HOMEWORK 3

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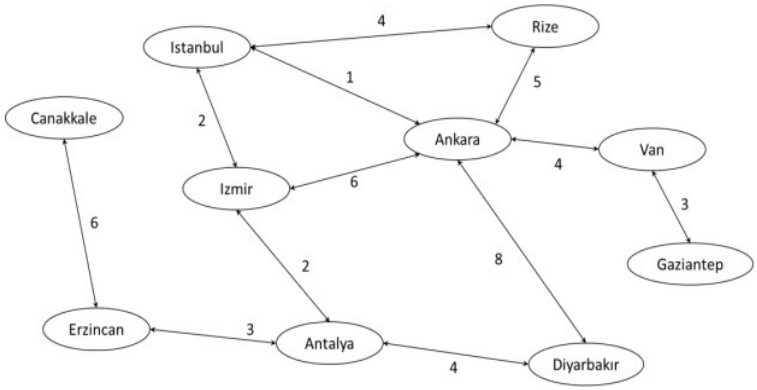
PART2

Firstly, I created the possible flight graph given in the homework pdf as knowledge base.




```
% knowledge base
flight(istanbul,ankara,1).
flight(istanbul,izmir,2).
flight(istanbul,rize,4).

flight(izmir,istanbul,2).
flight(izmir,antalya,2).
flight(izmir,ankara,6).


flight(rize,istanbul,4).
flight(rize,ankara,5).

flight(ankara,istanbul,1).
flight(ankara,izmir,6).
flight(ankara,rize,5).
flight(ankara,van,4).
flight(ankara,diyarbakır,8).

flight(van,ankara,4).
flight(van,gaziantep,3).

flight(gaziantep,van,3).

flight(diyarbakır,ankara,8).
flight(diyarbakır,antalya,4).

flight(antalya,izmir,2).
flight(antalya,diyarbakır,4).
flight(antalya,erzincan,3).

flight(erzincan,antalya,3).
flight(erzincan,canakkale,6).

flight(canakkale,erzincan,6).
```

In the given graph, there are at most 8 roads from one city to another (canakkale->gaziantep). Therefore, I made a check on navigating the graph for a maximum of 8 roads. And the cost of each journey is added up and the total cost is obtained.

