

Gebze Technical University
Computer Engineering

CSE 222
2017 Spring

HOMEWORK 09 REPORT

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1-Problem Solution Approach

Verilen sınıfları ve interfaceri kullandım. Ödevde istenen abstract bir sınıf implement etmemiz. Ve istenilen methodları implement etmemiz sonrada test etmemis isteniyor ödevde. İstenilen AbstractGraphExtended sınıfı AbstractGraph sınıfını extend etmekte.

Ödevde implement etmemiz gereken methodlar.

AddRandomEdgesToGraph(int edgeLimit) methodu verilen edgeLimitine kadar random bir sayı belirleyip o random sayı adedinde edge eklemekte ve eklediği edge lerin vertexleride 0 ile o random sayı arasında belirlenmektedir. Öncelikle bu methodun içinde eklenen edgeleri daha öncedende objeye eklenip eklenmediğini kontrol etmek(isEdge methodunu kullandım.) için yani bir edge yi bir kez eklemek için bir HashSet objesi kullandım obje üzerinde olan tüm edgeleri oraya ekledim ve yeni oluşturduklarımıda bu HashSet objesine ekleyerek obje üzerinde bir edgenin tek kez olmasını sağladım. Ve return değeri olarakda sadece yeni eklenen edge sayısını döndürdüm.

BreadthFirstSearch(int start) methodu çağırılan graph objesi üzerinde verilen start vertexiyle ona bağlı olan ve en yakınından itibaren tüm vertex leri gezmektedir. Bu method için kitaptaki implementasyonu kullandım. Vertexleri gezme sırası için bir Queue objesi kullanılmıştır. Vertexlerin parentlerinin tutulduğu bir dizi ve gezilip gezilmediğini belirlemek içinde bir boolean array i kullanılmıştır. Bir vertexden başlanıp yakınındaki vertexler gezilmektedir. Ve sonunda vertexlerin parenlerini array olarak return etmektedir.

writeGraphToFile (String fileName) methodu okuduğumuz formatta aynı zamanda ödev pdf inde belirtilen formatta dosya ya yazan method.

Edge leri tuttuğum bir set objesi oluşturup obje üzerindeki hep bir vertex I gezerek bu set üzerine ekledim ve eklerken tersinin oluşmadığını kontrol edip ekledim böylece yönsüz graphlardaki birden fazla kez yazma sorununu engellemiş oldum.

GetConnectedComponentUndirectedGraph() methodu çağırılan graph objesi üzerindeki birbiri ile bağlı yönsüz graphları Graph dizisi olarak return etmektedir. Methodu yazarken öncelikle bir helper yardımcı method kullandım(helperConnected(int start, Boolean[] visited)). Helper method verilen vertex den başlayıp bağlı olduğu tüm vertexleri gezip ve onları visited olarak işaretlemektedir. Asıl işi yapan methodumuzda bir tane HashSet objesi ve gezilmiş olanlar için Boolean dizisi oluşturdum. Önce bir kez gezerek obje üzerinde kaç adet connected olmayan graph sayısını buldum.

Ondan sonra ise objenin ListGraph yada MatrixGraph olmasına göre iki ayrı durum için değerlendirme yaptım. Method içinde oluşturduğum her iki graph objesi içinde duruma göre değerlendirip graph sayısı kadar yer aldım. Sonra da obje üzerindeki bağlı olmayan graphları bu graphlara ekledim.

HelperConnected(int start, Boolean[] visited) methodu yardımcı method verilen vertex te ve o vertexe bağlı olan vertexleri gezip işaretleyen method. GetConnectedComponentUndirectedGraph() methoduna yardım için yazılmıştır.

IsBipartiteUndirectedGraph() bu methodu implement etmedim.

2- Test Cases

CASE-1:

ListGraph objesine ödevin yanında verilen example.txt den edge leri okuyup sonra tekrardan addRandomEdgesToGraph ile verilen aralıkta yeni edgeler ekledim. Ekliyor.

```
0  
1  
2  
3  
4  
5  
6  
7 public class mainT {  
8     public static void main(String[] args) throws IOException {  
9  
10        BufferedReader bf = new BufferedReader(new FileReader( fileName: "ExampleIGraphInputOrOut  
11        Scanner scann = new Scanner(bf);  
12        ListGraph objL = (ListGraph) AbstractGraphExtended.createGraph(scann, isDirected: false, ty  
13        //MatrixGraph objM = (MatrixGraph) AbstractGraphExtended.createGraph(scann, false, "Matr  
14        System.out.println("Eklenen EDGE NUMBER: "+objL.addRandomEdgesToGraph( edgeLimit: 9));  
15        objL.writeGraphToFile( fileName: "RExample.txt");  
16  
17        //obj.writeGraphToFile("mustaaaaaaa.txt");  
18        /*int[] arr =new int[9];  
19        arr=objL.breadthFirstSearch(0);*/  
20  
21        //objL.getConnectedComponentUndirectedGraph();  
22  
23    }  
24 }  
25  
26
```

mainT

```
/usr/lib/jvm/java-8-oracle/bin/java ...  
Eklenen EDGE NUMBER: 2  
0 1  
6 4  
5 7  
0 3  
1 2
```

