King Abdulaziz University - Computer Science Department - Fall 2011 (Semester 1, 1432/1433)

CPCS-223 • Test 2 (50 Points) • 60 Minutes

**Name:**   **Number:**

15 Multiple-choice questions each worth 1 point. Do not spend more than 25 minutes on the MCQ.

1. The efficiency of the recurrence $A(n) = 2A(n/2) + 2n, A(1) = 0$ is

    A) $\Theta(n^{\log_2 n})$ **B)** $\Theta(n)$ **C)** $\Theta(n^2)$ **D)** $\Theta(n \log n)$ **E)** $\Theta(1)$

2. Which of the following type of graph edge connects a vertex to one of its ancestors?
    A) Cross edge   **B)** Forward edge   **C)** Tree edge   **D)** Back edge   **E)** None of the above

3. Under reasonable assumptions, quickhull has _____ average efficiency compared to the
    _____ average of the brute force algorithm of the convex hull problem.
    A)   linear, cubic   **D)**   quadratic, quadratic
    B) $n \log n$, cubic   **E)**   linear, quadratic
    C)   quadratic, cubic

4. One of the following can be used to find articulation points of a graph
    A) Johnson-Trotter algorithm   **B)** DFS   **C)** Partition algorithm   **D)** BFS   **E)** DFS or BFS

5. In what order are the following permutations of {1,2,3,4}?
    4132 4312 4321
    A)   Squashed   **D)**   Lexicographic
    B)   Minimal-change   **E)**   Topological
    C)   Reflected Gray code

6. What problem is solved by the source-removal algorithm?
    A)   Identifying cycles in a graph   **D)**   Minimum-edge paths of a graph
    B)   Topological sorting   **E)**   Generating the power set of a finite set
    C)   Generating permutations

7. Subsets of a finite set of size n <u>can't</u> be generated in better than
    A) $n \log n$ **B)** $n!$ **C)** n^3 **D)** 2^n **E)** n

8. The worst-case performance of Interpolation search is:
    A) $n \log n$ **B)** quadratic   **C)** $\log n$ **D)** $\log \log n + 1$ **E)** linear

9. In a BFS traversal of a graph, vertices are visited according to
    A)   reverse traversal stack pop order   **D)**   vertex key order
    B)   random order   **E)**   as far from start vertex as possible
    C)   how close they are from the start vertex

10. A DFS-based solution of the topological sorting problem depends on _____ in the digraph
    representation of item pre-requisites (dependencies)
    A)   finding vertices with no incoming edges   **D)**   finding cross edges
    B)   finding minimum-edge paths   **E)**   finding forward edges
    C)   deciding if cycles exist

11. The average-case performance of insertion sort is
    A)   in the same efficiency class as n   **D)**   the same as its worst-case
    B)   half as fast as its worst-case   **E)**   twice as fast as its worst-case
    C)   linear

12. Which permutation is generated following $\overset{\leftarrow\leftarrow\leftarrow}{3\,1\,2}$ by the Johnson Trotter algorithm?

    A) $\overset{\leftarrow\leftarrow\rightarrow}{2\,1\,3}$ **B)** $\overset{\leftarrow\leftarrow\leftarrow}{1\,3\,2}$ **C)** $\overset{\leftarrow\leftarrow\leftarrow}{3\,2\,1}$ **D)** $\overset{\rightarrow\leftarrow\leftarrow}{3\,2\,1}$ **E)** $\overset{\leftarrow\leftarrow\leftarrow}{2\,3\,1}$

13. Which of the following applies to the graph?
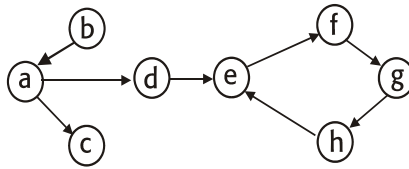
    A) Simple   **B)** Not connected   **C)** Strongly connected   **D)** Acyclic   **E)** Connected

14. If you can find the mode statistic of a sorted list of numbers in linear time, what would be the best performance for finding the mode for a randomly ordered list?
    A) logarithmic   **B)** cubic   **C)** linear   **D)** quadratic   **E)** $n \log n$

15. The permutation following 162543 according to lexicographic order is
    A) 162345   **B)** 164532   **C)** 163245   **D)** 164235   **E)** None of the above

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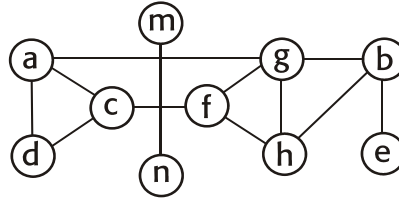
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16. **[10 Points, CLO 12]** Perform a BFS traversal of the following graph. Show: vertex visit table, BFS control data structure, and forest. You must start from vertex a and break ties by alphabetical order.
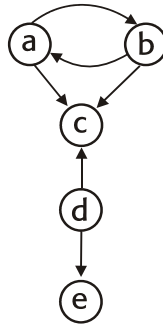
Vertex visit table (similar to class) - 4 points

BFS control data structure - 3 points

Forest (indicate edge types) - 3 points

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17. **[5 Points, CLO 17]** Write a formal description of the following graph.

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18. **[5 Points, CLO 12]** Use the bottom-up algorithm to generate permutations of the set {a,b,c}. Show each step on a separate line with comment to explain the operation.

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19. **[5 Points, CLO 13]** Write a divide-conquer algorithm to compute the number of leaves in a binary tree. Express algorithm properly. **Code not acceptable.**

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20. **[10 Points, CLO 12]** Find the median of the list 9, 12, 5, 17, 29 without presorting. **No points for final answer.**

[1 Points] Name of problem _____

[2 Points] Split Points: _____

[7 Points] Algorithm steps (for each step must show **scan indices**, **initial** and **final lists**)