HW4 REPORT

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Part-1: Everything works properly as I explained.

```
?- route(edirne,X).
X = edremit ;
X = erzincan ;
false.

?-
```

Possible flights from edirne.

```
?- route(edirne,van).
false.

?-
```

No route between edirne and van so it returns false.

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

There is a route between istanbul and antalya so it returns true.

```
?- route(istanbul,X).
X = izmir ;
X = isparta ;
X = burdur ;
X = antalya ;
X = konya ;
X = ankara ;
X = van ;
X = rize ;
X = gaziantep ;
X = gaziantep ;
X = antalya ;
X = konya ;
X = ankara ;
X = van ;
X = rize ;
X = ankara ;
X = konya ;
X = antalya ;
X = gaziantep ;
X = van ;
X = rize ;
X = van ;
X = ankara ;
X = konya ;
X = antalya ;
X = gaziantep ;
X = rize ;
X = rize ;
X = van ;
X = ankara ;
X = konya ;
X = antalya ;
X = gaziantep ;
false.

?-
```

Possible flights from istanbul.

Part – 2: Everything works properly as I explained.

```
?- sroute(edremit,erzincan,X).
X = 736.34 ;
false.

?-
```

X is 736.34 because I have a knowledge base part like following.

```
distance(edremit,erzincan,736.34).
```

```
?- sroute(van,konya,X).
X = 1147.6499999999999 ;
false.

?-
```

There is no way to go konya from van directly so I calculate the shortest route with using (van → ankara) + (ankara → konya)
X is ~ 1147.6499999999999999 because I have knowledge base parts like following.

```
distance(van,ankara,920.31).
distance(ankara,konya,227.34).
```

920.31 + 227.34 = ~ 1147.65

Part – 3: Everything works properly as I explained.

```
?- schedule(a,P,T).
P = z23,
T = 10 ;
P = z11,
T = 12.

?- usage(207,T).
T = 16 ;
T = 17.
```

Schedule of student-a according to our knowledge base.
Student-a uses z23 at 10 and z11 at 12.

207 is used by students at 16 and 17.

```
?- conflict(452,455).
true.

?- conflict(108,341).
false.
```

It returns true because 452 and 455 conflicts due to classroom.

There is no confliction between 108 and 341 due to classroom or time.

```
?- meet(a,b).
true
```

a and b students are in the same classroom at the same time so it returns true.

```
?- meet(b,c).
false.
```

a and b students can not be in the same classroom at the same time so it returns false.

Part – 4: Everything works properly as I explained.

```
?- element(13,[2,8,13,9]).
true.

?- element(5,[2,8,0]).
false.
```

13 is in [2,8,13,9] so it returns true.

5 is not in [2,8,0] so it returns false.

```
?- union([1,2,3],[4,5,6],X).
X = [1, 2, 3, 4, 5, 6]
```

Union of [1,2,3] and [4,5,6] is [1,2,3,4,5,6] so it returns it.

```
?- union([3,5],[7,8],[1,2,3,4,5]).
false.

?- union([3,5],[7,8],[3,5,7,8]).
true ;
```

Union of [3,5] and [7,8] is not [1,2,3,4,5] so it returns false.

Union of [3,5] and [7,8] is [3,5,7,8] so it returns true.

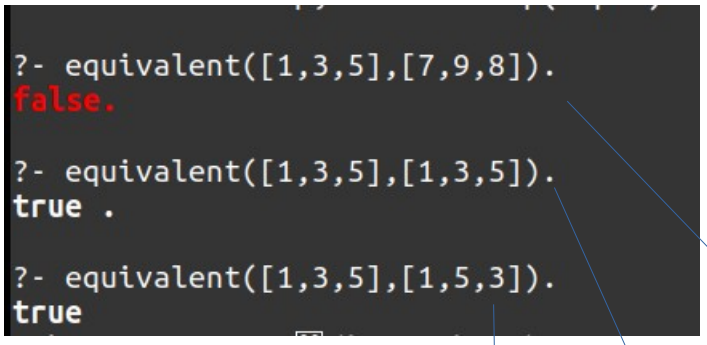
```
?- intersect([4,6,7,9],[0,1,2,7],X).
X = [7].

?- intersect([1,2,3],[7,8,9],X).
X = [].

?- intersect([7,6,3],[6,8,1],[6]).
true.

?- intersect([0,4,7],[11,7,9],[4]).
false.
```

Intersection of [4,6,7,9] and [0,1,2,7] is [7] so it returns it.

There is no Intersection between [1,2,3] and [7,8,9] is so it returns [].

Intersection of [7,6,3] and [6,8,1] is [6] so it returns true.

