Integrated Exercise for Software I

Mid-term Presentations

Development environment

Team: SpaceA

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Taize Sun(s1242009)

Platfrom: Github

Language: C

Tool: VScode

Development status

task 1 ~ 7 finished

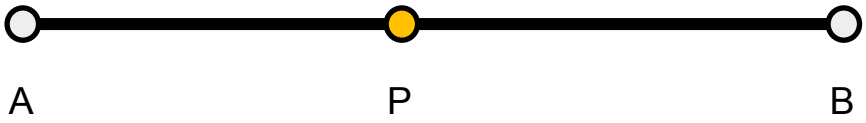
task 8 now working

testgenerator is also still in progress

Task 3~4 shortest path

Make Graph algorithm

For all lines

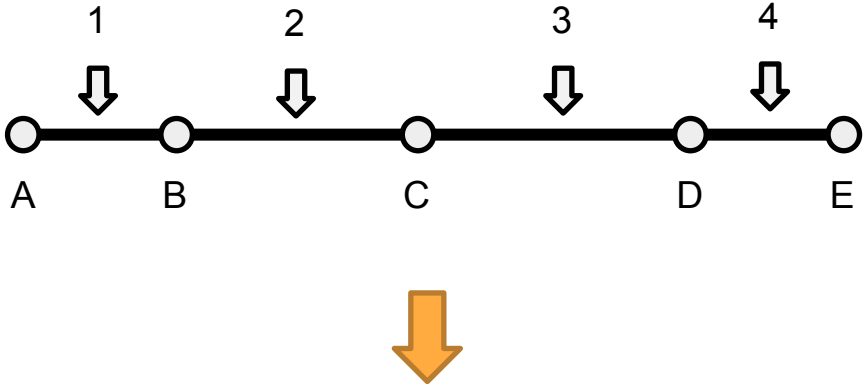


For all points and intersections

If P is on the line AB…

AP + PB = AB

→ AP + PB − AB = 0



Edge 1: AB
Edge 2: BC
Edge 3: CD
Edge 4: DE

Task 3~4 shortest path

pseudocode

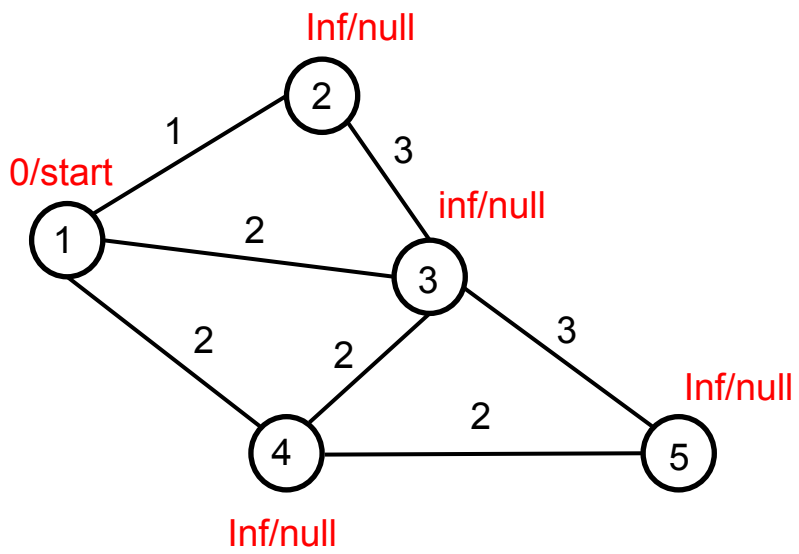
```
make array A (to use for saving points)

for i = 1 to number of lines
      for j = 1 to (number of points +number of
intersections)
            if(p is on the line)
                  add p to A

for i = 1 to (A.size - 1)
      edge[i] = (A[i],  A[i+1])
```

