Design and Analysis of Algorithms	**Exam #2**
CS3230	**10 November 2008**

Open book, no sharing of materials, no laptops, NOTP = "None of the Preceeding."

NOTE: These are some practice questions. The Midterm 2 will contain approximately 30+ questions.

1. Binomial coefficients can be computed with the following methods: (A) Dynamic programming. (B) Recursively. (C) Through factorial formulae. (D) All of the preceeding. (E) NOTP.
2. If a dynamic programming approach requires 2-dimensional storage space, it will always fill a table: (A) Row-by-row. (B) Column-by-column. (C) Could be either. (D) NOTP.
3. A digraphs transitive closure can be computed with: (A) DFS. (B) BFS. (C) Warshall's algorithm. (D) All of the preceeding. (E) NOTP.
4. What is the *time complexity* of Floyd's algorithm? (A) $\Theta(n)$. (B) $\Theta(n \log n)$. (C) $\Theta(n^2)$. (D) $\Theta(n^3)$. (E) NOTP.
5. A pseudo-polynomial time algorithm will display exponential behaviour only when confronted with the following input characteristic: (A) Negative values. (B) Polynomially bounded values. (C) Exponentially large values. (D) NOTP.
6. A sequence of values in a *row* of the dynamic programming table for an instance of the knapsack problem is always nondecreasing. (A) True. (B) False.
7. A sequence of values in a *column* of the dynamic programming table for an instance of the knapsack problem is always nondecreasing. (A) True. (B) False.
8. Using a memory function for the knapsack problem will achieve the following. (A) Increase the efficiency of the algorithm. (B) Increase the efficiency class of the algorithm. (C) NOTP.
9. Is Prim's algorithm a good algorithm to find a spanning tree of a connected graph with no weights on its edges? (A) Yes. (B) No.
10. For *dense* graphs, which of the two algorithms – Prim's or Kruskal's – will execute faster? (A) Prim's. (B) Kruskal's. (C) Both the same.
11. If e is a minimum-weight edge in a connected weighted graph, it must be among the edges of at least one minimum spanning tree of the graph. (A) True. (B) False.
12. If e is a minimum-weight edge in a connected weighted graph, it must be among the edges of each minimum spanning tree of the graph. (A) True. (B) False.
13. Will either Kruskal's or Prim's algorithm work correctly on graphs that have negative edge weights? (A) Kruskal's. (B) Prim's. (C) Both. (D) Neither.
14. Let T be a tree constructed by Dijkstra's algorithm in the process of solving the single-source shortest-paths problem for a weighted connected graph G. Then T is a spanning tree of G. (A) True. (B) False.
15. See the preceeding description. Then T is a minimum spanning tree of G. (A) True. (B) False.

16. The classic, recursive algorithm to solve the Tower of Hanoii puzzle makes the minimum number of disk moves needed to solve it. (A) True. (B) False.

17. A certain problem can be solved by an algorithm whose running time is in $O(2^{n^2})$. (A) The problem is tractable. (B) The problem is intractable. (C) NOTP.

18. Which of the following algorithmic approaches may return an optimal or close to optimal result for the Euclidean TSP problem in the worst-case in polynomial time?
(A) Exhaustive search. (B) Backtracking. (C) Branch-and-Bound. (D) An approximation algorithm. (E) NOTP.

19. There are graphs with a cycle that include all the vertices but with neither a Hamiltonion circuit nor an Eulerian circuit. (A) True. (B) False.

20. At each step, the Branch-and-Bound algorithmic strategy examines the bounding function values of only the current state-space node's children nodes. (A) True. (B) False.

21. For a high-quality approximation algorithm the *relative error* $re(s_a)$ should approach:
(A) 0. (B) 0.5. (C) 1. (D) ∞. (E) NOTP.

22. Applicability of dynamic programming to an optimization problem requires the problem to satisfy the *principle of optimality*. (A) True. (B) False.

23. We can interpret Kruskal's algorithm as a progression through a series of forests which at each execution step include the following: (A) All edges. (B) Fewer than all vertices (except at the last step). (C) All vertices. (D) NOTP.

24. The 4-queens problem has x *unique* solutions.
(A) $x = 1$. (B) $x = 2$. (C) $x = 4$. (D) $x = 8$. (E) NOTP.

25. The n-queens problem has no solution in the following instance.
(A) $n = 3$. (B) $n = 4$. (C) $n = 5$. (D) $n = 6$. (E) NOTP.