Intersection of [0,4,7] and [11,7,9] is not [4] so it returns false.



[1,3,5] is not equal to [7,9,8] so it returns false.

[1,3,5] is equal to [1,3,5] so it returns true.

[1,3,5] is also equal to [1,5,3] so it returns true. They are equal because I used permuation in equivalent.

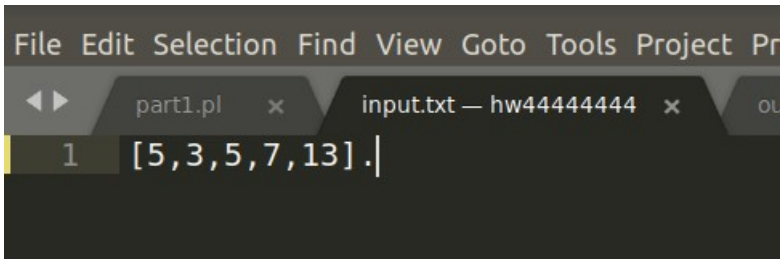
```
equivalent(S1, S2) :- permutation(S1, S2).
```

Part – 5: Everything works properly as I explained.

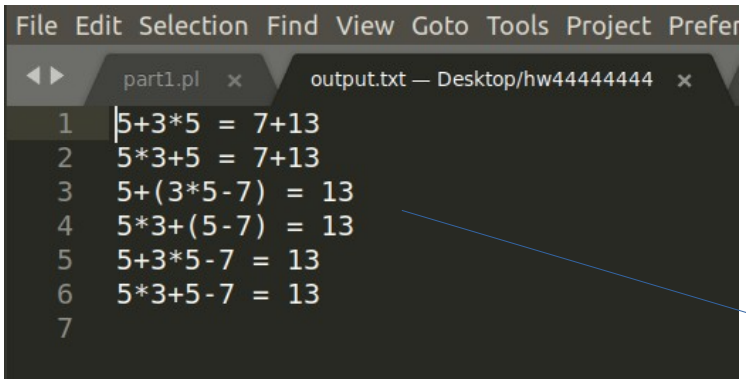
It finds a correct way of inserting arithmetic (operators) such that the result is a correct equation.
*Program reads from input.txt and prints to output.txt.

example(which is given on pdf):

input.txt: (don't use any spaces in input.txt/also you can write just one line)



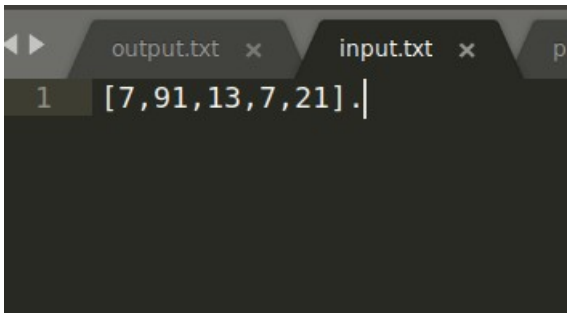
output.txt:



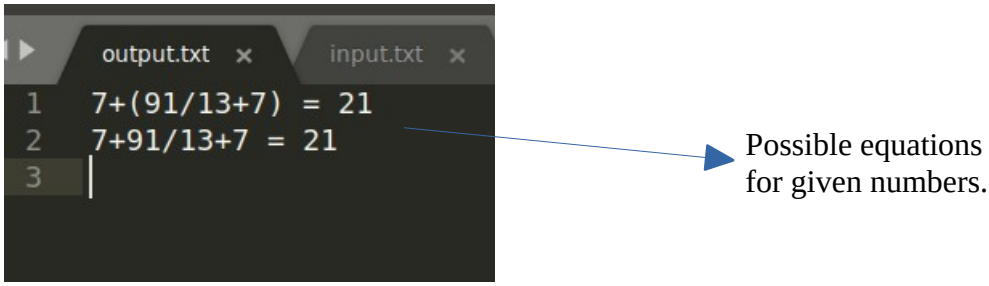
Possible equations
for given numbers.

example(extra):

input.txt: (don't use any spaces in input.txt/also you can write just one line)



output.txt:



Part – 6: Puzzle solving - Everything works properly as I explained.
there are 3 example puzzles to solve on pdf.
*Program also prints the solved puzzle to output.txt with bitmap.
*Test-2 and 3 take a lot of time to run!!!