ExampleIGraphInputOrOutputFile.txt

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
						1 5	2 5	3 6	4 6	4 7	5 7	6 8	7 8	

AbstractGraphExtended.java × mainT.java × RExample.txt × ExampleGr		
./Desktop/DATA/hw	1	9
	2	0 1
	3	6 4
AbstractGraph	4	5 7
AbstractGraphExte	5	0 3
Edge	6	1 2
amplelGraphInputC	7	4 7
Graph	8	1 5
ListGraph	9	1 4
mainT	10	3 6
MatrixGraph	11	0 6
c.H9RAPOR.docx#	12	2 5
st2.png	13	2 8
ist-Wrtie.png	14	6 8
amplelGraphInputOrC	15	8 7
RAPOR.docx	16	
9.iml		
mple.txt		
.1.txt		
.txt		
.txt		

ListGraph a limit olarak 9 verdim vertex sayısı kadar çalıştırdıktan sonra 2 adet yeni edge ekledi ve return değeri olarak console da gösterdim. Result dosyasındada Rexample.txt dede 2 tane fazla edge görülmekte.

CASE-2:

MatrixGraph objesi için addRandomEdgesToMatrix methodunu çağırdım ve eklediği edge sayısını console ve edge lerin vertexlerini de Result dosyasına yazdırdım.

```
4  /**
5  * Created by mustafa on 19.05.2017.
6  */
7  public class mainT {
8      public static void main(String[] args) throws IOException {
9
10         BufferedReader bf = new BufferedReader(new FileReader( fileName: "ExampleIGraphInputOrOutput
11         Scanner scann = new Scanner(bf);
12         //ListGraph objL = (ListGraph) AbstractGraphExtended.createGraph(scann, false, "List");
13         MatrixGraph objM = (MatrixGraph) AbstractGraphExtended.createGraph(scann, isDirected: false, t
14         System.out.println("Eklenen EDGE NUMBER: "+objM.addRandomEdgesToGraph( edgeLimit: 9));
15         objM.writeGraphToFile( fileName: "RExample.txt");
16
17         //obj.writeGraphToFile("mustaaaaaaa.txt");
18         /*int[] arr =new int[9];
19         arr=obj.breadthFirstSearch(0);*/
20
21         //objL.getConnectedComponentUndirectedGraph();
22     }
23 }
24
25
26
```

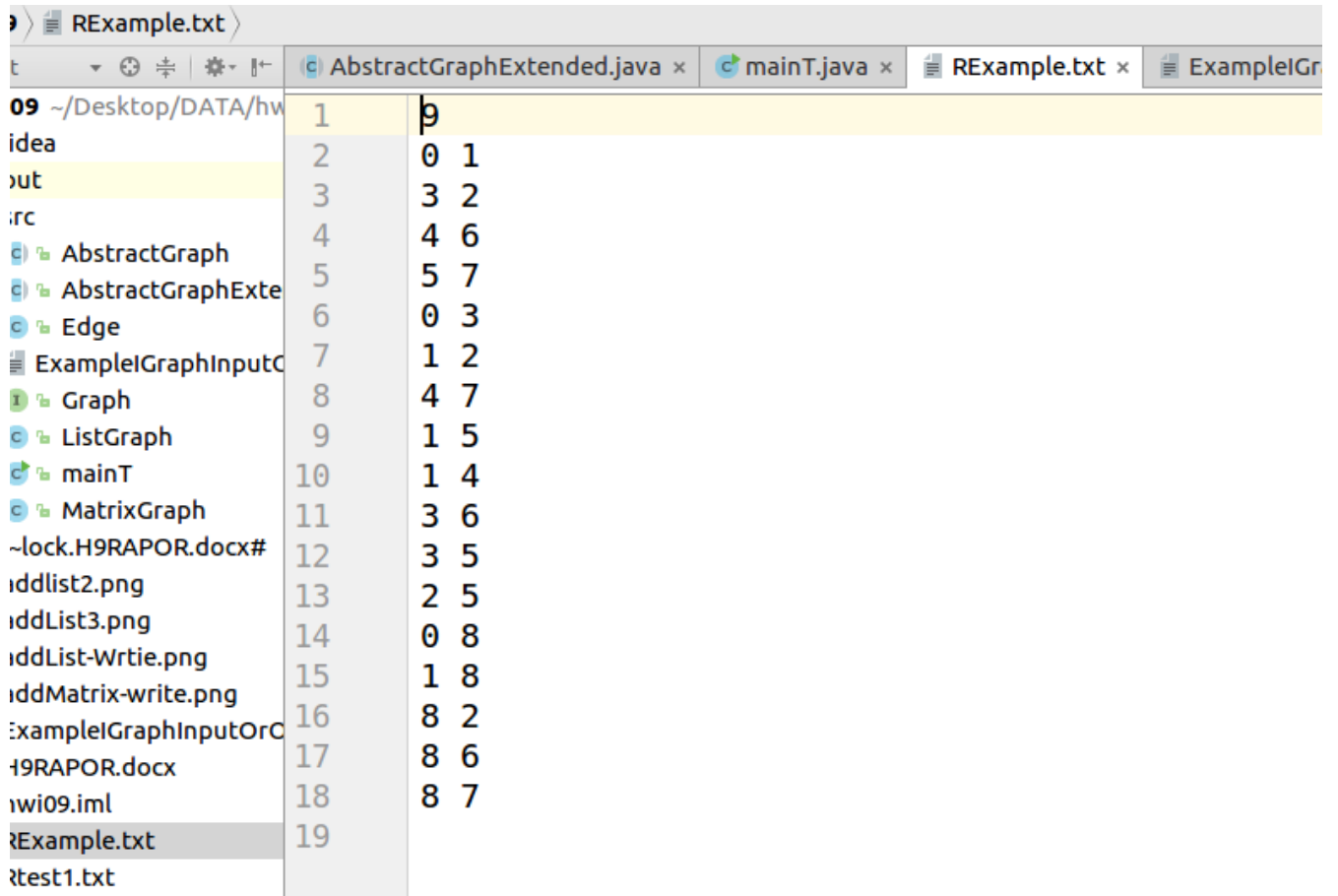
```
mainT
/usr/lib/jvm/java-8-oracle/bin/java ...
Eklenen EDGE NUMBER: 5
0 1
3 2
4 6
5 7
```

