

15 September 2022

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1. **Warm up:** Answer the following True / False questions.

- (a) Any loop made using `while` can be made using `for`, and vice versa.
- (b) Any case statement made using `switch` can be made using `if` and `else`, and vice versa.

2. This problem refers to the following C++ code, which compiled, is a program called `readstop`.

```
1    #include <iostream>
2    using namespace std;
3    int main() {
4        char next;
5        bool stop;
6        stop = false;
7        while (!stop) {
8            next = cin.peek();
9            if (next == "x") {
10               stop = true;
11            }
12            next = cin.get();
13            cout << next;
14        }
15        cout << endl;
16        return 0;
17    }
```

You may assume the input to the compiled program has no spaces.

- (a) What will be output if a file with contents `dexterous` will be used as input?
- (b) Modify the code so that the `while` loop exits at the second occurrence of `x`.
- (c) Modify the code so that the `while` loops exits either if `x` is encountered, or if the end-of-file character is encountered.  
*Hint: use the boolean `cin.eof()`.*
- (d) **Bonus:** Modify the code so that the `while` loop exits at the occurrence of two sequential characters `ax`, but not at each separately.

3. This question is about the *digits* of an *integer*.

- (a) Write a C++ program called `dropright` that takes as input an integer, and outputs the same integer, but without the units digit (that is, as a multiple of 10). For example, if the input 145 is given, then the program will print out 140.
- (b) Write a C++ program called `dropleft` that takes as input an integer, and outputs the same integer, but without the left-most digit (all the other digits are the same). For example, if the input 145 is given, then the program will print out 45.

4. This problem is about generating (pseudo-) random numbers.

(a) Write a C++ program called `random_by_square` that takes as input a positive integer having  $k$  digits, and outputs a different random integer with  $k$  digits as follows:

- The input integer is squared
- This square has the same number of digits ( $\pm 1$ ) taken off from the left and right side of it, to get another integer with  $k$  digits
- This is repeated 10 times, and the 10th integer is output to the user

You may assume that the square of an integer with  $k$  digits has  $2k$  digits. This will always be true if the left-most digit of the input integer is 4.

*Part (c) explains why this is true.*

(b) Test your program with integers having 1,2,3,4,5,6 digits. Is the result really a random number?

(c) Let  $n$  be a positive integer with  $k$  digits. How many digits will  $n^2$  have?

*Hint: There are two cases. Write  $n$  as  $m \cdot 10^k$  for some  $m$ .*