Spring 2013: CS 3329/5549 Final Exam

Total Time: 90 minutes Total Points: 50

Write your name clearly.

Name:_____ **Date:**_____

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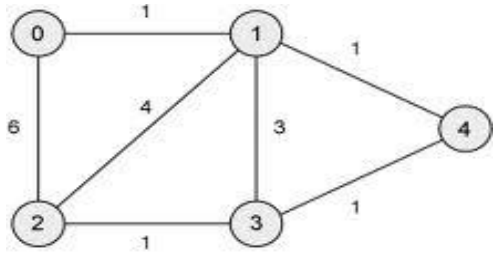
1. **[7]** Describe and analyze quick Sort algorithm.

2. **[5]** What is heapify procedure? What is the run time of min-heapify? Explain

3. **[4+4]** Use Kruskal's algorithm to find a minimal spanning tree for the weighted graph shown below, showing steps. Then, use Prim's algorithm to do the same thing, using the same weighted graph, again showing steps.



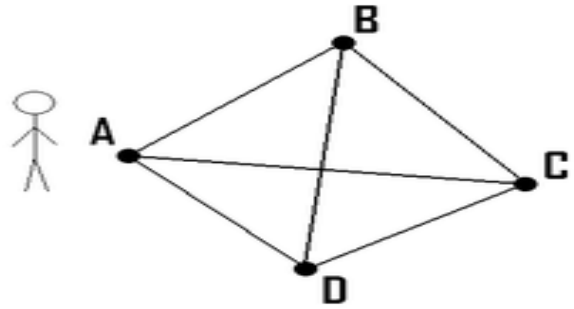
4. **[5] Devise an optimization solution of knapsack problem and explain how you would solve this problem using dynamic programming.**

5. **[3+4] Explain NP completeness. Define set cover problem and explain how it is NP complete.**

6. **[6]Travelling salesman problem is defined as Finding a path through a weighted graph which starts and ends at the same vertex, includes every other vertex exactly once, and minimizes the total cost of edges.**

   Given a graph G= (V,E), where V is set of vertices and E is the set of edges. In addition, weights of edges have following properties:

   e_{ii}= 0; and $e_{ik} + e_{kj} > e_{ij}$



A sample graph is shown above

7. **[2+2]Given a complete binary tree with node n, find the expression for**
    a. **Height of the tree**
    b. **Number of nodes at the lowest level**

8. **[3] Put the following notation and their description in the right combinations**

Θ	**Asymptotic Upper Bound**
Ω	**Asymptotic tight Bound**
O	**Asymptotic Lower Bound**

9. **[5]**Using the Master Method to give asymptotic bounds for the following recurrences:
    a. T(n) = 9T(n/3) + n
    b. T(n) = 3T(n/4) +1

Master Theorem if $T(n) = aT(n/b) + f(n)$ then

$$T(n) = \begin{cases} \Theta\left(n^{\log_b a}\right) & f(n) = O\left(n^{\log_b a - \varepsilon}\right) \\ \Theta\left(n^{\log_b a} \log n\right) & f(n) = \Theta\left(n^{\log_b a}\right) \\ \Theta(f(n)) & f(n) = \Omega\left(n^{\log_b a + \varepsilon}\right) \text{ AND } af(n/b) < cf(n) \text{ for large } n \end{cases} \quad \begin{matrix} \varepsilon > 0 \\ c < 1 \end{matrix}$$