CSE131s PROJECT TASK (3)

DOCUMENTATION

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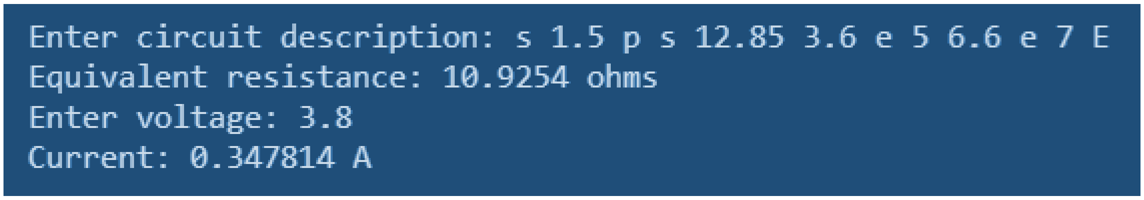
CODE:

```
#define _CRT_SECURE_NO_WARNINGS // To use strtok instead of strtok_s
#include <iostream>
#include <vector>
#include <cstring> // To use `strtok` function
#include <string>

using namespace std;

double calculate_resistance(vector<double>& resistances, char type) {
    double total_resistance = 0.0;

    if (type == 'S') {
        for (double resistance : resistances) {
            total_resistance += resistance;
        }
    }
    else {  // Parallel circuit
        for (double resistance : resistances) {
            total_resistance += 1.0 / resistance;
        }
        total_resistance = 1.0 / total_resistance;
    }

    return total_resistance;
}

bool is_number(const string& s) {
    char* p;
    (void)strtod(s.c_str(), &p);
    /*
   Ignoring the return value is fine in this case, because the function is only
used to check if the string is a number.
     In the is_number function, strtod(s.c_str(), &p) is used to check if the
entire string s can be interpreted as a number:
    - s.c_str() is the string to check.
    - &p is a pointer to a char that will be set to point to any part of the
string that couldn't be converted.
    */
    return *p == 0;
}

int main() {
    string circuit_description;
    cout << "Enter circuit description: ";
    getline(cin, circuit_description);
    vector<vector<double>> resistances_stack;
    vector<char> types;
    char* token = strtok(&circuit_description[0], " ");

    while (token != NULL) {
        string token_str(token);
        if (token_str == "E" || token_str == "e") {
            if (!types.empty()) {
                char type = types.back();
                types.pop_back();
                vector<double> current_resistances = resistances_stack.back();
                resistances_stack.pop_back();
                double equivalent_resistance =
calculate_resistance(current_resistances, type);
                if (!resistances_stack.empty()) {
                    resistances_stack.back().push_back(equivalent_resistance);
                }
                else {

resistances_stack.push_back(vector<double>{equivalent_resistance});
                }
            }
        }
        else if (token_str == "s" || token_str == "p" || token_str == "S" ||
token_str == "P") {
            token_str = toupper(token_str[0]); // here we convert s & p to
uppercase to handle the calculate_resistance function, we assume a user might be
too lazy to uppercase the letters (example: me XD)
            types.push_back(token_str[0]);
            resistances_stack.push_back(vector<double>{});
        }
        else {
            if (is_number(token_str)) {
                resistances_stack.back().push_back(stod(token_str));
            }
            else {
                cout << "Wrong Circuit Description" << endl;
                return 1;
            }
        }

        token = strtok(NULL, " ");
    }

    cout << "Equivalent resistance: " << resistances_stack.back()[0] << " ohms"
<< endl;

    cout << "Enter voltage: ";
    double voltage;
    cin >> voltage;
    cout << "Current: " << voltage / resistances_stack.back()[0] << " A" << endl;

    return 0;
}
```

