

SOFTCOM ENGINEERING TESTS
Intern Candidate Tests

Question 1

A binary gap within a positive integer N is any maximal sequence of consecutive zeros that is surrounded by ones at both ends in the binary representation of N .

For example, number 9 has binary representation 1001 and contains a binary gap of length 2. The number 529 has binary representation 1000010001 and contains two binary gaps: one of length 4 and one of length 3. The number 20 has binary representation 10100 and contains one binary gap of length 1. The number 15 has binary representation 1111 and has no binary gaps.

Write a function:

`int solution(int N);`

that, given a positive integer N , returns the length of its longest binary gap. The function should return 0 if N doesn't contain a binary gap.

For example, given $N = 1041$ the function should return 5, because N has binary representation 10000010001 and so its longest binary gap is of length 5.

Assume that:

N is an integer within the range $[1..2,147,483,647]$.

Complexity:

expected worst-case time complexity is $O(\log(N))$;

expected worst-case space complexity is $O(1)$.

Question 2

A zero-indexed array A consisting of N integers is given. Rotation of the array means that each element is shifted right by one index, and the last element of the array is also moved to the first place.

For example, the rotation of array A = [3, 8, 9, 7, 6] is [6, 3, 8, 9, 7]. The goal is to rotate array A K times; that is, each element of A will be shifted to the right by K indexes.

Write a function:

`function solution(A, K);`

that, given a zero-indexed array A consisting of N integers and an integer K, returns the array A rotated K times.

For example, given array A = [3, 8, 9, 7, 6] and K = 3, the function should return [9, 7, 6, 3, 8].

Assume that:

N and K are integers within the range [0..100];

each element of array A is an integer within the range [-1,000..1,000].

In your solution, focus on correctness. The performance of your solution will not be the focus of the assessment.

Question 3

A string S consisting of N characters is considered to be properly nested if any of the following conditions is true:

S is empty;

S has the form $"(U)"$ or $"[U]"$ or $"\{U\}"$ where U is a properly nested string;

S has the form $"VW"$ where V and W are properly nested strings.

For example, the string $"\{[(())]\}"$ is properly nested but $"([()])"$ is not.

Write a function:

`int solution(char *S);`

that, given a string S consisting of N characters, returns 1 if S is properly nested and 0 otherwise.

For example, given $S = "\{[(())]\}"$, the function should return 1 and given $S = "([()])"$, the function should return 0, as explained above.

Assume that:

N is an integer within the range $[0..200,000]$;

string S consists only of the following characters: $"(", "\{", "[", "]", "\}"$ and/or $)"$.

Complexity:

expected worst-case time complexity is $O(N)$;

expected worst-case space complexity is $O(N)$ (not counting the storage required for input arguments).

Question 4

Write a function

`int solution(int A[], int N);`

that, given a zero-indexed array A consisting of N integers, returns the number of distinct values in array A.

Assume that:

N is an integer within the range [0..100,000];

each element of array A is an integer within the range [-1,000,000..1,000,000].

For example, given array A consisting of six elements such that:

`A[0] = 2 A[1] = 1 A[2] = 1`

`A[3] = 2 A[4] = 3 A[5] = 1`

the function should return 3, because there are 3 distinct values appearing in array A, namely 1, 2 and 3.

Complexity:

expected worst-case time complexity is $O(N \cdot \log(N))$;

expected worst-case space complexity is $O(N)$, beyond input storage (not counting the storage required for input arguments).

Elements of input arrays can be modified.