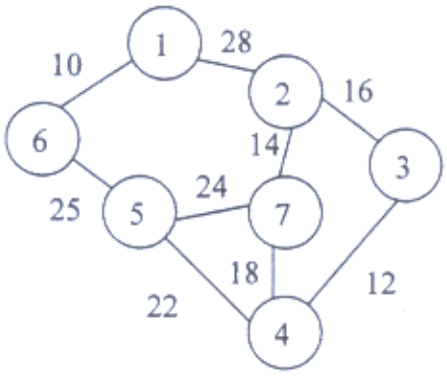
一、Data Structure (50%)

1. (6%) **How many** binary trees can be determined by the inorder: HDIBEAFCG and the postorder: HIDEBFGCA. Please draw all of them. (Write it down clearly and formally) and (2%) show their preorder sequences.
2. (5%) Please **design** a data structure to **draw** the thread binary tree corresponding to the tree in problem (1).
3. (6%) Use the double-ended queue (dequeue) to input: 1, 2, 3, 4, 5, 6, and 7 sequentially. In the following, what are the impossible outputs?
   (a). 5174236 (b). 1234576 (c). 2143756 (d). 7615243 (e). 4213765
4. (6%) Give the definition of the following different heaps. a.max heap b.Deap c.min-max heap. (12%) According to the above definitions, draw the final heap trees when inserting ten integers in the following order: 8,12,6,30,23,24,5,33,61,15. (4%) and write down the best, average, and worst time complexity respectively.
5. Given the undirected graph G = (V, E) with cost shown in the following.



(3%) Show the state and the final results of Kruskal's algorithm，(3%) Prim's algorithm，(3%) and Sollin's algorithm.

(背面仍有題目,請繼續作答)

二、Algorithms (50%)

1. (18%) Answer each part TRUE or FALSE for the little *o* notation.
   a) $n=o(2n)$.
   b) $2n=o(n^2)$.
   c) $2^n=o(3^n)$.
   d) $1=o(n)$.
   e) $n=o(\log n)$.
   f) $1=o(\frac{1}{n})$.

2. (12%) The Hamiltonian path problem *HAMPATH* asks whether the input directed graph contains a path from *s* to *t* that goes through every node exactly once. It was known that *HAMPATH* is NP-complete. Please use this result to show that the undirected version of the Hamiltonian path problem *UHAMPATH* is NP-complete.

3. (10%) Give asymptotic upper and lower bounds for $T(n)=2T(\frac{n}{2})+n^3$ as tight as possible (assume that $T(n)$ is constant for $n \le 2$).

4. (10%) In a comparison sort, we use only comparisons between elements to gain order information about an input sequence. Show that any comparison sort algorithm requires $\Omega(n \lg n)$ comparisons in the worst case.