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CMSC 441
HW 11

1. Exercise 25.2-4

As it appears above, the Floyd-Warshall algorithm requires $\Theta(n^3)$ space, since we computer $d_{ij}^{(k)}$ for $i, j, k = 1, 2, \ldots, n$. Show that the following procedure, which simply drops all the superscripts, is correct, and thus only $\Theta(n^2)$ space is required.

```
Floyd-Warshall'(W)
     n <- rows[W]
     D <- W
     for k <- 1 to n
          do for i <- 1 to n
               do for j <- 1 to n
                    do d_ij <- min (d_ij, d_ik + d_kj)
     return D
```

2. Exercise 25.3-6

Professor Michener claims that there is no need to create a new source vertex in line 1 of Johnson. He claims that instead we can just use $G' = G$ and let s be and vertex in $V[G]$. Give an example of a weighted, directed graph G for which incorporating the professor's idea into Johnson causes incorrect answers. Then show that if G is strongly connected (every vertex is reachable from every other vertex), the results returned by Johnson with the professor's modifications are correct.

3. Exercise 29.1-9

Give an example of a linear program for which the feasible region is not bounded, but the optimal objective value is finite.

4. An independent set of vertices in a graph $G=(V,E)$ is a subset V' of V such that no two vertices in V' are connected by an edge. The independent-set problem is to find a maximum-size independent set in G (see problem 34-1).

- **Explain how to formulate the independent-set problem as an integer linear programming problem (see problem 29-3).**
- **Do you think it is possible to formulate the independent-set problem as an ordinary linear programming problem?**

(Hint: look at problem 34-1(a) (but don't solve it!))