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

CPCS-223 • Test 1 (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 number of key comparisons made by bubble sort for an array of size 9 is
A) 36 **B)** 45 **C)** 72 **D)** 81 **E)** None of the above

2. Multiplicative constants are not considered in analysis of algorithms time efficiency because
A) constant functions grow very slowly with input size growth
B) they can be overcome by faster machines
C) they have a small effect when input size is small
D) they cancel out when computing count functions
E) they do not affect the actual run time of the algorithm

3. The main problem with mergesort algorithm is
A) the linear amount of extra storage
B) the exponential amount of extra storage
C) the quadratic amount of extra space
D) its linear time efficiency
E) the quadratic worst-case efficiency

4. Numbers in the Fibonacci sequence grow
A) by a constant factor
B) logarithmically
C) exponentially
D) cubically
E) quadratically

5. The efficiency of the recurrence A(n)=2A(n/2) + 2n, A(1)=0 is
A) $\Theta(n^2)$ **B)** $\Theta(1)$ **C)** $\Theta(n^{\log_2 n})$ **D)** $\Theta(n\log n)$ **E)** $\Theta(n)$

6. Choose the correct statement
A) $100n+5\in\Omega(n^2)$
B) $n^4+n+1\in\Theta(n^3)$
C) $\frac{1}{2}n(n-1)\in\Omega(n^2)$
D) $10000n\in\Omega(n^2)$
E) $n^3\in O(n^2)$

7. The basic operation of an algorithm is usually
A) a multiplication or an addirion
B) a key comparison operation
C) an expensive operation
D) a difficult to perform operation
E) a time-consuming operation in the innermost loop

8. The average case efficiency of binary search is
A) slightly smaller than worst-case but in the same class
B) much better than the worst-case
C) quadratic
D) exactly the same as its worst case-efficiency
E) None of the above

9. The number of comparisons made by brute force string matching for 7902 in 6175217901
A) 24 **B)** 12 **C)** 10 **D)** 11 **E)** 21

10. Algorithms that require ____________ number of operations are practical for solving only problems of very small size.
A) logarithmic **B)** linear **C)** constant **D)** exponential **E)** polynomial

11. One of the following <u>can not</u> be a convex set
A) circle
B) points on corners of a ploygon
C) polygon
D) half circle
E) the line between (1,4) and (5,8)

12. The worst-case efficiency class of an exhaustive search based solution to the sorting problem is

A) $(n-1)n/2$ **B)** $n!$ **C)** $(n-1)n!$ **D)** $(n-1)2^n$ **E)** 2^n

13. A *sentinel* is used in sequential search to

A) improve the algorithm's run time
B) simplify its efficiency analysis
C) improve the algorithm's time efficiency
D) make the algorithm more readable
E) improve the algorithm's memory usage

14. Hamiltonian circuits are used in the exhaustive search solution of the:

A) Travelling salesman problem
B) Knapsack problem
C) Simplex problem
D) Assignment problem
E) Convex Hull problem

15. The function $n\log_2 n$ grows ________ when input n is doubled in size

A) 4 times **B)** by 2 **C)** twofold **D)** slightly more than twofold **E)** quadratic

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16. **[10 Points, CLO 13]** Write an algorithm for a brute force solution to the convex hull problem based on testing all line segments. **Must write proper pseudocode. No points will be taken if you can't remember the extreme point test!**

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17. [5 Points, CLO 7,11] Determine the efficiency of the following algorithm. (No points for final answer!)

Algorithm $ComparisonCountSort$
Input $A[0..n-1]$
Output Sorted elements of A in $S[0..n-1]$

for $i \leftarrow 0$ **to** $n-1$ **do** $Count[i] \leftarrow 0$
for $i \leftarrow 0$ **to** $n-2$ **do**
    for $j \leftarrow i+1$ **to** $n-1$ **do**
        if $A[i] < A[j]$ **then**
            $Count[j] \leftarrow Count[j] + 1$
        else $Count[i] \leftarrow Count[i] + 1$
for $i \leftarrow 0$ **to** $n-1$ **do** $S[Count[i]] \leftarrow A[i]$
return S

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18. [5 Points, CLO 8] Solve the recurrence $M(n) = 2M(n-1) + n$ for n>1, $M(1) = 1$. **TO PASS SHOW 3 CORRECT SUBSTITUTIONS.**

Final Answer_________________________
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19. [10 Points, CLO 12] Perform a quicksort step-by-step using the class (slides) version of the algorithm. (No points for final answer.)

Q,U,I,C,K,S,O,R,T

Steps (SHOW FINAL POSITIONS OF i AND j AND SPLIT INDEX s FOR EACH STEP)

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20. [5 Points, CLO 15] How many key comparisons were needed to quicksort the list? Q,U,I,C,K,S,O,R,T