Example.txt

ExampleIGraphInputOrOutputFile.txt		
	1	9
	2	0 1
	3	0 3
AbstractGraph	4	1 2
AbstractGraphExtended	5	1 4
Edge	6	1 5
ExampleIGraphInputOrOutputFile.txt	7	2 5
Graph	8	3 6
ListGraph	9	4 6
mainT	10	4 7
MatrixGraph	11	5 7
k.H9RAPOR.docx#	12	6 8
ist-Wrtie.png	13	7 8
ExampleIGraphInputOrOutputFile.txt	14	

ResultExample.txt

5 adet yeni edge eklenmiş durumda.



09 ~/Desktop/DATA/hw	1	9
idea	2	0 1
out	3	3 2
src	4	4 6
AbstractGraph	5	5 7
AbstractGraphExte	6	0 3
Edge	7	1 2
ExamplelGraphInputC	8	4 7
Graph	9	1 5
ListGraph	10	1 4
mainT	11	3 6
MatrixGraph	12	3 5
~lock.H9RAPOR.docx#	13	2 5
iddlist2.png	14	0 8
iddList3.png	15	1 8
iddList-Wrtie.png	16	8 2
iddMatrix-write.png	17	8 6
ExamplelGraphInputOrC	18	8 7
H9RAPOR.docx	19	
wi09.iml		
RExample.txt		
test1.txt		

Text1.txt dosyasından kendi testim kendi vertexlerimi yazdım.
MatrixGraph objesi için.

```

4
5 * Created by mustafa on 19.05.2017.
6
7 public class mainT {
8     public static void main(String[] args) throws IOException {
9
10         BufferedReader bf = new BufferedReader(new FileReader( fileName: "test1.txt"));
11         Scanner scann = new Scanner(bf);
12         //ListGraph objL = (ListGraph) AbstractGraphExtended.createGraph(scann, false, "List");
13         MatrixGraph objM = (MatrixGraph) AbstractGraphExtended.createGraph(scann, isDirected: fal
14         System.out.println("Eklenen EDGE NUMBER: "+objM.addRandomEdgesToGraph( edgeLimit: 6));
15         objM.writeGraphToFile( fileName: "RExample.txt");
16
17         //obj.writeGraphToFile("mustaaaaaaa.txt");
18         /*int[] arr =new int[9];
19         arr=obj.breadthFirstSearch(0);*/
20
21         //objL.getConnectedComponentUndirectedGraph();
22
23     }
24 }
25
26

```

```

mainT
/usr/lib/jvm/java-8-oracle/bin/java ...
Eklenen EDGE NUMBER: 4
2 2
0 1
4 5
2 3

```

test1.txt

AbstractGraphExtended.java x mainT.java x RExample.txt x test1.txt :

desktop/DATA/hw	1	6
	2	0 1
AbstractGraph	3	1 2
AbstractGraphExtended	4	2 3
ExampleGraphInputOrC	5	4 5
Graph	6	
ListGraph		
mainT		
MatrixGraph		
H9RAPOR.docx#		
!.png		
3.png		
-Wrtie.png		
rix-write.png		
elGraphInputOrC		
OR.docx		

Test1.txt

	1	6
ATA/hw	2	2 2
ph	3	0 1
phExte	4	4 5
hInputC	5	2 3
1	6	1 2
docx#	7	0 4
g	8	0 5
ong	9	4 2
putOrC	10	

belirlenen random sayı sonrasındaki ekleme 4 adet yeni edge daha eklendi. Aynı edge ler hiçbir zaman eklenmemektedir.