Task 3~4 shortest path

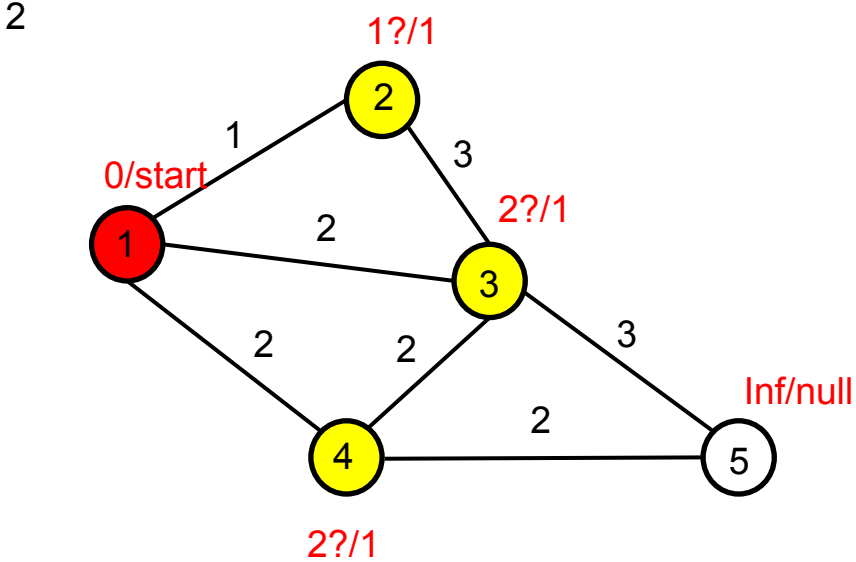
2. Dijkstra'salgorithm

Example: from 1 to 5

1



2

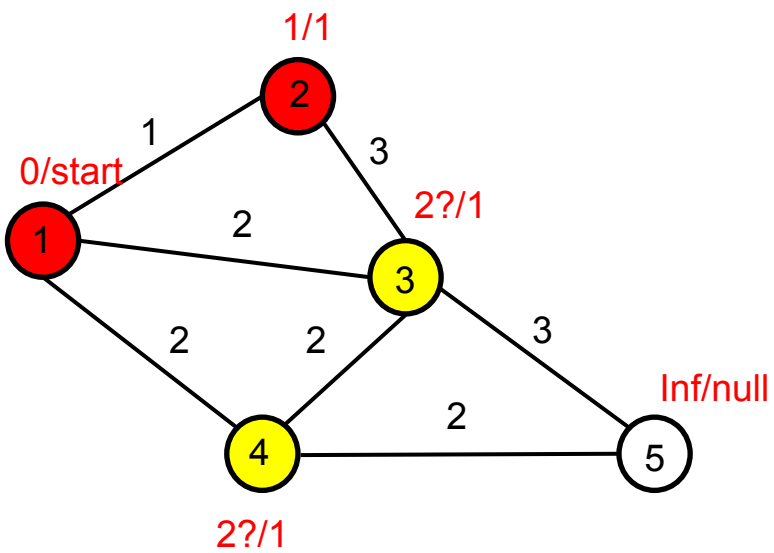


Task3~4 shortest path

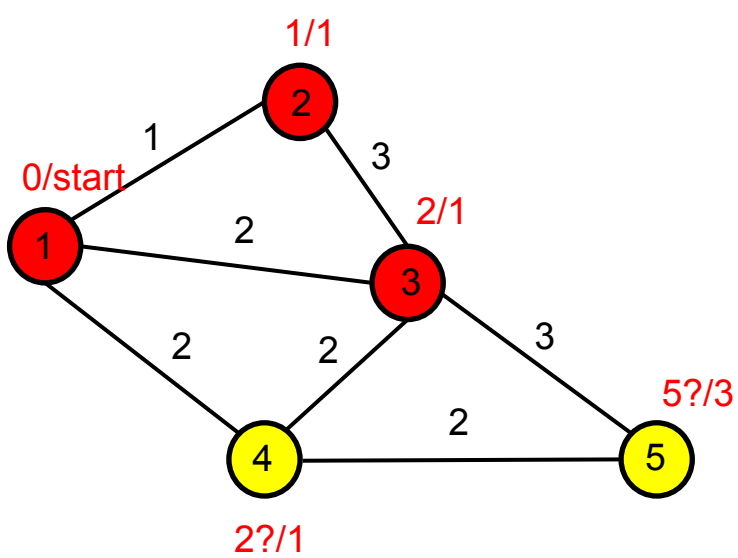
2. Dijkstra'salgorithm

Example: from 1 to 5

3



4

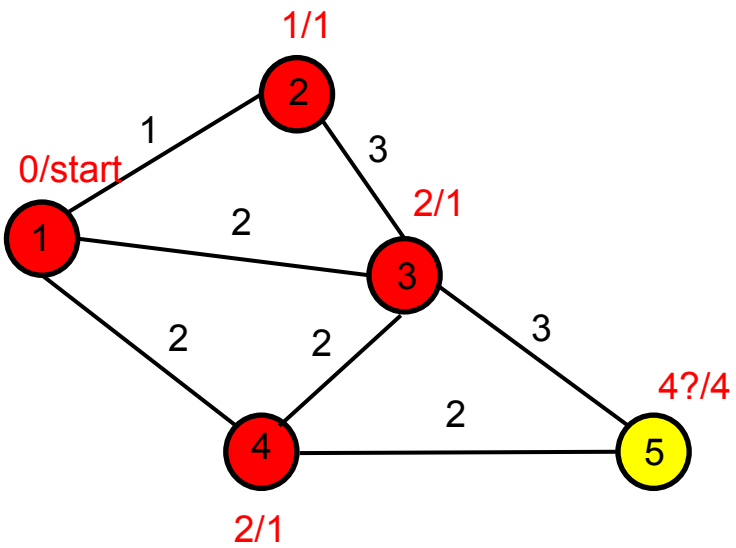


Task3~4 shortest path

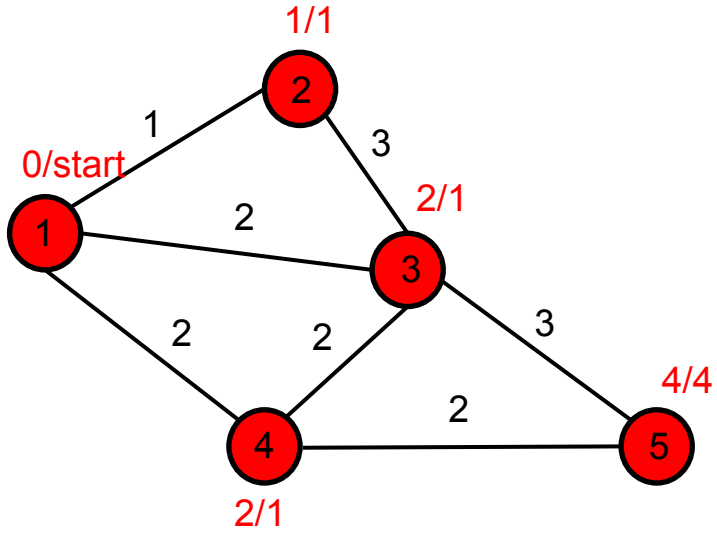
2. Dijkstra'salgorithm

Example: from 1 to 5

5



6



Distance = 4, Route = 1 – 4 - 5

Task 3~4 shortest path

pseudocode

```
start.distance = 0
push(start)

while(queue.size != 0)
        fromnode = pop()

        for(i = 1 to number of nodes)
                if node[i] connects fromnode
                        if( node[i].distance > fromnode.distance + edge.length)
                                node[i].distance = fromnode.distance + edge.length
                                node[i].from = fromnode
                                push(node[i])
while(goal.form != start)
        add goal to route
        goal = goal.from
}
add start to route
```

