國立嘉義大學九十六學年度
資訊工程學系碩士班招生考試試題

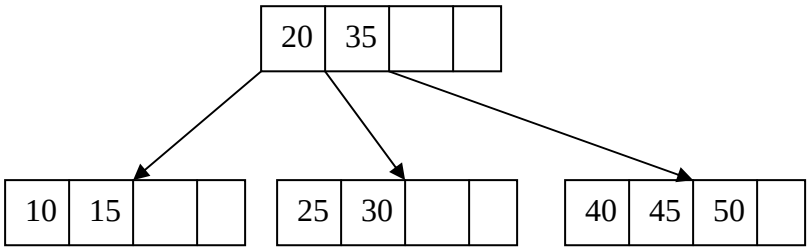
科目：數學

1. To play the Big Lotto Game, one buys a ticket selecting 6 numbers from 49 sequential numbers. The six lucky numbers plus a special number is drawn from the 49 numbers without duplication. The prize is awarded if there is at least 3 numbers on the ticket matching the six lucky numbers. Say there is a special award for the ticket matching none of the six numbers plus the special number. How many tickets does one have to buy that will guarantee to win a prize? (25%)

2. Give a deterministic finite automata to recognize the language over {a,b} with even number of a's, odd number of b's and end with ab. (e.g. accept *aab*, *baba*b, etc.; reject *aabbab*, *baab*, *aabbb*, etc.) (25%)

3. Suppose you are given an array A of *n* sorted integers that has been circularly shifted *k* positions to the right. For example, {35, 42, 5, 15, 27, 29} is a sorted array that has been circularly shifted *k* = 2 positions, while {27, 29, 35, 42, 5, 15} has been shifted *k* = 4 positions.
   (a) Suppose that *k* is unknown. Design an O(1) algorithm to find the largest number in A. (5%)
   (b) Suppose that *k* is known. Design an O(log n) algorithm to find the largest number in A. (10%)

4. (a) Insert the keys 62, 5, 85, 75, one at a time, into the order 5 B-tree shown below. Show the resulting B-tree. (10%)
   (b) Delete the keys 45, 40, 10, 25 from the order 5 B-tree shown below. Show the resulting B-tree. (10%)



5. Quick sort is unstable. Give an example of an input file with 5 records such that the order of records with equal keys is not preserved. Show the records after processing each pivot. Distinguish the records with equal keys. (15%)