Homework #1 (Due date see website)

1. CMOS Circuit Design   (15 points)

   (a)   Design a CMOS logic gate F=(A+B)(CD+E).   Draw the transistor-level (PMOS, NMOS) schematic.   Please indicate all the names of signals (F, A, B, C, D, E) and also the power/ground.

   (b)   Draw a stick diagram for the design in (a).

   (c)   The following PMOS network was designed to implement the Boolean function G(w,x,y,z).   Please write the Boolean equation of G.   Also complete the NMOS network.
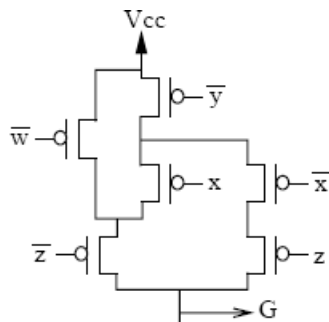
2. Computation Complexity (12 points)

   Determine which of the following is correct.

   (a) $n^k = O(c^n)$, k≥1 and c≥1.

   (b) $\lg (n!) = O(n^n)$

   (c) $3n+ 5n^2 + n^3 \lg n = O(n^4)$

3. Dijkstra Shortest-path Algorithm (20 points)

   For the directed graph of Fig. 3.15 in the textbook, use the Dijkstra shortest-path algorithm to find the shortest path from v_6 to v_5.   Please show all the iterations in the same table as Fig 3.16.   What is the shortest distance?

4. Prim's Algorithm for MST (20 points)

   For the following graph, use Prim's algorithm to find the minimum spanning tree. Please start from V1.   What is the tree weight of your result?
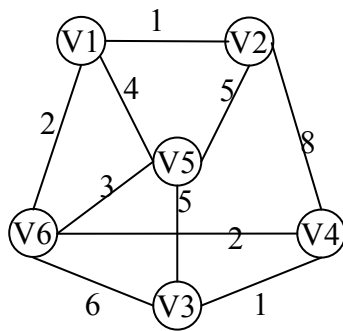
Show the iteration using the following table.   The definition of the variables are the same as our lecture note.

iteration	Key	π	Vertex in MST
1	key[V1]=0 key[V2]=∞ key[V3]=∞ key[V4]=∞ key[V5]=∞ key[V6]=∞	π[V1] = NIL	{V1}

5.   Branch and Bound   (23 points)

Use the branch and bound algorithm to solve the TSP problem in Figure 4.   Start and end with V_1.   Show the search tree as Fig. 5.6 in the textbook.   How many nodes do you have in your search tree?

6. DFS and BFS   (10 points)

(a)   Use DFS to traverse the graph of Fig 3.9 in the textbook.   Please start from V4. Show your steps in the same table as Fig 3.10.   Use the adjacency-list in Fig 3.9(b). When you have a choice of multiple vertices, please choose the one with the smallest vertex index number.   (i.e.   choose V1 earlier than V2 or V3)

(b)   Use BFS to traverse the graph of Fig 3.9 in the textbook.   Please start from V4. Show your steps in the same table as Fig 3.12.   Use the adjacency-list in Fig 3.9(b). When you have a choice of multiple vertices, please choose the one with the smallest vertex index number.