Task 5~6 K - shortest path

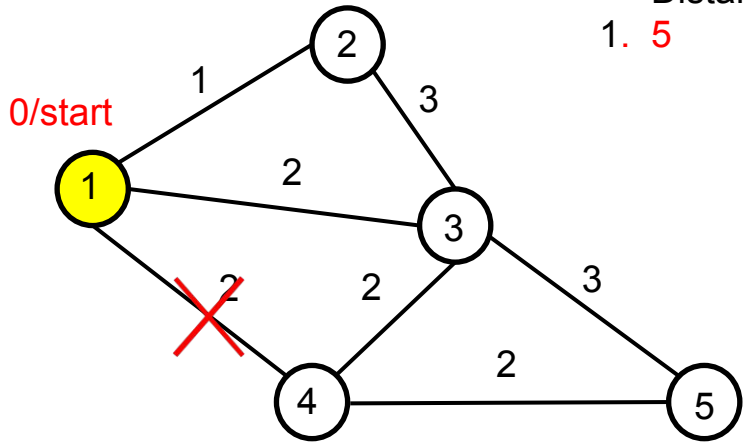
Yen's algorithm

Example: from 1 to 5

1

Delete Edge 1-4 temporarily and search shortest path from 1 to 5.

Shortest Route
1. Distance 4 Route = 1 - 4 - 5



Route Candidate

	Distance	Route
1.	5	1 – 3 - 5

Distance = 5, Route = 1 – 3 - 5

Task 5~6 K - shortest path

Yen's algorithm

Example: from 1 to 5

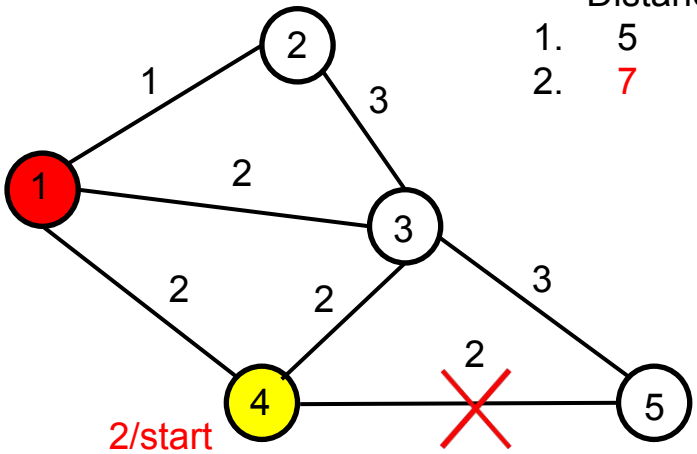
2

Delete Edge 4-5 temporarily
and search shortest path
from 4 to 5.

Shortest Route
1. Distance 4 Route 1 – 4 - 5

Route Candidate

	Distance	Route
1.	5	1 – 3 – 5
2.	7	1 – 4 – 3 – 5



Distance = 7, Route = 1 – 4 – 3 - 5

Task 5~6 K - shortest path

Yen's algorithm

Example: from 1 to 5

3

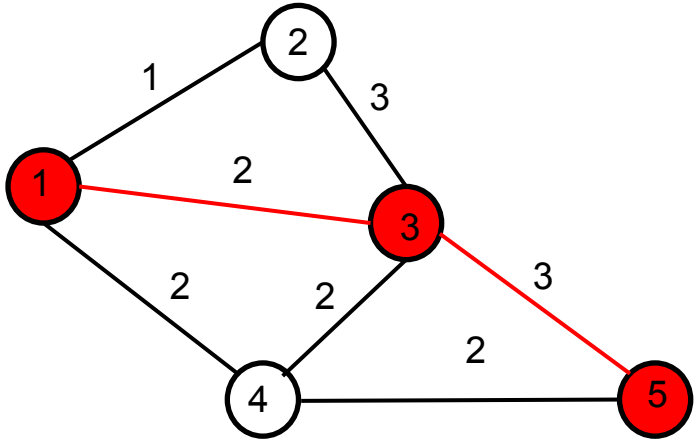
Choose the shortest route from candidate

Route Candidate

	Distance	Route
1.	5	1 – 3 – 5
2.	6	1 – 4 – 3 – 5

Shortest Route

1. Distance 4 Route 1 – 4 – 5
2. Distance 5 Route 1 – 3 – 5



Task 5~6 K - shortest path

Yen's algorithm

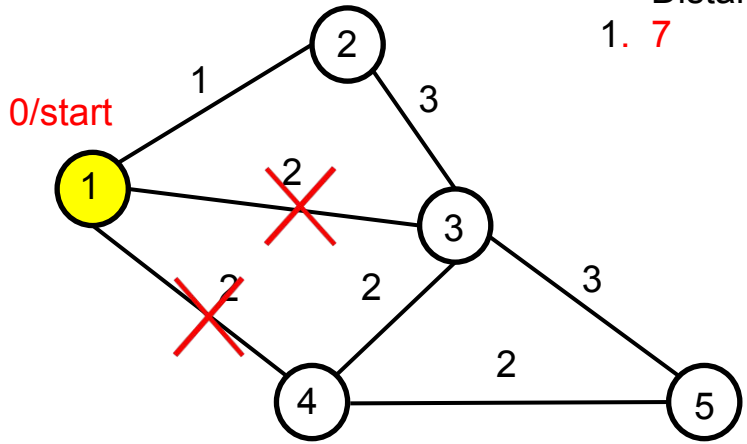
Example: from 1 to 5

4

Delete Edges 1-4, 1-3 temporarily
and search shortest path
from 1 to 5.