X → Y
X → Z → Y
X → Z → T → Y
X → Z → T → K → Y
X → Z → T → K → E → Y
X → Z → T → K → E → D → Y
X → Z → T → K → E → D → M → Y
X → Z → T → K → E → D → M → J → Y

```
% rules
route(X,Y,C):- flight(X,Y,A),not(X==Y),(C is A).

route(X,Y,C):- flight(X,Z,A),
               flight(Z,Y,B),not(X==Y),not(Z==Y),not(X==Z),(C is A+B).

route(X,Y,C):- flight(X,Z,A),flight(Z,T,B),flight(T,Y,N),
               not(X==Y),not(Z==T),not(Z==Y),not(T==Y),not(X==T),not(X==Z),(C is A+B+N).

route(X,Y,C):- flight(X,Z,A),flight(Z,T,B),flight(T,K,N),flight(K,Y,P),
               not(X==Y),not(Z==T),not(Z==Y),not(T==Y),not(X==T),not(X==Z),not(X==K),not(Z==K),not(T==K),not(Y==K),(C is A+B+N+P).

route(X,Y,C):- flight(X,Z,A),flight(Z,T,B),flight(T,K,N),flight(K,E,P),flight(E,Y,S),
               not(X==Y),not(Z==T),not(Z==Y),not(T==Y),not(X==T),not(X==Z),
               not(X==K),not(Z==K),not(T==K),not(Y==K),not(X==E),not(Z==E),not(T==E),not(K==E),not(Y==E),(C is A+B+N+P+S).

route(X,Y,C):- flight(X,Z,A),flight(Z,T,B),flight(T,K,N),flight(K,E,P),flight(E,D,S),flight(D,Y,U),
               not(X==Y),not(Z==T),not(Z==Y),not(T==Y),not(X==T),not(X==Z),not(X==K),not(Z==K),not(T==K),
               not(Y==K),not(X==E),not(Z==E),not(T==E),not(K==E),not(Y==E),not(X==D),not(Z==D),not(T==D),
               not(K==D),not(E==D),not(Y==D),(C is A+B+N+P+S+U).

route(X,Y,C):- flight(X,Z,A),flight(Z,T,B),flight(T,K,N),flight(K,E,P),flight(E,D,S),flight(D,M,U),flight(M,Y,Q),
               not(X==Y),not(Z==T),not(Z==Y),not(T==Y),not(X==T),not(X==Z),not(X==K),not(Z==K),not(T==K),not(Y==K),
               not(X==E),not(Z==E),not(T==E),not(K==E),not(Y==E),not(X==D),not(Z==D),not(T==D),not(K==D),not(E==D),
               not(Y==D),not(X==M),not(Z==M),not(T==M),not(K==M),not(E==M),not(Y==M),not(D==M),(C is A+B+N+P+S+U+Q).

route(X,Y,C):- flight(X,Z,A),flight(Z,T,B),flight(T,K,N),flight(K,E,P),flight(E,D,S),flight(D,M,U),flight(M,J,Q),flight(J,Y,W),
               not(X==Y),not(Z==T),not(Z==Y),not(T==Y),not(X==T),not(X==Z),not(X==K),not(Z==K),not(T==K),not(Y==K),not(X==E),
               not(Z==E),not(T==E),not(K==E),not(Y==E),not(X==D),not(Z==D),not(T==D),not(K==D),not(E==D),not(Y==D),not(X==M),
               not(Z==M),not(T==M),not(K==M),not(E==M),not(Y==M),not(D==M),not(X==J),not(Z==J),not(T==J),not(K==J),not(E==J),
               not(M==J),not(D==J),not(Y==J),(C is A+B+N+P+S+U+Q+W).
```

TEST

In this example, the cost totals from all possible routes from istanbul to ankara are on the screen. And I specifically wrote and tested whether they were correct.

While there is no road from istanbul to ankara at a cost of 25, there is a road at a cost of 16.

```
?- route(istanbul,ankara,X).
X = 1 ;
X = 8 ;
X = 9 ;
X = 16 ;
false.

?- route(istanbul,ankara,1).
true .

?-  route(istanbul,ankara,8).
true .

?-  route(istanbul,ankara,9).
true .

?-  route(istanbul,ankara,16).
true .

?-  route(istanbul,ankara,25).
false.

?-  route(istanbul,ankara,8).
true .

?-  route(istanbul,ankara,7).
false.
```

There is no road from Istanbul to Denizli on the graph because the city of Denizli is not included in the graph.

```
?- route(istanbul,denizli,X).
false.
```

Total costs of all notes that can be visited from antalya

```
?- route(antalya,Y,C).
Y = izmir,
C = 2 ;
Y = diyarbakır,
C = 4 ;
Y = erzincan,
C = 3 ;
Y = istanbul,
C = 4 ;
Y = ankara,
C = 8 ;
Y = ankara,
C = 12 ;
Y = canakkale,
C = 9 ;
Y = ankara,
C = 5 ;
Y = rize,
C = 8 ;
Y = istanbul,
C = 9 ;
Y = rize,
C = 13 ;
Y = van,
C = 12 ;
Y = diyarbakır,
C = 16 ;
Y = istanbul,
C = 13 ;
Y = izmir,
C = 18 ;
Y = rize,
C = 17 ;
Y = van,
C = 16 ;
Y = rize,
C = 10 ;
Y = van,
C = 9 ;
Y = diyarbakır,
C = 13 ;
Y = ankara,
C = 13 ;
Y = rize,
C = 13 ;
Y = istanbul,
C = 17 ;
Y = gaziantep,
C = 15 ;
Y = izmir,
C = 15 ;
Y = rize,
C = 17 ;
```

```
Y = istanbul,
C = 20 ;
Y = istanbul,
C = 21 ;
Y = gaziantep,
C = 19 ;
Y = gaziantep,
C = 12 ;
Y = van,
C = 17 ;
Y = diyarbakır,
C = 21 ;
Y = rize,
C = 24 ;
Y = izmir,
C = 23 ;
Y = gaziantep,
C = 20 ;
```