Test Cases: Top-to-bottom or Left-to-right

1. ([[3], [2,1], [3,2], [2,2], [6], [1,5], [6], [1], [2]],
   [[1,2], [3,1], [1,5], [7,1], [5], [3], [4], [3]])
2. ([[3,1], [2,4,1], [1,3,3], [2,4], [3,3,1,3], [3,2,2,1,3], [2,2,2,2,2], [2,1,1,2,1,1], [1,2,1,4], [1,1,2,2], [2,2,8], [2,2,2,4], [1,2,2,1,1,1], [3,3,5,1], [1,1,3,1,1,2], [2,3,1,3,3], [1,3,2,8], [4,3,8], [1,4,2,5], [1,4,2,2], [4,2,5], [5,3,5], [4,1,1], [4,2], [3,3]],
   [[2,3], [3,1,3], [3,2,1,2], [2,4,4], [3,4,2,4,5], [2,5,2,4,6], [1,4,3,4,6,1], [4,3,3,6,2], [4,2,3,6,3], [1,2,4,2,1], [2,2,6], [1,1,6], [2,1,4,2], [4,2,6], [1,1,1,1,4], [2,4,7], [3,5,6], [3,2,4,2], [2,2,2], [6,3]])
3. ([[5], [2,3,2], [2,5,1], [2,8], [2,5,11], [1,1,2,1,6], [1,2,1,3],[2,1,1], [2,6,2], [15,4], [10,8], [2,1,4,3,6], [17], [17], [18], [1,14], [1,1,14], [5,9], [8], [7]], [[5], [3,2], [2,1,2], [1,1,1], [1,1,1], [1,3], [2,2], [1,3,3], [1,3,3,1], [1,7,2], [1,9,1], [1,10], [1,10], [1,3,5], [1,8],
   [2,1,6],[3,1,7], [4,1,7], [6,1,8], [6,10], [7,10], [1,4,11], [1,2,11], [2,12], [3,13]])

Solving of test case-1:

```
(base) can@can-ThinkPad-L13:~/Desktop/hw44444444$ swipl part6.pl
Welcome to SWI-Prolog (threaded, 64 bits, version 8.2.3)
SWI-Prolog comes with ABSOLUTELY NO WARRANTY. This is free software.
Please run ?- license. for legal details.

For online help and background, visit https://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).

?- test_mode('gtu1').
```

output.txt:

part1.pl | output.txt

```
 1   _|X|X|X|_|_|_|_|   3
 2   X|X|_|X|_|_|_|_|   2  1
 3   _|X|X|X|_|_|X|X|   3  2
 4   _|_|X|X|_|_|X|X|   2  2
 5   _|_|X|X|X|X|X|X|   6
 6   X|_|X|X|X|X|X|_|   1  5
 7   X|X|X|X|X|X|_|_|   6
 8   _|_|_|_|X|_|_|_|   1
 9   _|_|_|X|X|_|_|_|   2
10    1 3 1 7 5 3 4 3
11    2 1 5 1
12
```

