all rooms

```
?- room(ID, Capacity, Hours, Equipments).
ID = z23,
Capacity = 130,
Hours = [8, 9, 10, 11, 12, 13, 14, 15, 16|...],
Equipments = [projector, smartboard, handicapped] ;
ID = z10,
Capacity = 110,
Hours = [8, 9, 10, 11, 12, 13, 14, 15, 16|...],
Equipments = [projector] ;
ID = z11,
Capacity = 120,
Hours = [9, 10, 11, 12, 15, 16],
Equipments = [smartboard] ;
ID = z06,
Capacity = 100,
Hours = [9, 10, 11, 12, 13, 14, 15, 16, 17],
Equipments = [] ;
ID = z07,
Capacity = 80,
Hours = [11, 12, 13, 14, 15],
Equipments = [projector, handicapped].
```

List all occupancy of z23

```
?- occupancy(z23, Course, Hours).
Course = cse222,
Hours = [8, 9] ;
Course = cse102,
Hours = [10, 11] ;
Course = cse321,
Hours = [15, 16, 17] ;
Course = cse311,
Hours = [13, 14].
```

add room

```
?- add_room(z25, 200, [8,9,10,11,12,13,14], [projector, handicapped]).
true.

?- room(z25, Capacity, Hours, Equipments).
Capacity = 200,
Hours = [8, 9, 10, 11, 12, 13, 14],
Equipments = [projector, handicapped].
```

Get cse102, cse101 informations, then check if there is a scheduling conflict

```
?- course(cse102, Instructor, Capacity, Hours, Room, R).
Instructor = inst03,
Capacity = 60,
Hours = [10, 11],
Room = z23,
R = [smartboard].

?- course(cse101, Instructor, Capacity, Hours, Room, R).
Instructor = inst05,
Capacity = 60,
Hours = [11, 12],
Room = z23,
R = [projector].

?- conflict(cse102, cse101).
true.
```

do the same for other examples

```
?- course(cse341, Instructor, Capacity, Hours, Room, R).
Instructor = inst04,
Capacity = 50,
Hours = [12, 13],
Room = z06,
R = [].

?- course(cse102, Instructor, Capacity, Hours, Room, R).
Instructor = inst03,
Capacity = 60,
Hours = [10, 11],
Room = z23,
R = [smartboard].

?- conflict(cse341, cse102).
false.
```

```
?- course(cse341, Instructor, Capacity, Hours, Room, R).
Instructor = inst04,
Capacity = 50,
Hours = [12, 13],
Room = z06,
R = [].

?- course(cse211, Instructor, Capacity, Hours, Room, R).
Instructor = inst14,
Capacity = 50,
Hours = [12, 13, 14],
Room = z06,
R = [].

?- conflict(cse341, cse211).
true.
```