Shortest Route

1. Distance 4 Route 1 – 4 – 5
2. Distance 5 Route 1 – 3 – 5



Route Candidate

	Distance	Route
1.	7	1 – 2 – 3 - 5

Distance = 7, Route = 1 – 2 – 3 - 5

Task 5~6 K - shortest path

Yen's algorithm

Example: from 1 to 5

5

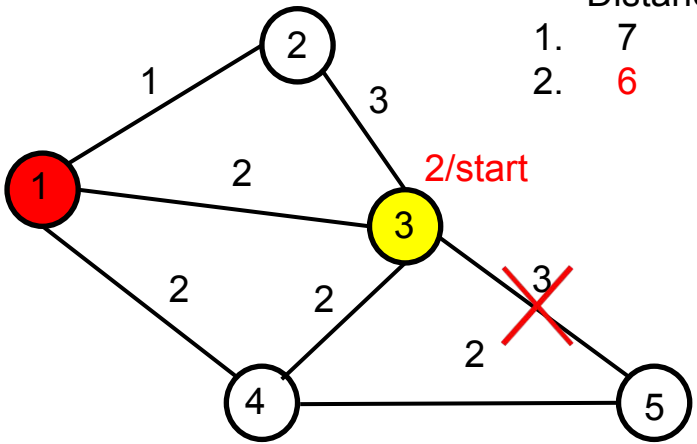
Delete Edge 3-5 temporarily and search shortest path from 3 to 5.

