CSc 600-01 (Section 1)

Homework 2 - Procedural Programming

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Homework is prepared by: Ilya Kopyl.
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1. Plateau program (max sequence length) (a combinatorial algorithm)

The array a(1..n) contains sorted integers. Write a function maxlen(a,n) that returns the length of the longest sequence of identical numbers (for example, if a= 1, 1, 1, 2, 3, 3, 5, 6, 6, 6, 6, 7, 9 then maxlen returns 4 because the longest sequence 6, 6, 6, 6 contains 4 numbers. Write a demo main program for testing the work of maxlen. Explain your solution, and insert comments in your program. The time complexity of the solution should belong to O(n).

A code listing of implementation of maxlen function:

```
unsigned int maxlen(int *a, unsigned int n)
{
    // handling the edge cases of arrays of size 0 and 1
    if (n < 2)
        return n;

    unsigned int max_count, current_count, i;
    i = max_count = 0;
    current_count = 1;

    printf("\ta[%d]=%d; \tcurrent_count=%d; \tmax_count=%d\n",
           i, a[i], current_count, max_count);

    for (i = 1; i < n; ++i)
    {
        if (a[i] != a[i-1])    // starting the count of the new sequence:
        {
            if (current_count > max_count)
                max_count = current_count;

            // exit the loop if max_count is sufficiently large:
            if (max_count >= n - i)
                break;

            current_count = 1;
        }
        else                   // continuing the count of the current sequence:
        {
            current_count++;

            if (i == n-1 && current_count > max_count)
                max_count = current_count;
        }

        printf("\ta[%d]=%d; \tcurrent_count=%d; \tmax_count=%d\n",
               i, a[i], current_count, max_count);
    }
    return max_count;
}
```

The result of the program execution:

```
Array a:    1  1  1  2  3  3  5  6  6  6  6  7  9
    a[0]=1;     current_count=1;        max_count=0
    a[1]=1;     current_count=2;        max_count=0
    a[2]=1;     current_count=3;        max_count=0
    a[3]=2;     current_count=1;        max_count=3
    a[4]=3;     current_count=1;        max_count=3
    a[5]=3;     current_count=2;        max_count=3
    a[6]=5;     current_count=1;        max_count=3
    a[7]=6;     current_count=1;        max_count=3
    a[8]=6;     current_count=2;        max_count=3
    a[9]=6;     current_count=3;        max_count=3
    a[10]=6;    current_count=4;        max_count=3
Max sequence length of array a = 4

Array b:
Max sequence length of array b = 0

Array c:    12
Max sequence length of array c = 1

Array d:    16  16  16  18  18  20
    a[0]=16;    current_count=1;        max_count=0
    a[1]=16;    current_count=2;        max_count=0
    a[2]=16;    current_count=3;        max_count=0
Max sequence length of array d = 3

Array e:    0  0
    a[0]=0;     current_count=1;        max_count=0
    a[1]=0;     current_count=2;        max_count=2
Max sequence length of array e = 2

Array f: 0  1
    a[0]=0;     current_count=1;        max_count=0
Max sequence length of array f = 1

Array g:    1  2  3  3
    a[0]=1;     current_count=1;        max_count=0
    a[1]=2;     current_count=1;        max_count=1
    a[2]=3;     current_count=1;        max_count=1
    a[3]=3;     current_count=2;        max_count=2
Max sequence length of array g = 2
```

4. Write a BNF definition.

Following is an example :