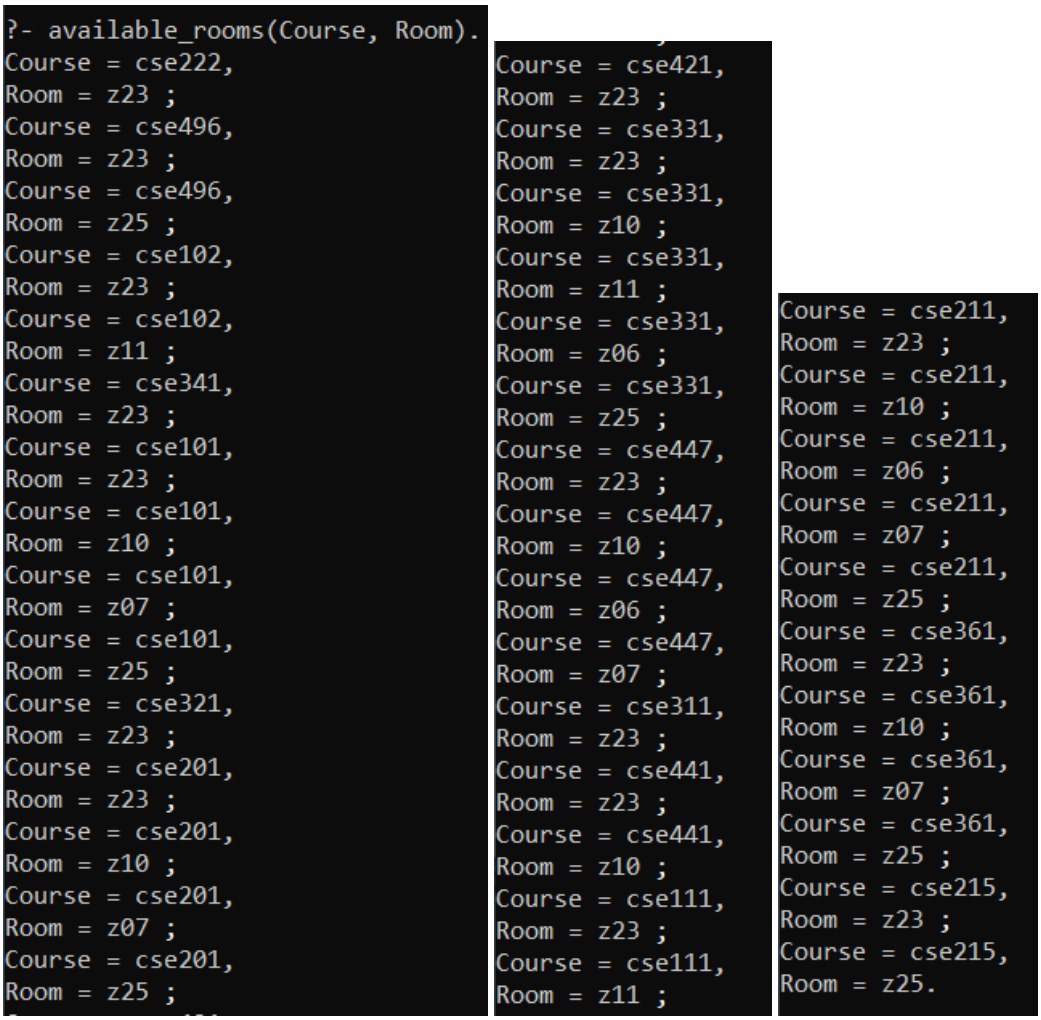
list all of the courses that have scheduling conflict with cse102

```
?- conflict(cse102, Course).
Course = cse496 ;
Course = cse102 ;
Course = cse101 ;
Course = cse201 ;
Course = cse421 ;
Course = cse331 ;
Course = cse111 ;
Course = cse361 ;
Course = cse215.
```

list all available rooms for cse102

```
?- available_rooms(cse102, Room).
Room = z23 ;
Room = z11 ;
false.
```

list all available rooms for any course



Get 012 id student, and cse222 course information, then check if student can be enrolled to that class

```
?- student(012, Courses, Handicap).
Courses = [cse201, cse421, cse102],
Handicap = yes.

?- course(cse222, Instructor, Capacity, Hours, Room, R).
Instructor = inst01,
Capacity = 70,
Hours = [8, 9],
Room = z23,
R = [projector, smartboard].

?- enroll(012, cse222).
true.
```

Do this with cse111 course

```
?- student(012, Courses, Handicap).
Courses = [cse201, cse421, cse102],
Handicap = yes.

?- course(cse111, Instructor, Capacity, Hours, Room, R).
Instructor = inst13,
Capacity = 60,
Hours = [11, 12],
Room = z11,
R = [smartboard].

?- enroll(012, cse111).
false.
```

Student id is 010, course is cse496

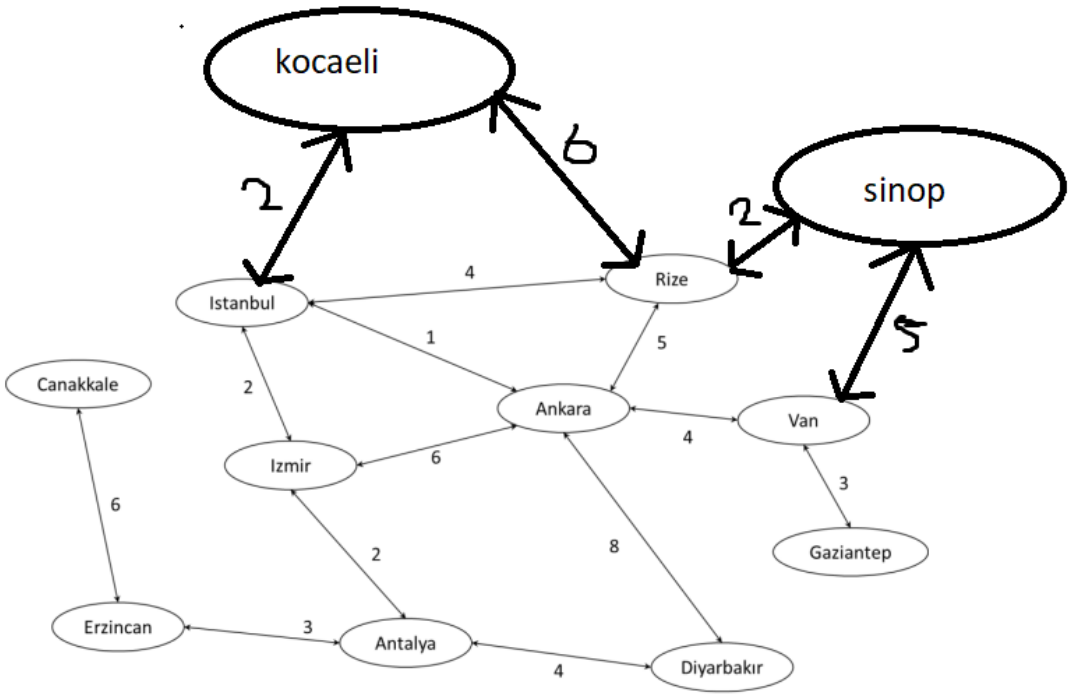
```
?- student(010, Courses, Handicap).
Courses = [cse321, cse421, cse331, cse447, cse211, cse311],
Handicap = no.

?- course(cse496, Instructor, Capacity, Hours, Room, R).
Instructor = inst02,
Capacity = 50,
Hours = [9, 10],
Room = z10,
R = [].

?- enroll(010, cse496).
true .
```

