

CS447/547/MA447/EE669 Quiz 3 (fourth). Fall 2019 (take home).

Note: You may consult class materials but the submitted solution must be your own work.

Match the algorithms with the complexities.

Algorithms

- (i) Binary search.
- (ii) Median finding (deterministic).
- (iii) Mergesort.
- (iv) Heapsort.
- (v) Insertion sort.
- (vi) Random walk for 2SAT (satisfiable instance with n variables).
- (vii) Edit Distance (inputs of length n).
- (viii) Integer Multiplication (n -bit integers, Karatsuba).
- (ix) Matrix Multiplication ($n \times n$ matrices, Strassen).
- (x) Strongly Connected Components (n -vertex m -edge graph, Depth First Search twice).
- (xi) Shortest Path (n -vertex m -edge graph, Breadth First Search).
- (xii) Shortest Path (n -vertex m -edge weighted graph, Dijkstra).
- (xiii) All-pairs shortest paths (n -vertex m -edge graph).
- (xiv) Maximum Flow (n -vertex m -edge graphs, Edmonds-Karp).
- (xv) Linear programming (n -variable m -constraint, Simplex method).

Complexities

- (1) $T(n, m) = \Omega\left(\binom{n+m}{n}\right)$.
- (2) $T(n, m) = \Theta(nm)$.
- (3) $T(n, m) = \Theta(n^3)$.
- (4) $T(n, m) = \Theta(n^2 + m)$.
- (5) $T(n, m) = \Theta(n + m)$.
- (6) $T(n, m) = \Theta(n + m)$.
- (7) $T(n) = 7T(n/2) + n^2$.
- (8) $T(n) = 3T(n/2) + n$.
- (9) $T(n) = \Theta(n^2)$.
- (10) $T(i) = \frac{1}{2}(T(i-1) + T(i+1)) + 1$, $T(n) = T(n-1) + 1$, $T(0) = 1$.
- (11) $T(n) = T(n-1) + n$.
- (12) $T(n) = \sum_{k=1}^n \log_2 k$.
- (13) $T(n) = 2T(n/2) + n$.
- (14) $T(n) = T(7n/10) + T(n/5) + n$.
- (15) $T(n) = T(n/2) + 1$.