
1. Which is the correct order of magnitude?

- A. $n^2 \log n + n^3 + 3n^2 + 3$ $O(n^2)$
- B. $n + 1000$ $O(1)$
- C. $6n^{20} + 2n$ $O(n^{20})$**
- D. $n^3 + 5n^2 \log n + n$ $O(n^3)$**

2. Which of the following statements is correct?

- A. $O((\log n)^2) < O(\sqrt{n}) < O(n \log n) < O(n^2 * (\log n)^4) < O(n^3)$**
- B. $O(\sqrt{n}) < O((\log n)^2) < O(n \log n) < O(n^3) < O(n^2 * (\log n)^4)$
- C. $O(\sqrt{n}) < O(n \log n) < O((\log n)^2) < O(n^2 * (\log n)^4) < O(n^3)$
- D. $O(\sqrt{n}) < O(n \log n) < O((\log n)^2) < O(n^3) < O(n^2 * (\log n)^4)$

3. Which is the most efficient algorithm in worst case when search a number in a **pre-sorted list**?

- A. Linear search
- B. Binary search**
- C. Horspool Algorithm
- D. They are equal

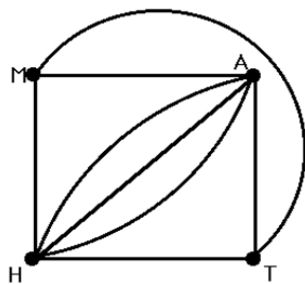
4. Which of the following algorithm is NOT the best worst-case comparison-based sorting algorithm?

- A. Quick sort
- B. Counting sort**
- C. Selection sort
- D. None of the above algorithms are the worst-case comparison-based sorting algorithms.

5. Which of the following time complexity expressions belongs to Merge sort($n \neq 1$)?

- A. $T(n) = T(n/2) + 1$
- B. $T(n) = 2T(n/2) + 1$
- C. $T(n) = 2T(n/2) + n$**
- D. $T(n) = 2T(n-1) + 1$

6. What is the degree of this graph?

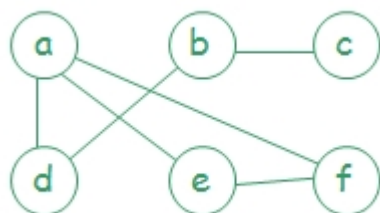


- A. 3
- B. 5**
- C. 4
- D. 6

7. Which graph allows a self loop and which path is a circuit containing every vertex of graph exactly once?

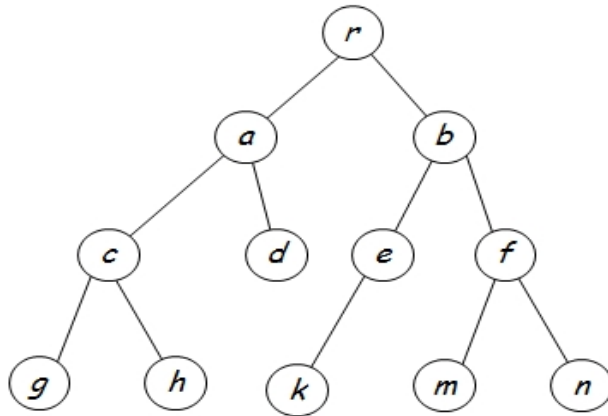
- A. multiple graph ; Hamiltonian circuit**
- B. loop graph ; Euler path
- C. loop graph ; Euler circuit
- D. pseudo graph ; Hamiltonian circuit**

8. Apply BFS and DFS to the following graph starting from vertex a and list the order of exploration. Which of the following is true?



- A. BFS : a d e f b c ; DFS : a d b c e f**
- B. BFS : a d e b f c ; DFS : a e f d b c
- C. BFS : a d e f b c ; DFS : a d e b f c
- D. BFS : a d b c e f ; DFS : a d b c e f

9. Traversing a binary tree by postorder traversal. Which of the following order is correct?



- A. r, a, c, g, h, d, b, e, k, f, m, n
- B. g, c, h, a, d, r, k, e, b, m, f, n
- C. g, h, c, d, a, k, e, m, n, f, b, r**
- D. None of above orders are correct

10. Which of the following statements is correct?

- A. Dijkstra's algorithm can always find the shortest paths.
- B. The time complexity of *Prim's* algorithm is $O(|V|\log|E|)$**
- C. The idea of divide and conquer is to find the solution by dividing the original problem into small problems and solving the smallest problem in some bottom-up manner.
- D. The time complexity of the *Kruskal's* algorithm is only related to the number of edges in the graph

11. Which of the following statements is correct?

- A. Horspool algorithm is a simplified version of the Boyer-Moore algorithm**
- B. The shift table of TCCTATTCTT is

A	T	G	C
5	2	9	1

- C. Boyer-Moore algorithm preprocesses pattern left to right to get useful information for later searching
- D. Counting sort is a comparison sort with a time complexity $O(n+k)$

12. Which of the following statements is correct?

- A. Bellman-Ford Algorithm can only find a shortest path or detect a negative weighted cycle in a graph for single-source shortest paths
- B. Warshall's Algorithm is used to compute the transitive closure of a relation**
- C. The time complexity of Warshall's Algorithm is $O(n^2 \log n)$

D. Floyd's Algorithm does not reflect the idea of dynamic programming

13. Which of the following statements is correct?

- (1) Global methods are useful when you want to force two sequences to align over their entire length
- (2) In the table of local alignment, the minimal score can be negative
- (3) One of the Longest Common Subsequence between sequences of GAGT and AGACCT is AGT
- (4) When trace back, global alignment start at highest score and trace arrows back to first 0

- A. (1)(4)
- B. (2)(3)(4)
- C. (1)(3)**
- D. (1)(2)(3)(4)

14. Which of the following statements is false?

- A. The complexity class NP is the set of all problems that can be verified in polynomial time.**
- B. A problem M is said to be NP-Complete if every other problem in NP is polynomial time reducible to M
- C. $P \neq NP$, $P \cap NPC = \{\}$
- D. Vertex Cover is a NP-Complete problem

15. Which of the following statements is correct?

- A. Given the following instance of the 0/1 Knapsack problem and the Knapsack Capacity $W=3$, the value of the most valuable subset is 30

item	weight	value
1	2	\$12
2	1	\$10
3	3	\$20

- B. Backtracking using breadth-first search to explore the state space tree
- C. The expression of accuracy ratio for minimization problems is $r(S_a) = f(S^*)/f(S_a)$
- D. The solution of the following TSP by using Twice-Around-the-Tree Algorithm is abcdea**