Shortest Route

1. Distance 4 Route 1 – 4 – 5
2. Distance 5 Route 1 – 3 – 5

Route Candidate

	Distance	Route
1.	7	1 – 2 – 3 – 5
2.	6	1 – 3 – 4 – 5



Distance = 6, Route = 1 – 3 – 4 - 5

Task 5~6 K - shortest path

Yen's algorithm

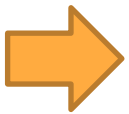
Example: from 1 to 5

6

Choose the shortest route from candidate

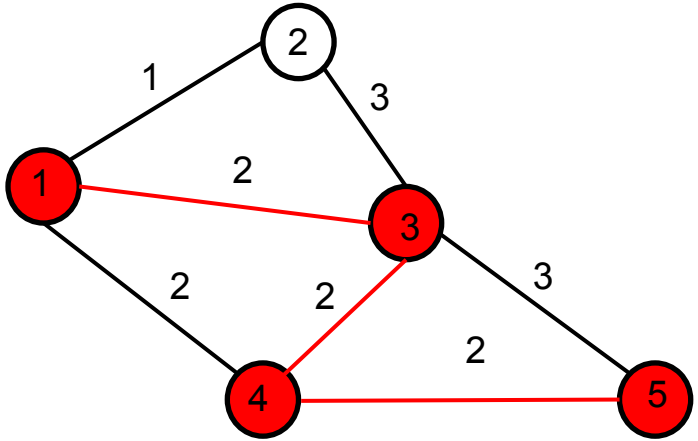
Route Candidate

	Distance	Route
1.	7	1 – 2 – 3 – 5
2.	6	1 – 3 – 4 – 5



Shortest Route

1. Distance 4 Route 1 – 4 – 5
2. Distance 5 Route 1 – 3 – 5
3. Distance 6 Route 1 – 3 – 4 – 5

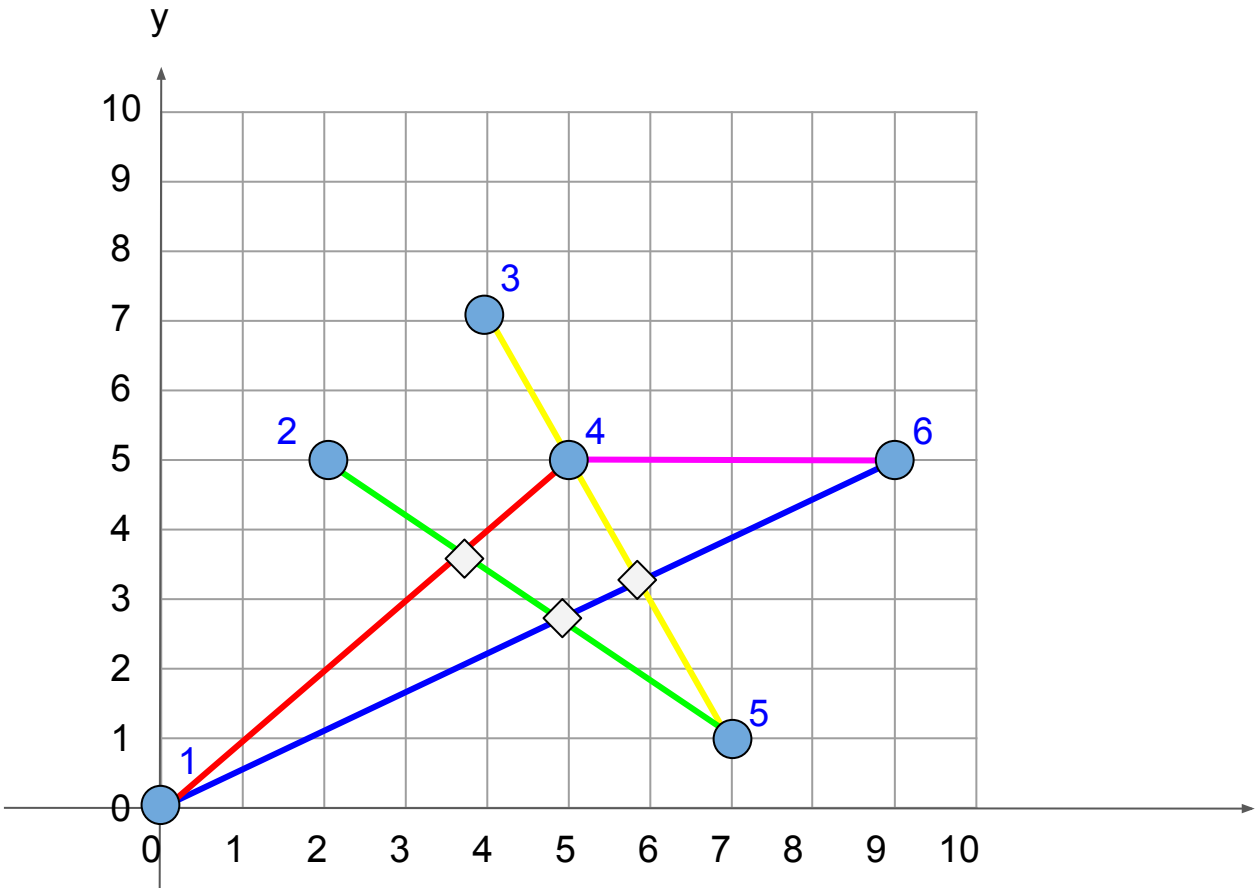


Task 5~6 K-shortest path

pseudocode

```
k_route[1] = shortest(from, to)

for (i = 2 to k)
    temproute[1] = start

    for(j = 1 to i - 1)
        if (k_route[1] == temproute)
            edge delete temporarily

        Candidate[j] = shortest(start ,goal)
        update temproute and start

    choose shortest route from Candidate
```

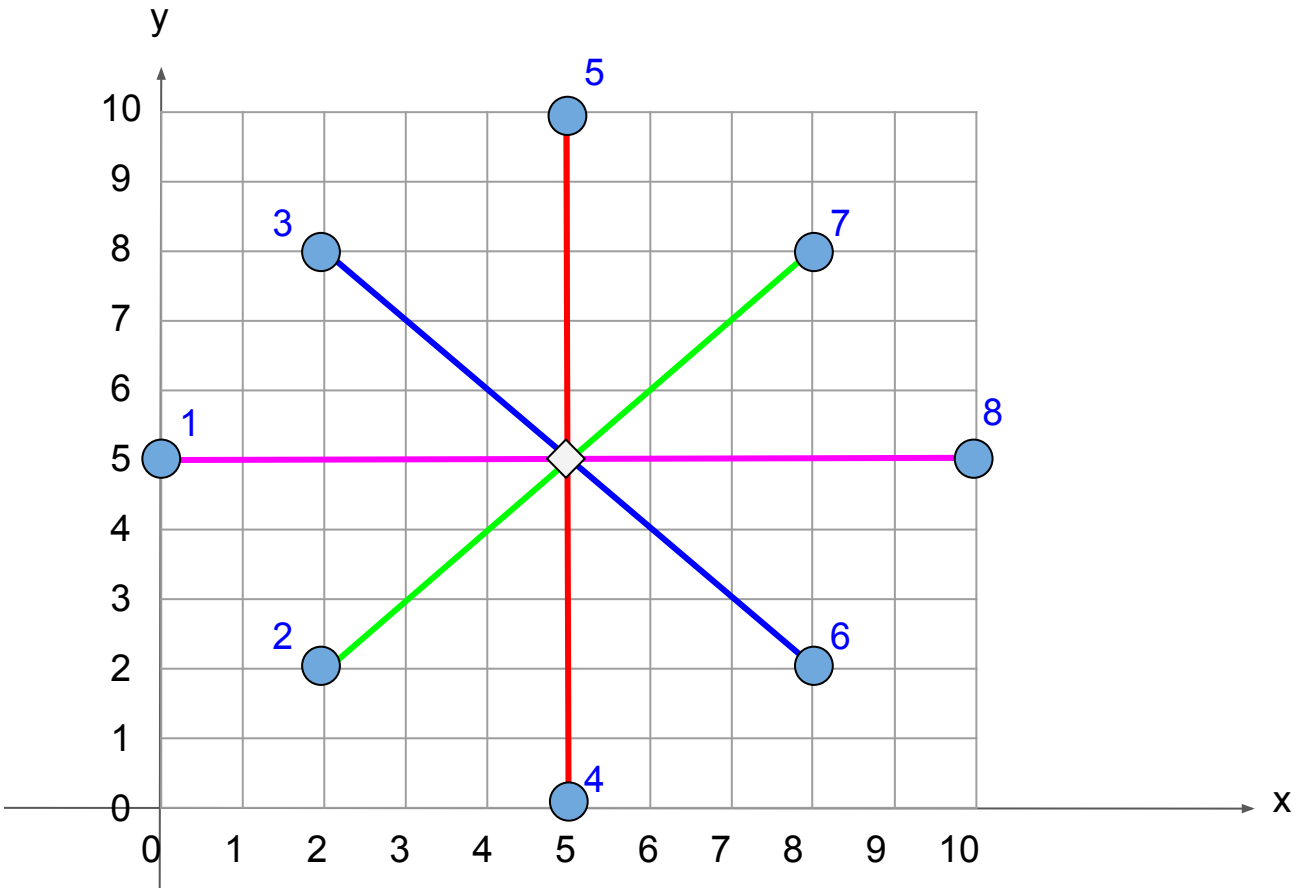
Demonstration



TestCase1

```
6 5 0 2
0 0
2 5
4 7
5 5
7 1
9 5
1 4
1 6
2 5
3 5
4 6
1 4 5
C1 C3 10
```

