Data Structures
BITL2

Worksheet 1

Fall 2021

2 September 2020

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

   (a) One byte is four bits.

   (b) One integer `int` is four bytes.

   (c) The sign of an integer `int` is given by the bit `-` in front of the `int`.

   (d) Since one byte can have 256 different values, 10 bytes can have 2560 different values.

The next two problems refer to the following `C++` code. When compiled, the code on the left is a program called `power`, and the code on the right is a program called `readstop`.

```
#include <iostream>
using namespace std;
int main() {
    float base;
    int exp;
    cin >> base;
    cin >> exp;
    float result = base;
    for (int i = 1; i < exp; i++) {
        result = result*base;
    }
    cout << result << "\n";
    return 0;
}
```

```
#include <iostream>
using namespace std;
int main() {
    char next;
    bool stop;
    stop = false;
    while (!stop) {
        next = cin.peek();
        if (next == 'x') {
            stop = true;
        }
        cin >> next;
        cout << next;
    }
    cout << endl;
    return 0;
}
```

2. This question is about the program `power`.

   (a) Complete the table below for a given input to the program `power`.

input	`2 4`	`4 4 4`	`-2 4`	`2 -4`	`-2 -4`	`2.9 4`	`2.9 4.9`	`2E10 4`
output								

   (b) Recall that `float` has a limited range. What is the largest number `X` for which the input `X 2` will output the square of `X`?

3. This question is about the program `readstop`. You may assume the input has no spaces.

   (a) What will be output if a file with contents `dexterous` will be used as input?

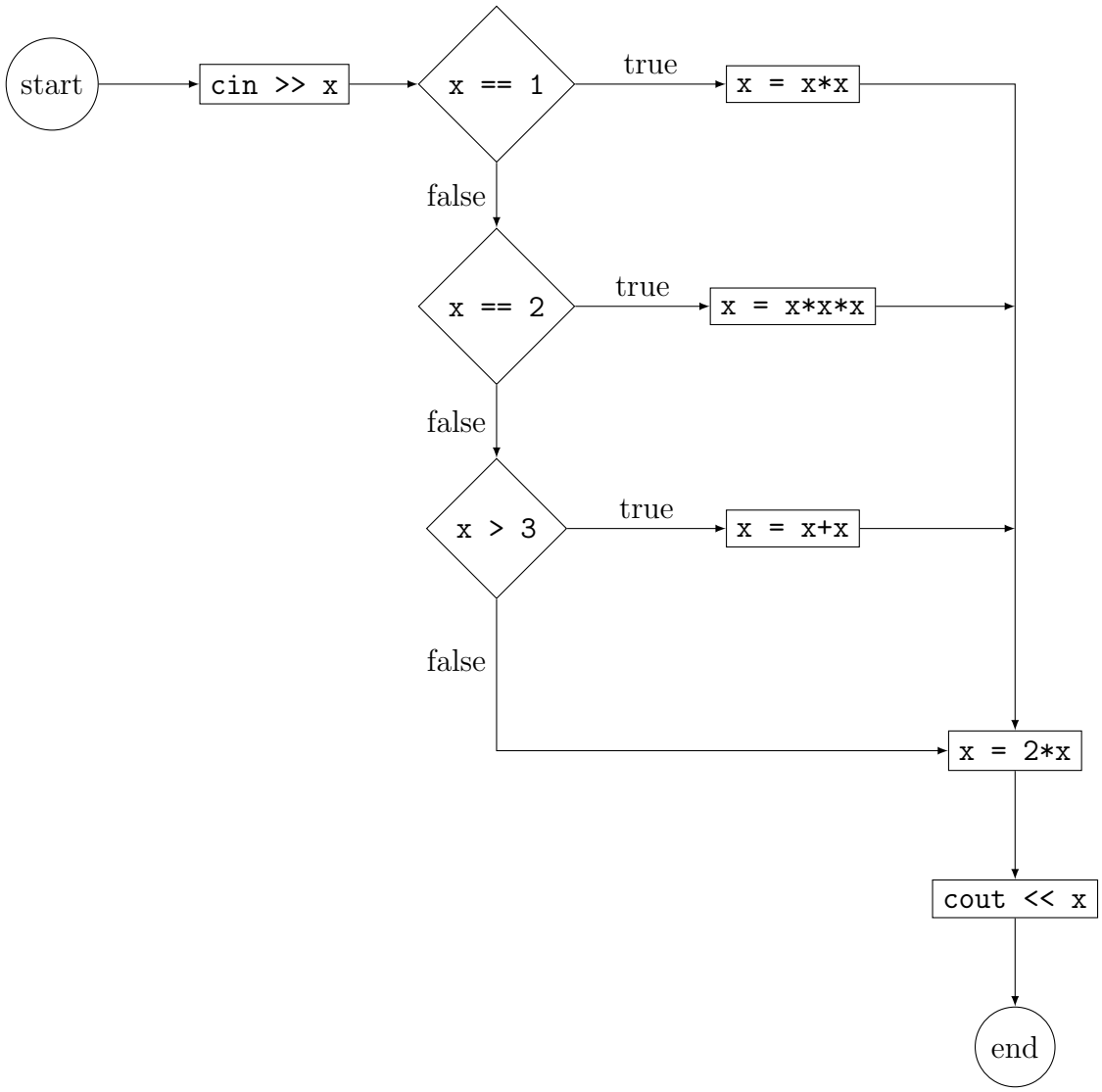
   (b) Modify the code so that the `while` loop exits at the second occurence of `x`.

   (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 occurence of two sequential characters `ax`, but not at each separately.

4. This question is about *flowcharts*.

   (a) Write a program that corresponds to the following flowchart and uses `switch`.



   (b) Write a program for the same flowchart, but using `if` and without `switch`.

   (c) What will the program ouput if 3 is input?

   (d) Is it ever possible to get an odd number output?

   (e) Find two different numbers that give the same output.

5. Write a `C++` program called `dropunits` that takes as input an integer, and outputs the same integer, but without the units (that is, as a multiple of 10). For example, if the input `145` is given, then the program will print out `140`.