國立中山大學資訊工程學系
109 學年度第 1 學期博士班資格考試

科目：演算法

1. Explain NP, NP-complete. (8%)
2. A greedy method can be used for solving the *knapsack* problem (not 0/1 knapsack). Please describe it. (12%)
3. Design an algorithm to find both the *minimum* and the *maximum* of n elements with at most $\lceil 3n/2 \rceil$ comparisons. (15%)
4. Present the divide-and-conquer method for solving the 2-D *maxima finding* problem. Analyze the time complexity. (15%)
5. A first-fit method can be used for solving the *bin packing* problem. Please describe it. (10%)
6. (a) Please give the definition of an AVL tree. (5%)

   (b) Give the situation that an AVL tree will increase its height after a new element is inserted into the tree. (5%)
7. Prove that the *Hamiltonian cycle* decision problem polynomially reduces to the *travelling salesperson* decision problem. (15%)
8. 3201 has a divisor 11, and 95324713 also has a divisor 11. A positive integer N can be represented as a decimal number $d_{m-1}d_{m-2}\ldots d_1d_0$ with m digits. That is, $N = d_{m-1}\times 10^{m-1}+d_{m-2}\times 10^{m-2}+\ldots+d_1\times 10+d_0$. If $(d_0+d_2+d_4+\ldots)-(d_1+d_3+d_5)=11h$, where h is an integer, then N has a divisor 11. Please prove it. (15%)