CASE-3

Çağırılan ListGraph objesi üzerindeki bağlı olmayan yönsüz graphları console da yazdırdım. Ve bağlı olmayanları ayrı ayrı yazmakta.


```
3  
4 /**  
5  * Created by mustafa on 19.05.2017.  
6  */  
7 public class mainT {  
8     public static void main(String[] args) throws IOException {  
9  
10        BufferedReader bf = new BufferedReader(new FileReader( fileName: "test1.txt"));  
11        Scanner scann = new Scanner(bf);  
12        ListGraph objL = (ListGraph) AbstractGraphExtended.createGraph(scann, isDirected: false,  
13        //MatrixGraph objM = (MatrixGraph) AbstractGraphExtended.createGraph(scann, false, "Ma  
14        //System.out.println("Eklenen EDGE NUMBER: "+objM.addRandomEdgesToGraph(6));  
15        objL.getConnectedComponentUndirectedGraph();  
16        objL.writeGraphToFile( fileName: "RExample.txt");  
17  
18    }  
19 }  
20  
21
```

Process finished with exit code 0

Consoleda da görüldüğü gibi ayrı olarak yazmakta.

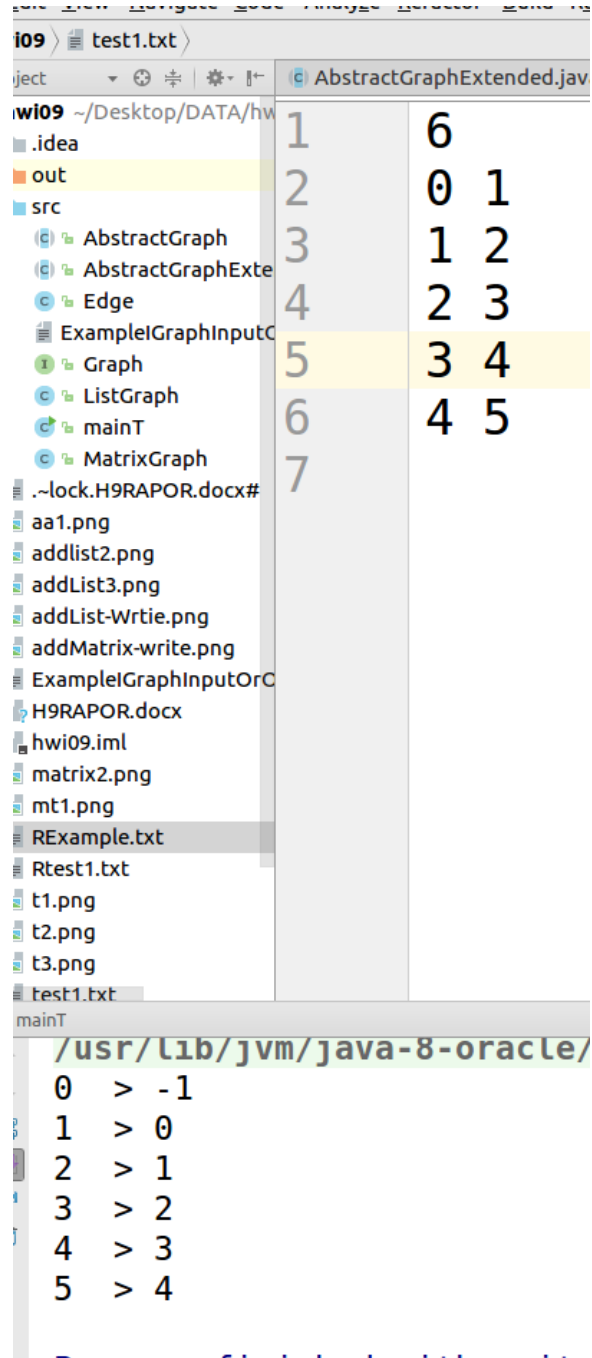
Aynı durumu MatrixGraph objesi için gerçekleştirdim.

```
1 import java.io.*;  
2 import java.util.Scanner;  
3  
4 /**  
5  * Created by mustafa on 19.05.2017.  
6  */  
7 public class mainT {  
8     public static void main(String[] args) throws IOException {  
9  
10        BufferedReader bf = new BufferedReader(new FileReader( fileName: "test1.txt"));  
11        Scanner scann = new Scanner(bf);  
12        //ListGraph objL = (ListGraph) AbstractGraphExtended.createGraph(scann, false, "List");  
13        MatrixGraph objM = (MatrixGraph) AbstractGraphExtended.createGraph(scann, isDirected: false, typ  
14        //System.out.println("Eklenen EDGE NUMBER: "+objM.addRandomEdgesToGraph(6));  
15        objM.getConnectedComponentUndirectedGraph();  
16        objM.writeGraphToFile( fileName: "RExample.txt");  
17  
18    }  
19 }  
20  
21
```