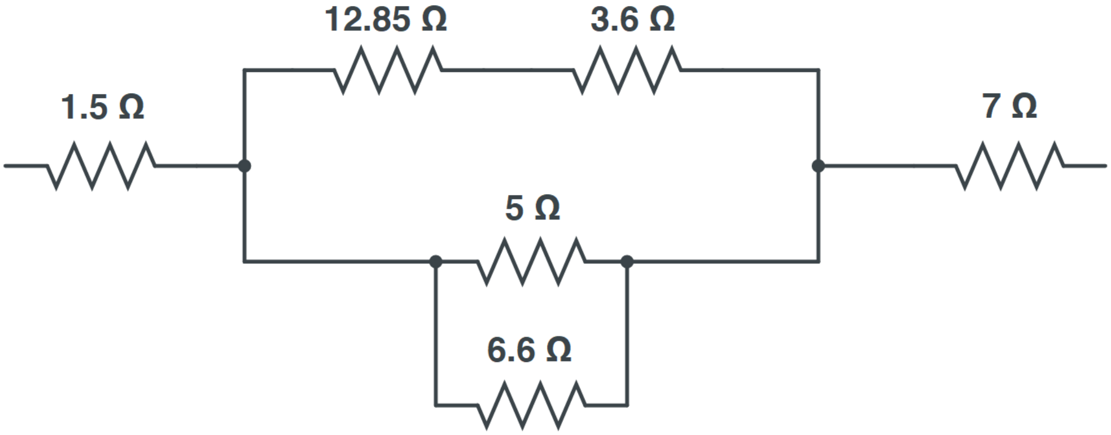
TEST CASES:

❶ Circuit description: **S 1.5 P S 12.85 3.6 e 5 6.6 e 7 E**
Voltage applied: **3.8**



```
Enter circuit description: s 1.5 p s 12.85 3.6 e 5 6.6 e 7 E
Equivalent resistance: 10.9254 ohms
Enter voltage: 3.8
Current: 0.347814 A
```

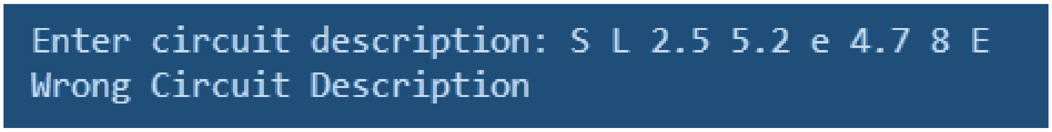
Theoretical Solution:



$1.5\ \Omega + (\ (12.85\ \Omega + 3.6\ \Omega) \parallel (\ 5\ \Omega \parallel 6.6\ \Omega)\ ) + 7\ \Omega = 10.92\ \Omega$ **#PASS**

$\because \mathrm{V} = \mathrm{IR}\ ,\ \mathrm{V} = 3.8\ \mathrm{V} \therefore \mathrm{I} = 3.8/10.92 = 0.348\ \mathrm{A}$ **#PASS**

❷ Circuit description: **S L 2.5 5.2 e 4.7 8 E**
Voltage applied: **9**

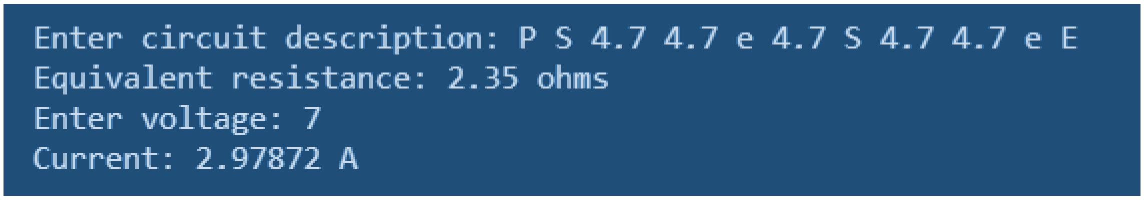


```
Enter circuit description: S L 2.5 5.2 e 4.7 8 E
Wrong Circuit Description
```

Theoretical Solution:
(NOT APPLICABLE)