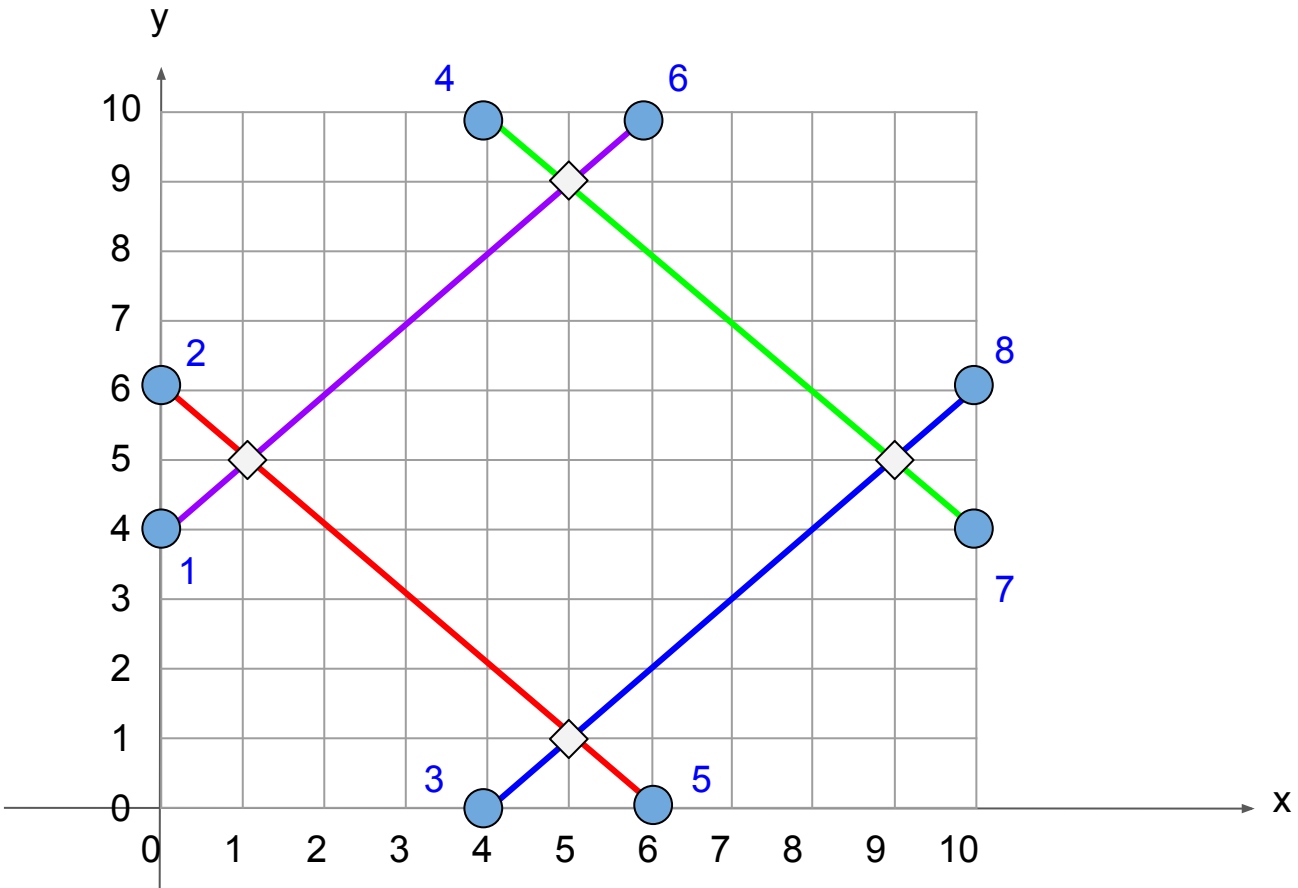
Demonstration



TestCase2

```
8 4 0 2
0 5
2 2
2 8
5 0
5 10
8 2
8 8
10 5
1 8
2 7
3 6
4 5
1 3 10
2 8 10
```

