SI@UCF Computer Science Camp
Intro to Competitive Programming in C++
Quiz #1
Date: 6/14/2025

Name: _____

1) (10 pts) Write a segment of code in C++ which reads in a positive integer, n, from the user (no prompt necessary), and then prints out the values 2^0, 2^1, 2^2, …, 2^n to the screen. Your code MAY NOT use any intermediate values that are floating point numbers. You may assume that the user enters a number in between 0 and 30, inclusive.

2) (5 pts) Show the output of the following C++ program.

```
using namespace std;
#include <bits/stdc++.h>

int main() {
    vector<int> arr = {3,2,12,6,8,5};
    sort(arr.rbegin(), arr.rend());
    for (int i=0; i<arr.size(); i++)
        cout << arr[i] << " ";
    cout << endl;
    return 0;
}
```

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3) (5 pts) Explain why the following boolean expression might equal false. Assume that the math library is imported.

```
pow(cbrt(123),3) == 123
```

4) (25 pts) A common task in programming is taking in a long string and separating it into several strings according to a splitting character (often a space). For example, given the string "Hello how are you" and the tokenizer character " ", the result of tokenizing the original string would be the list of strings "Hello", "how", "are", and "you", It's natural to store these resultant strings in a vector of strings. Complete the function below, so that it takes in a string and a tokenizing character stored in a string, and returns a vector storing each of the tokens formed after the input string is tokenized. (None of the strings in the vector returned should contain the tokenizing character. These characters should be deleted.) To make the task a bit easier, you may assume that the tokenizing character won't appear two consecutive times and that it won't be either the first or last character of the input string. It is possible that the tokenizing character (called split below) doesn't appear in the input string (original) at all.

```
vector<string> tokenize(string original, string split) {

}
```

5) (15 pts) In the problem downtime, which was solved in lecture, the input given was a list of requests for jobs to be completed. Each of the jobs took 1000 ms and each server could simultaneously work on at most k jobs. The problem asked to compute the minimum number of servers necessary so that each job could immediately be given to a server at the time of the request. One solution to this problem was to simulate the process. (Go through the jobs in order, and pick a server that had fewer than k active jobs to start working on it. Mark that server, etc.) It was mentioned that this solution would be tedious and unnecessary and that there was a cleaner, easier solution. In your own words, (a) describe the key observation and that easier solution, (b) explain the key idea behind an efficient implementation of the solution, and (c) a very similar solution to the problem got a Time Limited Exceeded verdict in class, explain what inefficiency was added to the correct solution to obtain this outcome.

6) (10 pts) A solution to a problem called the following function roughly 3,000,000 times:

```
int binarysearch(vector<int> arr);
```

The vector passed to the function was of size 20,000 and the number of operations the function executed on each run was relatively small (less than 100). The solution got a time limit exceeded verdict. It turns out that a very simple fix existed to change the verdict to correct. What is that fix and why does it speed up the program so much?

7) (25 pts) What follows is the prompt for a Kattis problem that can be solved with a string. Complete the solution for it on the space provided.

Coffee Cup Combo

Jonna is a university student who attends n lectures every day. Since most lectures are way too simple for an algorithmic expert such as Jonna, she can only stay awake during a lecture if she is drinking coffee. During a single lecture she needs to drink exactly one cup of coffee to stay awake. Some of the lecture halls have coffee machines, so Jonna can always make sure to get coffee there. Furthermore, when Jonna leaves a lecture hall, she can bring at most two coffee cups with her to the following lectures (one cup in each hand). But note that she cannot bring more than two coffee cups with her at any given time.

Given which of Jonna's lectures have coffee machines, compute the maximum number of lectures during which Jonna can stay awake.

Input

The first line contains the integer, **n** ($1 \leq \mathbf{n} \leq 10^5$), the number of lectures Jonna attends.

The second line contains a string **s** of length **n**. The i^{th} letter is 1 if there is a coffee machine in the i^{th} lecture hall, and otherwise it is 0.

Output

Print one integer, the maximum number of lectures during which Jonna can stay awake.

Sample Input #1

```
10
0100010100
```

Sample Output #1

```
8
```

Sample Input #1

```
10
1100000000
```

Sample Output #1

```
4
```

Note: In the first sample, she can't get coffee in the first lecture or fifth lecture. In the second sample, she only has coffee for the first four lectures and has none for lectures 5 through 10, inclusive.

```
using namespace std;

#include <bits/stdc++.h>

int main() {

	// Get input.
	int n, res = 0;
	string s;
	cin >> n >> s;









	// Ta da!
	cout << res << endl;

	return 0;
}
```

8) (5 pts) June 14th (the day this exam was made) was World Blood Donor Day. What do Blood Donors donate?

_____

String Class Documentation

```
// Returns the substring of this string starting at index pos
// that is of length len.
string substr (size_t pos, size_t len);

// Returns the index in this string, starting at position pos,
// where the substring is equal to str.
size_t find (const string& str, size_t pos);
```

Vector Class Documentation

```
// Adds val to the end of this vector.
void push_back (const value_type& val);
```

Scratch Page – Please clearly mark any work on this page you would like graded.