List all of the courses which 012 id student(handicapped) can be enroll

```
?- enroll(012, Course).
Course = cse222 ;
Course = cse102 ;
Course = cse101 ;
Course = cse321 ;
Course = cse447 ;
Course = cse311 ;
Course = cse361 ;
Course = cse215.
```

Part 2: flight_db

Explanation of Part 2



I added 2 more city and connection to the graph as indicated in the pdf.

schedule(X, Y, C). : gives all the schedules, if variable provided, it gives a specific schedule, if all of the parameters are provided it will give true or false. (Example: schedule(X, Y, 3). -> gives all schedules with 3 cost)

connection(izmir, X, C). : gives all connections with source as izmir.

connection(izmir, istanbul, C). : gives all connections between izmir and istanbul, directed and undirected.

Test Part 2

List all schedules

```
?- schedule(Source, Dest, Cost).
Source = canakkale,
Dest = erzincan,
Cost = 6 ;
Source = erzincan,
Dest = canakkale,
Cost = 6 ;
Source = erzincan,
Dest = antalya,
Cost = 3 ;
Source = antalya,
Dest = erzincan,
Cost = 3 ;
Source = antalya,
Dest = izmir,
Cost = 2 ;
Source = antalya,
Dest = diyarbakir,
Cost = 4 ;
Source = diyarbakir,
Dest = antalya,
Cost = 4 ;
Source = diyarbakir,
Dest = ankara,
Cost = 8 ;
Source = ankara,
Dest = diyarbakir,
Cost = 8 ;
Source = ankara,
Dest = izmir,
Cost = 6 ;
Source = ankara,
Dest = istanbul,
Cost = 1 ;
Source = ankara,
Dest = rize,
Cost = 5 ;
Source = ankara,
Dest = van,
Cost = 4 ;
Source = izmir,
Dest = antalya,
Cost = 2 ;
Source = izmir,
Dest = istanbul,
Cost = 2 ;
Source = izmir,
Dest = ankara,
Cost = 6 ;
Source = istanbul,
Dest = izmir,
Cost = 2 ;
Source = istanbul,
Dest = ankara,
Cost = 1 ;
Source = istanbul,
Dest = rize,
Cost = 4 ;
Source = istanbul,
Dest = kocaeli,
Cost = 2 ;
Source = kocaeli,
Dest = istanbul,
Cost = 2 ;
Source = kocaeli,
Dest = rize,
Cost = 6 ;
Source = rize,
Dest = istanbul,
Cost = 4 ;
Source = rize,
Dest = ankara,
Cost = 5 ;
Source = rize,
Dest = kocaeli,
Cost = 6 ;
Source = rize,
Dest = sinop,
Cost = 2 ;
Source = sinop,
Dest = rize,
Cost = 2 ;
Source = sinop,
Dest = van,
Cost = 5 ;
Source = van,
Dest = ankara,
Cost = 4 ;
Source = van,
Dest = gaziantep,
Cost = 3 ;
Source = van,
Dest = sinop,
Cost = 5 ;
Source = gaziantep,
Dest = van,
Cost = 3.
```

List all schedules from izmir

```
?- schedule(izmir, Dest, Cost).
Dest = antalya,
Cost = 2 ;
Dest = istanbul,
Cost = 2 ;
Dest = ankara,
Cost = 6.
```