Process finished with exit code 0

Aynı şekilde çalışmakta.

ListGraph Objesi için breadthFirstSearch methodu parentlerini return etmekte.



The screenshot shows an IDE with three main panels. The top panel is a file explorer showing a project structure with folders like .idea, out, and src, and various files including AbstractGraph, AbstractGraphExtended, Edge, Example1GraphInputOrC, Graph, ListGraph, mainT, MatrixGraph, and test1.txt. The middle panel shows a class hierarchy with AbstractGraphExtended at the top, followed by Graph, ListGraph, and MatrixGraph. The bottom panel is a console output showing the results of a breadthFirstSearch method call on a ListGraph object. The output is a list of parent nodes for each node in the graph, starting from node 0 and ending at node 5.

```
0 > -1
1 > 0
2 > 1
3 > 2
4 > 3
5 > 4
```

Parentleri console da görülmekte.

```
6  */
7  public class mainT {
8  public static void main(String[] args) throws :
9
10     BufferedReader bf = new BufferedReader(new
11     Scanner scann = new Scanner(bf);
12     ListGraph objL = (ListGraph) AbstractGraph
13     //MatrixGraph objM = (MatrixGraph) Abstrac
14     //System.out.println("Eklenen EDGE NUMBER:
15     /*objL.getConnectionComponentUndirectedGrap
16     objL.writeGraphToFile("REExample.txt");
17     */
18
19
20     int[] ar = new int[objL.getNumV()];
21     ar=objL.breadthFirstSearch( start: 0);
22     for(int i=0; i<ar.length; ++i){
23         System.out.println(i+" > "+ar[i]);
24     }
25 }
26 }
27
```

```
/usr/lib/jvm/java-8-oracle/bin/java ...
0 > -1
1 > 0
2 > 1
3 > 2
4 > 3
5 > 4
```

Ödevde verilen Example.txt dosyası ile de denedim.

hw109 - [~/Desktop/DATA/hw109] - [hw109] - ~/Desktop/

Edit View Navigate Code Analyze Refactor Build Run

hw109 > Example1GraphInputOrOutputFile.txt

Project AbstractGraphExtended.java x

hw109 ~/Desktop/DATA/hw109

- .idea
- out
- src
 - AbstractGraph
 - AbstractGraphExtended
 - Edge
 - Example1GraphInputOrOutputFile.txt
 - Graph
 - ListGraph
 - mainT
 - MatrixGraph
- ..lock.H9RAPOR.docx#
- aa1.png
- aa2.png
- addlist2.png
- addList3.png
- addList-Wrtie.png
- addMatrix-write.png
- Example1GraphInputOrOutputFile.txt
- H9RAPOR.docx
- hw109.iml
- matrix2.png
- mt1.png
- RExample.txt
- Rtest1.txt
- t1.png
- t2.png
- t3.png

