

**CSE 4256: Homework 7 - Due Thursday, June 24**

**Complement of a Graph**

The complement of a graph  $G$  is a graph  $H$  on the same vertices such that two distinct vertices of  $H$  are adjacent if and only if they are not adjacent in  $G$ . Show below is a graph  $G$  and its complement.



Figure 1: Graph G



Figure 2: The complement of G

### The Transpose of a Directed Graph

A directed graph is one in which the edges can be travelled in only one direction. The transpose of a directed graph  $G$  is another directed graph on the same set of vertices with all of the edges reversed compared to the orientation of the corresponding edges in  $G$ .



Figure 3: A directed graph  $G$



Figure 4: A directed graph  $G$

## Homework

### Question 1:

Write a method called **complementw1(m)** that takes an adjacency-matrix representation of an undirected graph as an argument, and returns a matrix representing its complement. For example, for the matrix:

```
[[0, 1, 0, 0],  
 [1, 0, 0, 1],  
 [0, 0, 0, 1],  
 [0, 1, 1, 0]]
```

The method should return:

```
[[0, 0, 1, 1],  
 [0, 0, 1, 0],  
 [1, 1, 0, 0],  
 [1, 0, 0, 0]]
```

### Question 2:

Write a method called **complement2(g)** that takes an adjacency-list representation (i.e. a dictionary) of an undirected graph as an argument, and returns an adjacency-list representing its complement. For example, for the dictionary:

```
g = {0: [1, 2, 4],  
     1: [0, 2, 4],  
     2: [0, 1, 3],  
     3: [2, 4],  
     4: [1, 3]}
```

The method should return:

```
g = {0: [3],  
     1: [3],  
     2: [4],  
     3: [0, 1],  
     4: [0, 2]}
```

### Question 3:

Write a method called **transpose1(m)** that takes an adjacency-matrix representation of a directed graph as an argument, and returns a matrix representing its transpose. For example, for the matrix:

```
[[0, 1, 0, 1],  
 [0, 0, 1, 0],  
 [1, 1, 0, 1],  
 [0, 1, 1, 0]]
```

The method should return:

```
[[0, 0, 1, 0],  
 [1, 0, 1, 1],  
 [0, 1, 0, 1],  
 [1, 0, 1, 0]]
```

**Question 4:**

Write a method called **transpose2(g)** that takes an adjacency-list representation (i.e. a dictionary) of a directed graph as an argument, and returns an adjacency-list representing its transpose. For example, for the dictionary:

```
g = {0: [1, 2, 4],  
     1: [0, 2, 4],  
     2: [0, 1, 3],  
     3: [2, 4],  
     4: [1, 3]}
```

The method should return:

```
g = {0: [1, 2],  
     1: [0, 2, 4],  
     2: [0, 1, 3],  
     3: [2, 4],  
     4: [0, 1, 3]}  
}
```

**What to Submit**

Submit your Python file on Carmen.