Problem 1: Graphs

Calculate $M^2$, $M^3$ and $M^4$ for the adjacency matrix

\[
M = \begin{bmatrix}
0 & 1 & 0 & 0 \\
0 & 0 & 1 & 0 \\
0 & 0 & 0 & 1 \\
1 & 0 & 0 & 0
\end{bmatrix}
\]

Problem 2: Graphs

Use Dijkstra’s algorithm on the following graph to determine the shortest distances to each vertex:
(a) from vertex A
(b) from vertex C

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Diagram of the graph with edge labels:

- C to B: 11
- C to D: 5
- D to A: 4
- D to B: 12
- E to F: 6
- E to D: 8
- F to E: 2
- B to A: 3
- A to C: 10

Problem 3: Algorithms
Given the pseudocode below and assuming \( n \) is a positive integer do the following:

\[
\begin{align*}
    s &:= 0 \\
    \text{for } i &:= 1 \text{ to } n \\
    \quad \text{for } j &:= 1 \text{ to } i \\
    \quad s &:= s + j \times (i-j+1) \\
    \text{next } j \\
    \text{next } i
\end{align*}
\]

(1) compute the number of additions, subtractions and multiplications the are performed when the algorithm is executed.

(2) Find the order (in big O notation) of this algorithm.