mainT

/usr/lib/jvm/java-8-oracle/bin/jav

0 > -1

1 > 0

2 > 1

3 > 0

4 > 1

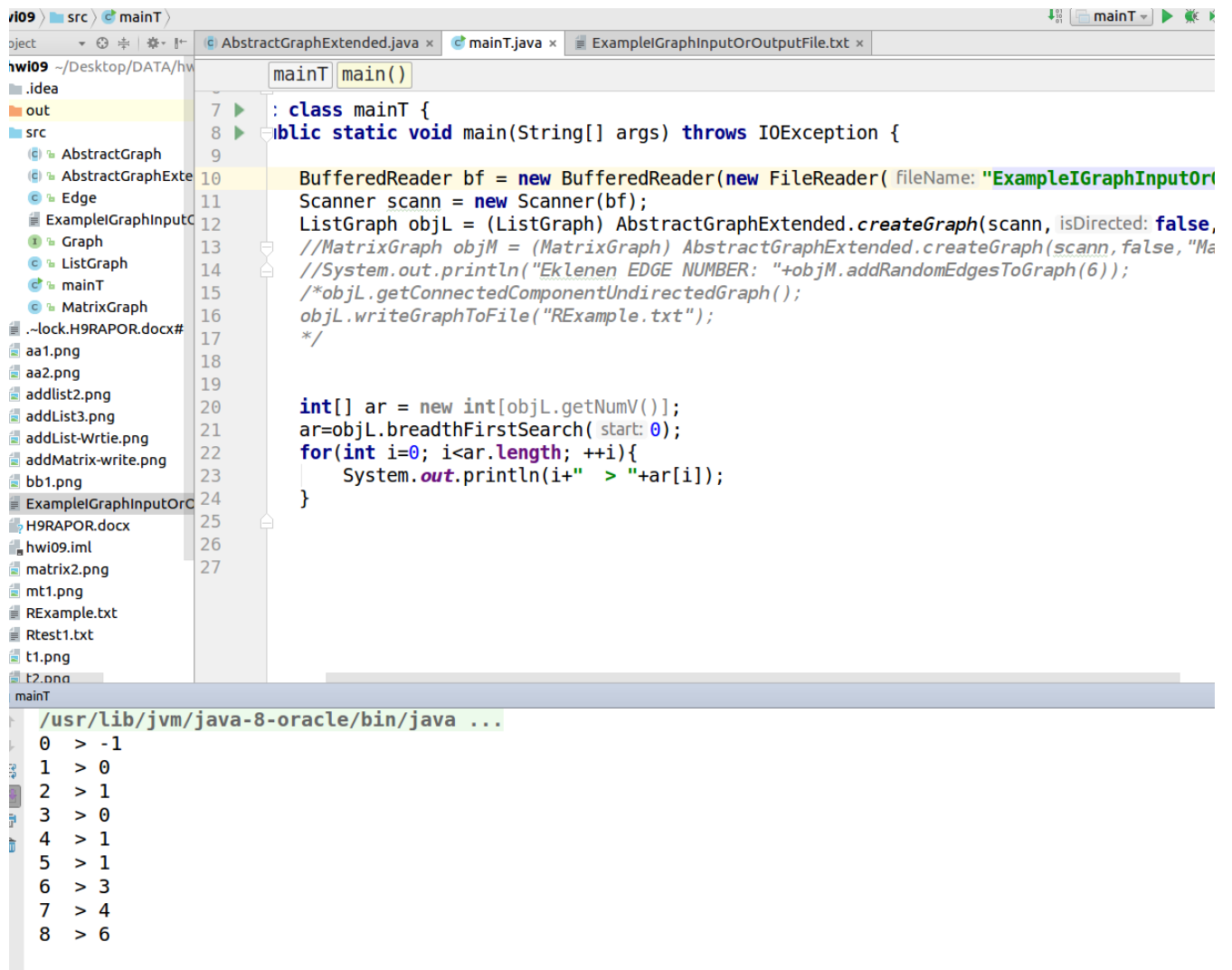
5 > 1

6 > 3

7 > 4

8 > 6

1	9
2	0 1
3	0 3
4	1 2
5	1 4
6	1 5
7	2 5
8	3 6
9	4 6
10	4 7
11	5 7
12	6 8
13	7 8
14	



```
hw109 > src > mainT
AbstractGraphExtended.java x mainT.java x ExampleIGraphInputOrOutputFile.txt x
hw109 ~/Desktop/DATA/hw109
src
  AbstractGraph
  AbstractGraphExtended
  Edge
  ExampleIGraphInputOrOutputFile
  Graph
  ListGraph
  mainT
  MatrixGraph
  .lock.H9RAPOR.docx#
aa1.png
aa2.png
addList2.png
addList3.png
addListWrite.png
addMatrixWrite.png
bb1.png
ExampleIGraphInputOrOutputFile
H9RAPOR.docx
hw109.iml
matrix2.png
mt1.png
REExample.txt
Rtest1.txt
t1.png
t2.png
mainT

7 : class mainT {
8 public static void main(String[] args) throws IOException {
9
10     BufferedReader bf = new BufferedReader(new FileReader( fileName: "ExampleIGraphInputOrOutputFile.txt"));
11     Scanner scann = new Scanner(bf);
12     ListGraph objL = (ListGraph) AbstractGraphExtended.createGraph(scann, isDirected: false, "MatrixGraph");
13     //MatrixGraph objM = (MatrixGraph) AbstractGraphExtended.createGraph(scann, false, "MatrixGraph");
14     //System.out.println("Eklenen EDGE NUMBER: "+objM.addRandomEdgesToGraph(6));
15     /*objL.getConnectedComponentUndirectedGraph();
16     objL.writeGraphToFile("REExample.txt");
17     */
18
19
20     int[] ar = new int[objL.getNumV()];
21     ar=objL.breadthFirstSearch( start: 0);
22     for(int i=0; i<ar.length; ++i){
23         System.out.println(i+" > "+ar[i]);
24     }
25
26
27

/usr/lib/jvm/java-8-oracle/bin/java ...
0 > -1
1 > 0
2 > 1
3 > 0
4 > 1
5 > 1
6 > 3
7 > 4
8 > 6
```

Console da parentleri gözükmekte.