Solving of test case-2:

```
(base) can@can-ThinkPad-L13:~/Desktop/hw44444444$ swipl part6.pl
Welcome to SWI-Prolog (threaded, 64 bits, version 8.2.3)
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For online help and background, visit https://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).

?- test_mode('gtu2').
```
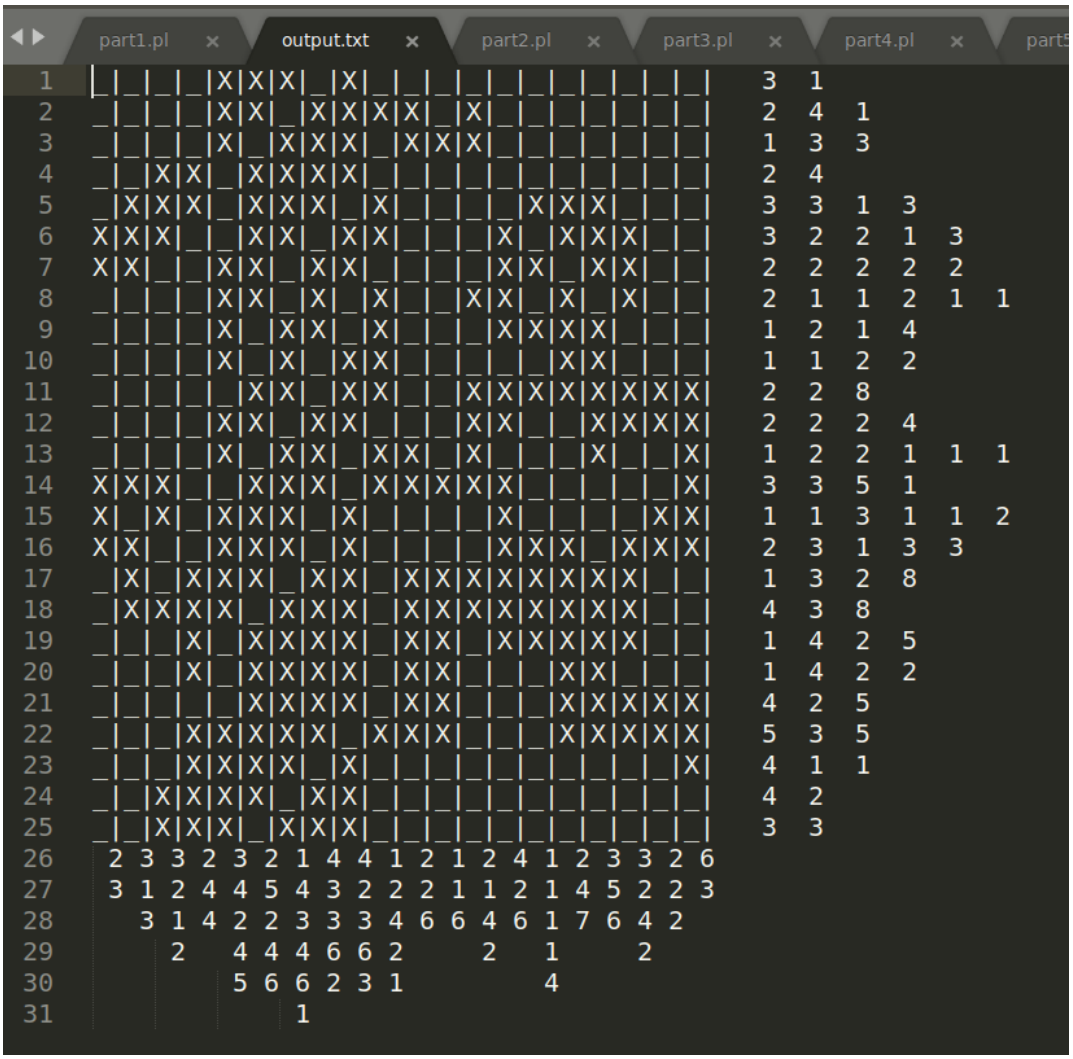

output.txt:



Solving of test case-3:

```
(base) can@can-ThinkPad-L13:~/Desktop/hw44444444$ swipl part6.pl
Welcome to SWI-Prolog (threaded, 64 bits, version 8.2.3)
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Please run ?- license. for legal details.

For online help and background, visit https://www.swi-prolog.org
For built-in help, use ?- help(Topic). or ?- apropos(Word).

?- test_mode('gtu3').
```
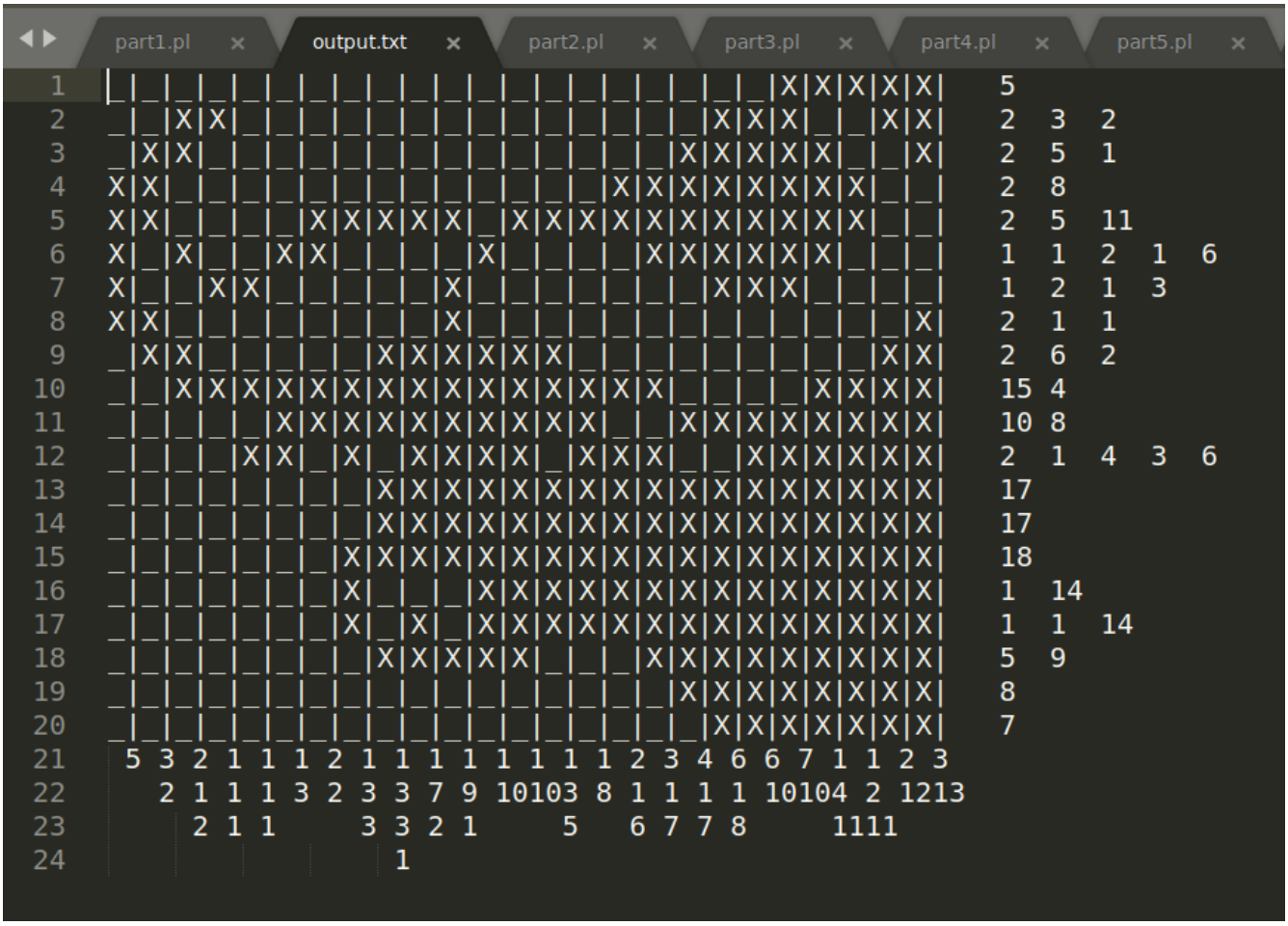