List all schedules with cost 3

```
?- schedule(Source, Dest, 3).
Source = erzincan,
Dest = antalya ;
Source = antalya,
Dest = erzincan ;
Source = van,
Dest = gaziantep ;
Source = gaziantep,
Dest = van.
```

List all connections from canakkale

```
?- connection(canakkale, Dest, Cost).

Path: [canakkale,erzincan]
Dest = erzincan,
Cost = 6 ;

Path: [canakkale,erzincan,antalya]
Dest = antalya,
Cost = 9 ;

Path: [canakkale,erzincan,antalya,izmir]
Dest = izmir,
Cost = 11 ;

Path: [canakkale,erzincan,antalya,diyarbakir]
Dest = diyarbakir,
Cost = 13 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul]
Dest = istanbul,
Cost = 13 ;

Path: [canakkale,erzincan,antalya,izmir,ankara]
Dest = ankara,
Cost = 17 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara]
Dest = ankara,
Cost = 14 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,rize]
Dest = rize,
Cost = 17 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,kocaeli]
Dest = kocaeli,
Cost = 15 ;
```

```
Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,diyarbakir]
Dest = diyarbakir,
Cost = 22 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,rize]
Dest = rize,
Cost = 19 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,van]
Dest = van,
Cost = 18 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,rize,kocaeli]
Dest = kocaeli,
Cost = 25 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,rize,sinop]
Dest = sinop,
Cost = 21 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,rize,sinop,van]
Dest = van,
Cost = 26 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,rize,sinop,van,gaziantep]
Dest = gaziantep,
Cost = 29 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,van,gaziantep]
Dest = gaziantep,
Cost = 21 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,van,sinop]
Dest = sinop,
Cost = 23 ;

Path: [canakkale,erzincan,antalya,izmir,istanbul,ankara,van,sinop,rize]
Dest = rize,
Cost = 25 ;
```

It continues like that till all possible connections are listed

List all connections between izmir and canakkale

```
?- connection(izmir, canakkale, Cost).

Path: [izmir,antalya,erzincan,canakkale]
Cost = 11 ;

Path: [izmir,istanbul,ankara,diyarbakir,antalya,erzincan,canakkale]
Cost = 24 ;

Path: [izmir,istanbul,rize,ankara,diyarbakir,antalya,erzincan,canakkale]
Cost = 32 ;

Path: [izmir,istanbul,rize,sinop,van,ankara,diyarbakir,antalya,erzincan,canakkale]
Cost = 38 ;

Path: [izmir,istanbul,kocaeli,rize,ankara,diyarbakir,antalya,erzincan,canakkale]
Cost = 36 ;

Path: [izmir,istanbul,kocaeli,rize,sinop,van,ankara,diyarbakir,antalya,erzincan,canakkale]
Cost = 42 ;

Path: [izmir,ankara,diyarbakir,antalya,erzincan,canakkale]
Cost = 27 ;
false.
```

List all connections between gaziantep and kocaeli

```
?- connection(gaziantep, kocaeli, Cost).

Path: [gaziantep,van,ankara,diyarbakir,antalya,izmir,istanbul,kocaeli]
Cost = 25 ;

Path: [gaziantep,van,ankara,diyarbakir,antalya,izmir,istanbul,rize,kocaeli]
Cost = 33 ;

Path: [gaziantep,van,ankara,izmir,istanbul,kocaeli]
Cost = 17 ;

Path: [gaziantep,van,ankara,izmir,istanbul,rize,kocaeli]
Cost = 25 ;

Path: [gaziantep,van,ankara,istanbul,kocaeli]
Cost = 10 ;

Path: [gaziantep,van,ankara,istanbul,rize,kocaeli]
Cost = 18 ;

Path: [gaziantep,van,ankara,rize,kocaeli]
Cost = 18 ;

Path: [gaziantep,van,ankara,rize,istanbul,kocaeli]
Cost = 18 ;

Path: [gaziantep,van,sinop,rize,kocaeli]
Cost = 16 ;

Path: [gaziantep,van,sinop,rize,istanbul,kocaeli]
Cost = 16 ;

Path: [gaziantep,van,sinop,rize,ankara,diyarbakir,antalya,izmir,istanbul,kocaeli]
Cost = 33 ;

Path: [gaziantep,van,sinop,rize,ankara,izmir,istanbul,kocaeli]
Cost = 25 ;

Path: [gaziantep,van,sinop,rize,ankara,istanbul,kocaeli]
Cost = 18 ;
false.
```