

SC1007 Data Structures and Algorithms

2022/23 Semester 2

Tutorial 4: Analysis of Algorithm

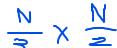
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The function subset() below takes two linked lists of integers and determines whether the first is a subset of the second. Give the worst-case running time of subset as a function of the lengths of the two lists. When will this worst case happen?

```
typedef struct _listnode{
      int item;
      struct _listnode *next;
    } ListNode;
    //Check whether integer X is an element of linked list Q
    int element (int X, ListNode* Q)
      int found; //Flag whether X has been found
      found = 0;
      while ( Q != NULL && !found) {
         found = Q->item == X;
         Q = Q -> next;
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      return found;
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    // Check whether L is a subset of {\tt M}
    int subset (ListNode* L, ListNode* M)
19
20
      int success; // Flag whether L is a subset so far
21
      success = 1;
22
      while ( L != NULL && success) {
23
           success = element(L->item, M);
           L = L -> next;
26
27
      return success;
    }
```

Q2 Find the number of printf used in the following functions. Write down its time complexity in Θ notation in terms of N.



```
void Q2b (int N)
{
    int i;
    if(N>0)
    {
        for(i=0;i<N;i++)
            printf("SC1007\n");
        Q2b(N-1);
        Q2b(N-1);
    }
}</pre>
```

Q3 A sequence, $x_1, x_2, ..., x_n$, is said to be cyclically sorted if the smallest number in the sequence is x_i for some i, and the sequence, $x_i, x_{i+1}, ..., x_n, x_1, x_2, ..., x_{i-1}$ is sorted in increasing order. Design an algorithm to find the minimal element in the sequence in $\mathcal{O}(\log n)$ time. What is the worst-case scenario?