output.txt:


part1.pl
output.txt
part2.pl
part3.pl
part4.pl
part5.pl
_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|X|X|X|X|X| 5
_|_|X|X|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|X|X|X|_|_|X|X| 2 3 2
_|X|X|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|X|X|X|X|X|_|_|X| 2 5 1
X|X|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|X|X|X|X|X|X|X|_|_| 2 8
X|X|_|_|_|_|X|X|X|X|X|_|X|X|X|X|X|X|X|X|X|X|_|_| 2 5 11
X|_|X|_|_|X|X|_|_|_|_|X|_|_|_|_|X|X|X|X|X|X|_|_|_| 1 1 2 1 6
X|_|_|X|X|_|_|_|_|_|X|_|_|_|_|_|_|X|X|X|_|_|_|_| 1 2 1 3
X|X|_|_|_|_|_|_|_|_|X|_|_|_|_|_|_|_|_|_|_|_|_|X| 2 1 1
_|X|X|_|_|_|_|_|X|X|X|X|X|X|_|_|_|_|_|_|_|_|_|X|X| 2 6 2
_|_|X|X|X|X|X|X|X|X|X|X|X|X|X|X|X|_|_|_|_|X|X|X|X| 15 4
_|_|_|_|_|X|X|X|X|X|X|X|X|X|_|_|X|X|X|X|X|X|X|X| 10 8
_|_|_|_|X|X|_|X|_|X|X|X|X|_|X|X|X|_|_|X|X|X|X|X|X| 2 1 4 3 6
_|_|_|_|_|_|_|_|_|X|X|X|X|X|X|X|X|X|X|X|X|X|X|X|X| 17
_|_|_|_|_|_|_|_|_|X|X|X|X|X|X|X|X|X|X|X|X|X|X|X|X| 17
_|_|_|_|_|_|_|_|_|X|X|X|X|X|X|X|X|X|X|X|X|X|X|X|X| 18
_|_|_|_|_|_|_|_|X|_|_|_|X|X|X|X|X|X|X|X|X|X|X|X|X| 1 14
_|_|_|_|_|_|_|_|X|_|X|_|X|X|X|X|X|X|X|X|X|X|X|X|X| 1 1 14
_|_|_|_|_|_|_|_|_|X|X|X|X|X|_|_|_|X|X|X|X|X|X|X|X| 5 9
_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|X|X|X|X|X|X|X| 8
_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|X|X|X|X|X|X| 7
5 3 2 1 1 1 2 1 1 1 1 1 1 1 2 3 4 6 6 7 1 1 2 3
2 1 1 1 3 2 3 3 7 9 10103 8 1 1 1 1 10104 2 1213
2 1 1 3 3 2 1 5 6 7 7 8 1111
1