考生注意：1. 依次序作答，只要標明題號，不必抄題。
2. 答案必須寫在答案卷上，否則不予計分，並限以藍黑色筆作答。
3. 試題隨卷繳回。(餘請詳閱試場規則)

1. Suppose that we cut a stick of length L (a positive integer) with the probability P at each position such that its distance from the left end is a positive integer.

   a. When L = 7, calculate the probability that a stick of length at least 5 remains. (5%)

   b. Design an efficient dynamic programming algorithm for calculating the probability that a stick of length at least n remains. (25%)

   c. Explain the basic concept and advantages of the dynamic programming method. (10%)

2. Show and explain the time complexities of the straight selection sort under three situations, the best case, the average case and the worst case. (15%)

3. Write a C or java program to randomly generate the Lottery numbers (6 different random integers between 1 and 49) using the linear congruential method. (15%)

4. For an AVL tree,
   a. Write a C or java program to perform the R-R, L-L, R-L, L-R rotations, respectively. Explain your algorithm briefly. (20%)
   b. Write a C or java program to check the balance of the tree and determine the rotation type when a new node is inserted. Explain your algorithm briefly. (10%)