國立成功大學 109 學年度碩士班招生考試試題

系　　所：電機資訊學院-資訊聯招

考試科目：程式設計　　考試日期：0210，節次：2

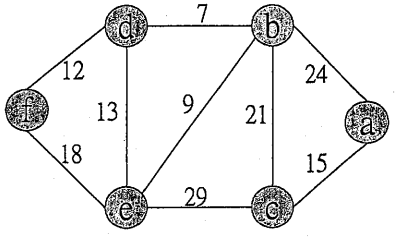
※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

Part I.　資料結構 (50%)

1. Answer **True** or **False** for the following statements. Give correct answers for **False** statements. (30%, 6% for each question)
   (1) In static hashing, the worst-case number of comparisons needed for a successful search is O(n) for open addressing. The number could be reduced to O(log n) by using balanced search tree.
   (2) Let d_i be the degree of vertex i in a graph G with $|V| = n$ and $|E| = e$, then $e = \sum_{i=0}^{n-1} d_i$.
   (3) The path from vertex u to vertex v on a minimal cost spanning tree of an undirected graph G is also a shortest path from u to v.
   (4) Let G be a graph with e edges and v vertices. If G is represented by adjacency lists, DFS requires O(ev^2) time.
   (5) If an AOV network represents a feasible project, its topological order is not unique.

2. A Bloom Filter consists of m bits of memory and h uniform and independent hash functions f_1, f_2, …, f_h. Each f_i hashes a key k to an integer in the range [1, m]. Initially all m filter bits are zero, and the data set is empty. When key k is added to the data set, bits $f_1(k)$, $f_2(k)$, …, $f_h(k)$ of the filter are set to 1. When a query "Is key k is in the data set?" is made, bits $f_1(k)$, $f_2(k)$, …, $f_h(k)$ are examined. The query answer is "maybe" if all these bits are 1. Otherwise, the answer is "no." A *filter error* occurs whenever the answer is "maybe" and the key is not in the data set. Assume that key k is an integer in the range [1, n] and u updates are made. Compute the probability of filter error for an arbitrary query after the u-th update.　(10%)

3. Consider the following graph:



Compute minimum cost and construct minimum spanning tree. (10%)

Part II. 演算法 (50%)

1. Is $5^{n+1} = O(5^n)$? Is $6^{2n} = O(6^n)$? (10%)

2. Give asymptotic upper and lower bound for $T(n) = \sqrt{n}T(\sqrt{n}) + n$. Assume that $T(n)$ is constant for sufficiently small n. Make your bounds as tight as possible. (10%)

3. Show how the time complexity of quicksort can be made to run in $O(n \lg n)$ time. (10%)

4. Determine an Longest Common Subsequence of <1,0,0,1,0,1,0,1> and <0,1,0,1,1,0,1,1,0>. (10%)

5. If possible, use the master method to solve $T(n) = 27T(\frac{n}{3}) + \Theta(\frac{n^3}{\lg n})$. (10%)