Şimdi bir de aynısını MatrixGraph objesi için deneyelim.

hw109 - [~/Desktop/DATA/hw109] - [hw109] - ~/Desktop/

Edit View Navigate Code Analyze Refactor Build Run

hw109 > Example1GraphInputOrOutputFile.txt

Project AbstractGraphExtended.java x

hw109 ~/Desktop/DATA/hw109

- .idea
- out
- src
 - AbstractGraph
 - AbstractGraphExtended
 - Edge
 - Example1GraphInputOrOutputFile.txt
 - Graph
 - ListGraph
 - mainT
 - MatrixGraph
- ..lock.H9RAPOR.docx#
- aa1.png
- aa2.png
- addlist2.png
- addList3.png
- addList-Wrtie.png
- addMatrix-write.png
- Example1GraphInputOrOutputFile.txt
- H9RAPOR.docx
- hw109.iml
- matrix2.png
- mt1.png
- RExample.txt
- Rtest1.txt
- t1.png
- t2.png
- t3.png

mainT

/usr/lib/jvm/java-8-oracle/bin/jav

0 > -1

1 > 0

2 > 1

3 > 0

4 > 1

5 > 1

6 > 3

7 > 4

8 > 6

1	9
2	0 1
3	0 3
4	1 2
5	1 4
6	1 5
7	2 5
8	3 6
9	4 6
10	4 7
11	5 7
12	6 8
13	7 8
14	

```
.idea
out
src
  AbstractGraph
  AbstractGraphExtended
  Edge
  ExampleIGraphInputOrOutput
  Graph
  ListGraph
  mainT
  MatrixGraph
  ..lock.H9RAPOR.docx#
  aa1.png
  aa2.png
  addlist2.png
  addlist3.png
  addList-Wrtie.png
  addMatrix-write.png
  bb1.png
  bb2.png
  ExampleIGraphInputOrOutput
  H9RAPOR.docx
  hwi09.iml
  matrix2.png
  mt1.png
  RExample.txt
  Rtest1.txt
  t1.png
mainT

7 ▶ : class mainT {
8 ▶ public static void main(String[] args) throws IOException {
9
10     BufferedReader bf = new BufferedReader(new FileReader( fileName: "ExampleIGraphInputOrOutput.txt"));
11     Scanner scann = new Scanner(bf);
12     //ListGraph objL = (ListGraph) AbstractGraphExtended.createGraph(scann, false, "ListGraph");
13     MatrixGraph objM = (MatrixGraph) AbstractGraphExtended.createGraph(scann, isDirected: true);
14     //System.out.println("Eklenen EDGE NUMBER: "+objM.addRandomEdgesToGraph(6));
15     /*objL.getConnectedComponentUndirectedGraph();
16     objL.writeGraphToFile("RExample.txt");
17     */
18
19
20     int[] ar = new int[objM.getNumV()];
21     ar=objM.breadthFirstSearch( start: 0);
22     for(int i=0; i<ar.length; ++i){
23         System.out.println(i+" > "+ar[i]);
24     }
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2612
2613
2614
2615
2616
2617
2618
2619
2620
2621
2622
2623
2624
2
```


hw09 > test1.txt

ject

AbstractGraphExtended.jav

hw09 ~/Desktop/DATA/hw

.idea

out

src

AbstractGraph

AbstractGraphExte

Edge

ExampleIGraphInputC

Graph

ListGraph

mainT

MatrixGraph

./lock.H9RAPOR.docx#

aa1.png

addlist2.png

addList3.png

addList-Wrtie.png

addMatrix-write.png

ExampleIGraphInputOrC

H9RAPOR.docx

hw09.iml

matrix2.png

mt1.png

RExample.txt

Rtest1.txt

t1.png

t2.png

t3.png

test1.txt

1

2

3

4

5

6

7

6

0 1

1 2

2 3

3 4

4 5

mainT

/usr/lib/jvm/java-8-oracle/

0 > -1

1 > 0

2 > 1

3 > 2

4 > 3

5 > 4

The screenshot shows an IDE with a project named 'main1'. The file explorer on the left lists various files including 'MatrixGraph', 'test1.txt', and 'test2.txt'. The main editor displays the following Java code:

```
8 public static void main(String[] args) throws IOException {
9
10     BufferedReader bf = new BufferedReader(new FileReader("test1.txt"));
11     Scanner scann = new Scanner(bf);
12     //ListGraph objL = (ListGraph) AbstractGraphExtended.createGraph(scann, fa
13     MatrixGraph objM = (MatrixGraph) AbstractGraphExtended.createGraph(scann,
14     //System.out.println("Eklenen EDGE NUMBER: "+objM.addRandomEdgesToGraph(6
15     /*objL.getConnectedComponentUndirectedGraph();
16     objL.writeGraphToFile("RExample.txt");
17     */
18
19
20     int[] ar = new int[objM.getNumV()];
21     ar=objM.breadthFirstSearch( start: 0);
22     for(int i=0; i<ar.length; ++i){
23         System.out.println(i+" > "+ar[i]);
24     }
25
26
27 }
```