Testing the results

```
?- route(antalya,istanbul,20).
true .

?- route(antalya,istanbul,21).
true .

?- route(antalya,diyarbakır,21).
true .

?- route(antalya,rize,24).
true .

?- route(antalya,izmir,23).
true .

?- route(antalya,gaziantep,20).
true .

?- route(antalya,izmir,23).
true .
```

PART1

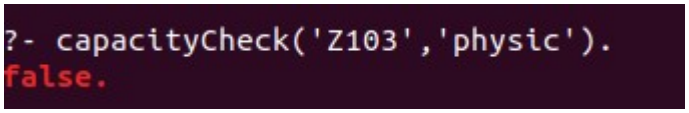
```
?- room(Id,Capacity,Hours,Specials).
Id = 'Z101',
Capacity = 80,
Hours = hours(13, 14, 15, 16),
Specials = special(projector, smart_board) ;
Id = 'Z102',
Capacity = 120,
Hours = hours(8, 9, 10, 11),
Specials = special(projector) ;
Id = 'Z103',
Capacity = 100,
Hours = hours(14, 15, 16, 17),
Specials = special(projector, handicapped) ;
Id = 'Z104',
Capacity = 70,
Hours = hours(10, 11, 12),
Specials = special(smart_board) ;
Id = 'Z105',
Capacity = 70,
Hours = hours(8, 9, 10),
Specials = special(smart_board).
```

```
?- course(Id,Instructor,Room,Capacity,Hours,Student,Specials).
Id = chemical,
Instructor = ayseKaya,
Room = 'Z101',
Capacity = capacity(100),
Hours = hours(13, 14, 15),
Student = student(s25, s30),
Specials = special(smart_board) ;
Id = math,
Instructor = cemCan,
Room = 'Z102',
Capacity = capacity(40),
Hours = hours(9, 10, 11),
Student = student(s26, s27),
Specials = special(smartBoard, handicapped) ;
Id = physic,
Instructor = aliKoc,
Room = 'Z103',
Capacity = capacity(30),
Hours = hours(14, 15, 16),
Student = student(s31),
Specials = special(projector, handicapped) ;
Id = turkish,
Instructor = mehmetBulut,
Room = 'Z104',
Capacity = capacity(30),
Hours = hours(14, 15, 16),
Student = student(s28),
Specials = special(projector, smartBoard) ;
Id = english,
Instructor = hasanAla,
Room = 'Z105',
Capacity = capacity(30),
Hours = hours(8, 9, 10),
Student = student(s29),
Specials = special(smart_board).
```

```
?- instructor(Id,Course,Specials).
Id = i18,
Course = course(chemical, math),
Specials = special(smart_board) ;
Id = i17,
Course = course(math),
Specials = special(projector) ;
Id = i16,
Course = course(physic),
Specials = special(projector) ;
Id = i15,
Course = course(turkish, physic),
Specials = special(smart_board) ;
Id = i14,
Course = course(english),
Specials = special(smart_board).
```

```
?- student(Id,Course,Special).
Id = s25,
Course = course(chemical),
Special = special() ;
Id = s26,
Course = course(math),
Special = special() ;
Id = s27,
Course = course(math),
Special = special(handicapped) ;
Id = s28,
Course = course(turkish, english),
Special = special() ;
Id = s29,
Course = course(english),
Special = special() ;
Id = s30,
Course = course(chemical, math),
Special = special() ;
Id = s31,
Course = course(physic),
Special = special(handicapped).
```

if course capacity not enough for room capacity



if course hour not enough for room hour