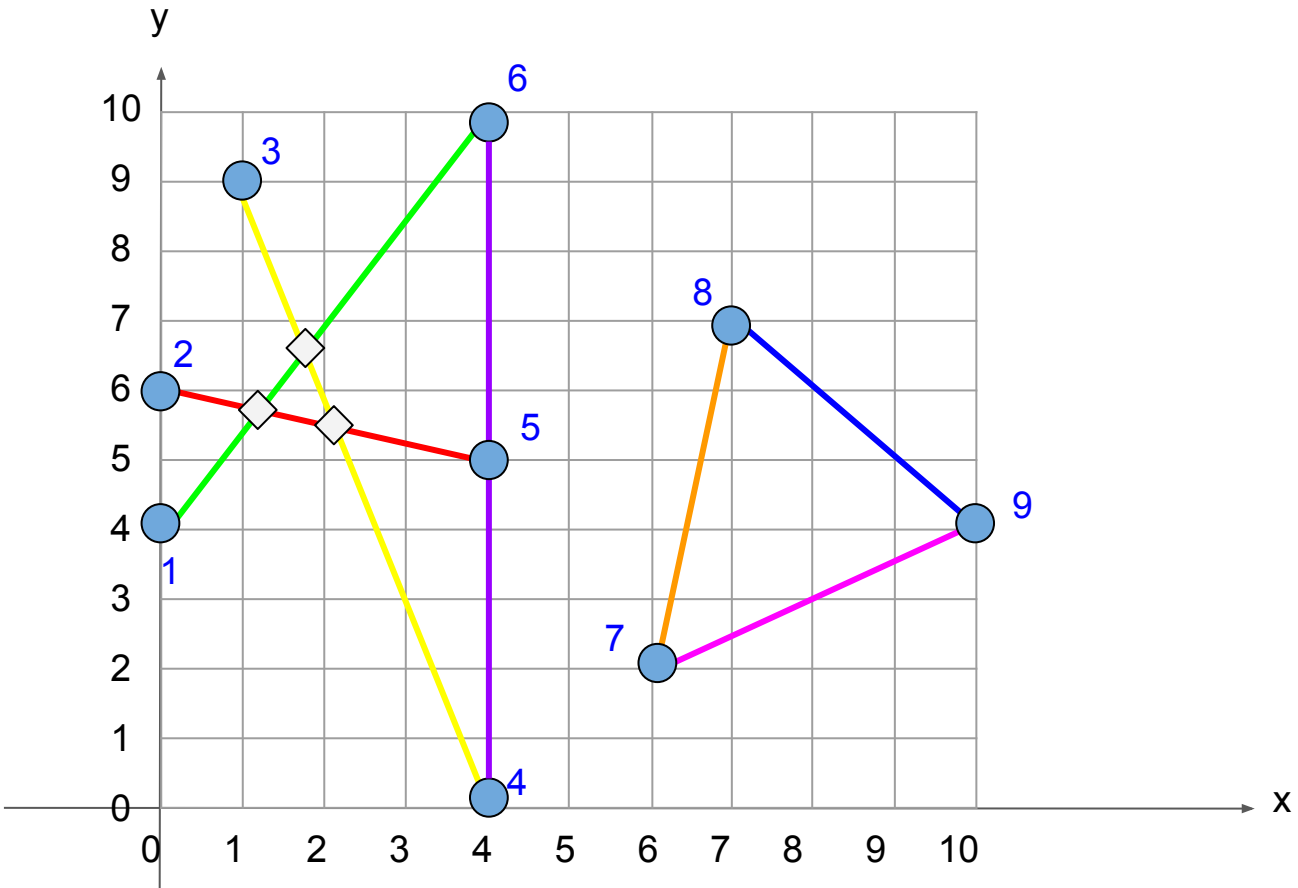
Demonstration



TestCase3

```
8 4 0 3
0 4
0 6
4 0
4 10
6 0
6 10
10 4
10 6
1 6
2 5
3 8
4 7
1 8 10
2 8 10
3 5 10
```

Demonstration



TestCase4

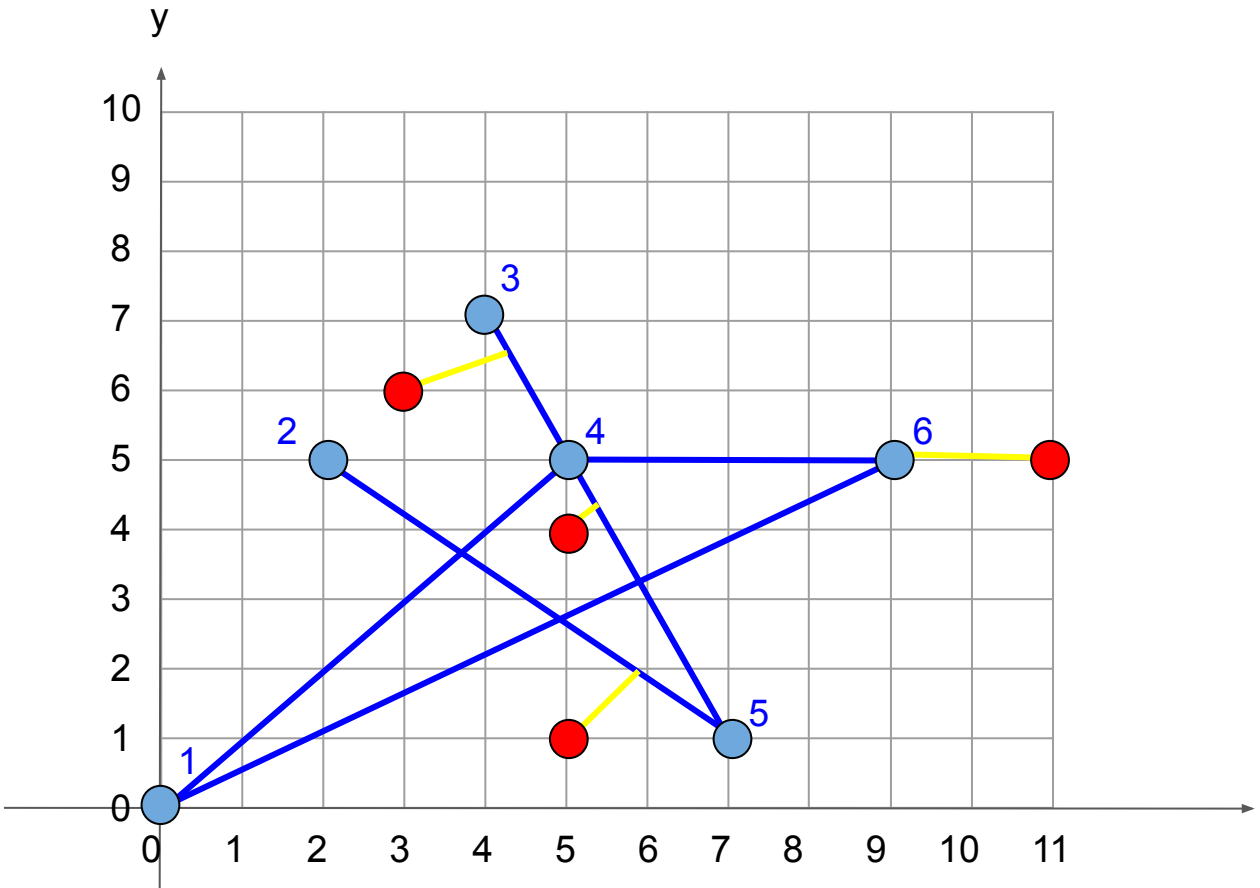
```
9 7 0 3
0 4
0 6
1 9
4 0
4 5
4 10
6 2
7 7
10 4
1 6
2 5
3 4
4 6
7 8
7 9
8 9
1 5 10
7 9 10
1 9 10
```

