ASSIGNMENT WEEK 7

There are two problems for this assignment.

CONNECTED COMPONENT

0. Consider the following algorithm to check connectivity of a graph defined by its adjacency matrix.

ALGORITHM *Connected*$(A[0..n-1, 0..n-1])$

```
//Input: Adjacency matrix A[0..n − 1, 0..n − 1]) of an undirected graph G
//Output: 1 (true) if G is connected and 0 (false) if it is not
if n = 1 return 1   //one-vertex graph is connected by definition
else
    if not Connected(A[0..n − 2, 0..n − 2]) return 0
    else for j ← 0 to n − 2 do
            if A[n − 1, j] return 1
        return 0
```

1. Implement this algorithm in a class **Graph** as static method **Connected** which returns a **Boolean** value. Use a two-dimensional Boolean array $A[\,][\,]$. In your main program, use the graph with the given matrix.
   Provide a screenshot of the output of your test run.
   Hint: A slice of a one-dimensional array can be created with **Arrays.copyOfRange**.

$$A = \begin{bmatrix} 0 & 0 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 1 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 1 & 0 \end{bmatrix}$$

2. Does this algorithm work correctly for every undirected graph with n > 0 vertices? If you answer yes, indicate the algorithm's efficiency class in the worst case; if you answer no, explain why.

The parts 1 – 2 will be graded according to the rubric on the next page for a total of 8 points.

WARSHALL'S ALGORITHM

In class we implemented Warshall's All-Shortest Paths Algorithm.

1. Use the code created in class as a starting point. Apply Warshall's algorithm to find the transitive closure of the digraph defined by the following adjacency matrix.

$$A = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

   Use an appropriate Java method to print the transitive closure. **Provide a screenshot of the output of your test run.**

Part 1 will be graded according to the rubric for a total of 4 points.

SCORE	**4**	**3**	**2**	**1**	**0**
SKILL LEVEL	Response gives evidence of a complete understanding of the problem; is fully developed; is clearly communicated.	Response gives the evidence of a clear understanding of the problem but contains minor errors or is not fully communicated.	Response gives evidence of a reasonable approach but indicates gaps in conceptual understanding. Explanations are incomplete, vague, or muddled.	Response gives some evidence of problem understanding but contains major math or reasoning errors.	No response or response is completely incorrect or irrelevant.