CS2223 D Term 2020 Quiz 25

(1 point) Question 1: "My brain is open. . . ."
I pledge that I am taking this quiz on my own, with help from no one else and no notes:

(3 points) Question 2: Given $n \times n$ adjacency matrix A for a (di)graph, the (i, j) entries in $A^k, k \geq 1$ represent[1]:

a.) The number of distinct walks from i to j with fewer than k steps.
b.) The number of distinct walks from i to j with exactly k steps.
c.) The number of distinct walks from i to j with k or fewer steps.
d.) The number of distinct walks from i to j with k or more steps.
e.) The number of distinct walks from i to j with more than k steps.

(3 points) Question 3: Given $n \times n$ adjacency matrix A, a (di)graph representing the Transitive Closure of its modeled relation consists of:

a.) At least as many edges as non-zero entries in A
b.) At least $\frac{n^2}{2}$ edges
c.) Weighted edges that count the number of paths between vertices
d.) Binary (0 or 1) entries representing edges connecting vertices in arbitrarily-many steps
e.) Non-negative (0,1,2,. . .) entries representing edges counting arbitrarily-many steps

(3 points) Question 4: Given $n \times n$ adjacency matrix A, an adjacency matrix representing the Transitive Closure of its modeled relation consists of:

a.) At least as many edges as non-zero entries in A
b.) At least $\frac{n^2}{2}$ edges
c.) Weighted edges that count the number of paths between vertices
d.) Binary (0 or 1) entries representing edges connecting vertices in arbitrarily-many steps
e.) Non-negative (0,1,2,. . .) entries representing edges counting arbitrarily-many steps

(1 point) Bonus Question: Our method of raising $n \times n$ adjacency matrix A to powers and 'or'-ing them (taking unions) for finding the Connectivity Relation has time complexity:

a.) Dominated by the 'or'-ing operation: $O(n^2)$.
b.) The same as Matrix Multiplication: $O(n^3)$.
c.) n Matrix Multiplications and n 'or's: $O(n \cdot n^3 + n \cdot n^2) = O(n^4)$
d.) Dominated by n^2 Matrix Multiplications: $O(n^2 \cdot n^3) = O(n^5)$.
e.) n Matrix Multiplications times n 'or's: $O(n \cdot n^3 \times n \cdot n^2) = O(n^7)$

[1] In a walk, vertices and edges can both be repeated. Technically, in a path, neither can.