



CX1107 Data Structures and Algorithms

2020/21 Semester 2

Tutorial 4: Algorithm Analysis

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Q1 Given the precedence of some operators,

Operators	Precedence
$*, /, \%$	highest
$+, -$	
$<<, >>$	
$\&\&$	
$=$	lowest

- (a) convert an infix expression, $x = a + b * c \% d >> e$, to a postfix expression
- (b) convert a prefix expression, $= y \&\& << ab >> c + de$, to an infix expression
- (c) convert a postfix expression, $xabc * d \% + e >> =$, to a prefix expression

Q2 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?

```

1  typedef struct _listnode{
2      int item;
3      struct _listnode *next;
4  } ListNode;
5
6  //Check whether integer X is an element of linked list Q
7  int element (int X, ListNode* Q)
8  {
9      int found; //Flag whether X has been found
10     found = 0;
11     while ( Q != NULL && !found) {
12         found = Q->item == X;
13         Q = Q->next;
14     }
15     return found;
16 }
17
18 // Check whether L is a subset of M
19 int subset (ListNode* L, ListNode* M)
20 {
21     int success; // Flag whether L is a subset so far
22     success = 1;
23     while ( L != NULL && success) {
24         success = element(L->item, M);
25         L = L->next;
26     }
27     return success;
28 }
```

Q3 Find the number of printf used in the following functions. Write down its time complexity in Θ notation in terms of N .

```
1 void Q3a (int N)
2 {
3     int j, k;
4     for (j=1; j<=N; j*=3)
5         for(k=1;k<=N; k*=2)
6             printf("CZ1107\n");
7 }
```

```
1 void Q3b (int N)
2 {
3     int i;
4     if(N>0)
5     {
6         for(i=0;i<N;i++)
7             printf("CZ1107\n");
8         Q3b(N-1);
9         Q3b(N-1);
10    }
11 }
```