Task 7

1. Find the determinant between the segment and the point
2. Loop to compare the point to every segment
    a. Find t = [determinant]/ [length of determinant]^2
    b. If 0 <= t <= 1: (line: xp1, yp1, xq1, yq1; point: p_x, p_y)
        i. yes: d = |(xq1-xp1)*(yp1-p_y)-(yq1-yp1)*(xp1-p_x)| / ((xq1-xp1)^2+(yq1-yp1)^2)^½
        ii. no: shortest distance is from the point to one end of the line

https://math.stackexchange.com/questions/2248617/shortest-distance-between-a-point-and-a-line-segment

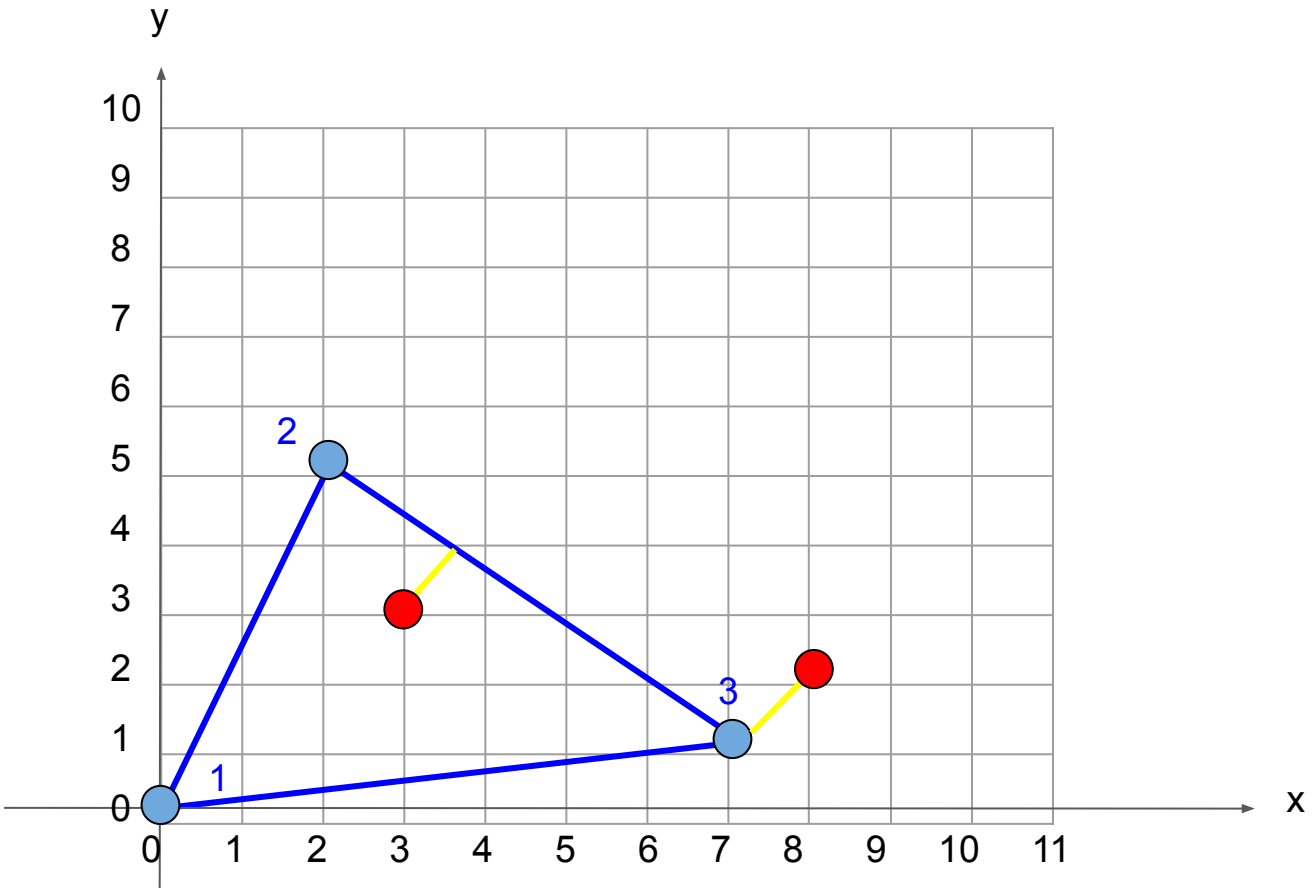
Demonstration



TestCase1

```
6 5 4 0
0 0
2 5
4 7
5 5
7 1
9 5
1 4
1 6
2 5
3 5
4 6
5 1
11 5
5 4
3 6
```

Demonstration



TestCase2

```
3 3 2 0
0 0
2 5
7 1
1 2
2 3
1 3
3 3
8 2
```

Contribution of each member

Team work: Discussion about:
- making points on lines (to make graph)
- process of making graph

Sinchhean Phea(s1250250)
Shortest distance from a point to given segments (Task 7)

Yusaku Numajiri(s1250078)
Graph implementation and shortest path(Task 3-6)
Making test generator

Taize Sun(s1242009)
slides and helping parts of tasks

Thank you for you attention