The output window at the bottom shows the results of the execution:

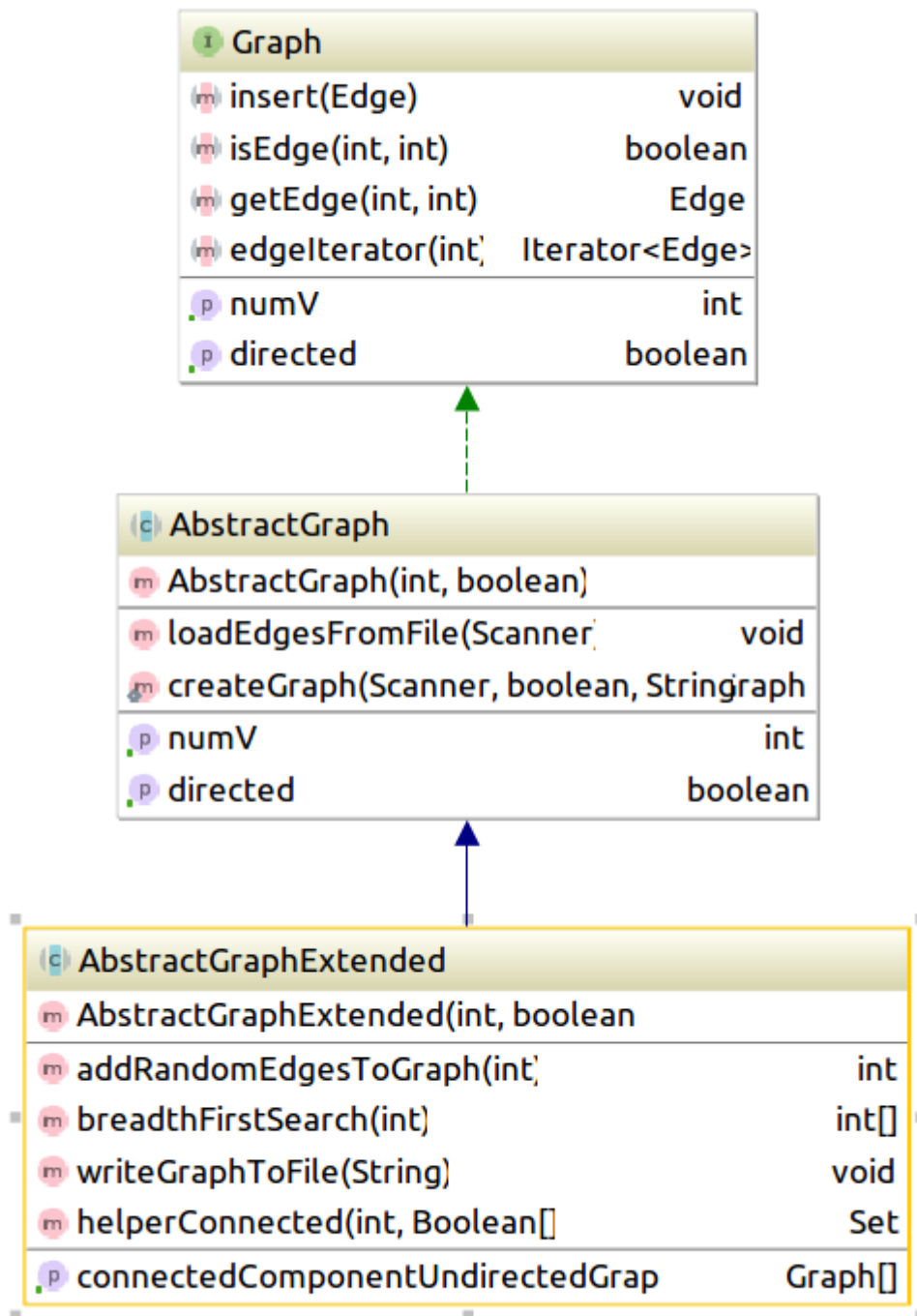
```
mainT
/usr/lib/jvm/java-8-oracle/bin/java ...
0 > -1
1 > 0
2 > 1
3 > 2
4 > -1
5 > -1
```

BreadthFirstSearch methodu bu obje ile de çalışıyor.

3-Running Command and Results

Case durumlarında tüm çalışma durumlarımda adım adım gösterdim. Buraya da eklemedim tekrardan.

4-Class Diagram



https://github.com/mstfbngl/141044077_hw09