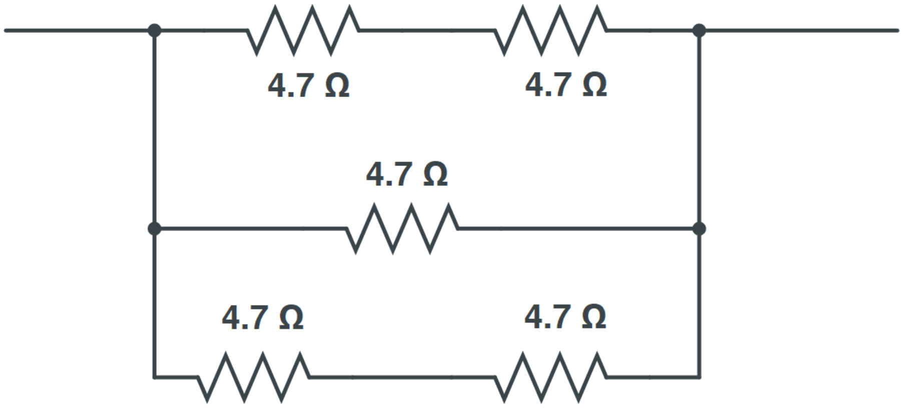
Wrong Circuit Description **#PASS**

❸ Circuit description: **P S 4.7 4.7 e 4.7 S 4.7 4.7 e E**
Voltage applied: **7**



```
Enter circuit description: P S 4.7 4.7 e 4.7 S 4.7 4.7 e E
Equivalent resistance: 2.35 ohms
Enter voltage: 7
Current: 2.97872 A
```

Theoretical Solution:

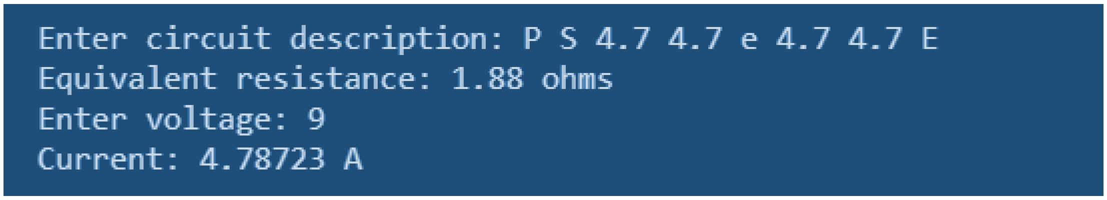


$(4.7\ \Omega + 4.7\ \Omega) \parallel (4.7\ \Omega) \parallel (4.7\ \Omega + 4.7\ \Omega) = 2.35\ \Omega$ #PASS

$\because V = IR\ ,\ V = 7\ V \therefore I = 7/2.35 = 2.98\ A$ #PASS

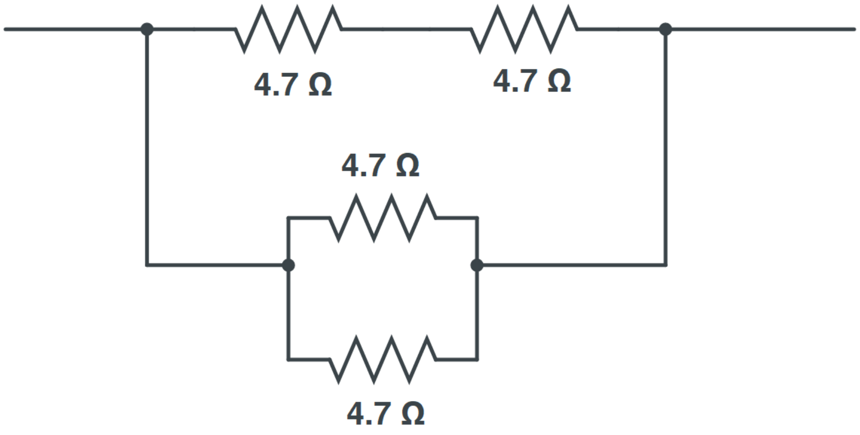
4 Circuit description: **P S 4.7 4.7 e 4.7 4.7 E**

Voltage applied: **9**



```
Enter circuit description: P S 4.7 4.7 e 4.7 4.7 E
Equivalent resistance: 1.88 ohms
Enter voltage: 9
Current: 4.78723 A
```

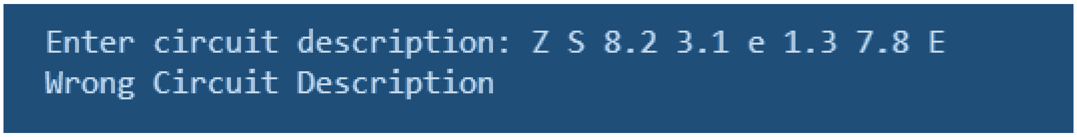
Theoretical Solution:



$(4.7\ \Omega + 4.7\ \Omega) \parallel (4.7\ \Omega \parallel 4.7\ \Omega) = 1.88\ \Omega$ #PASS

$\because V = IR\ ,\ V = 9\ V \therefore I = 9/1.88 = 4.79\ A$ #PASS

❺ Circuit description: **Z S 8.2 3.1 e 1.3 7.8 E**
Voltage applied: **5**



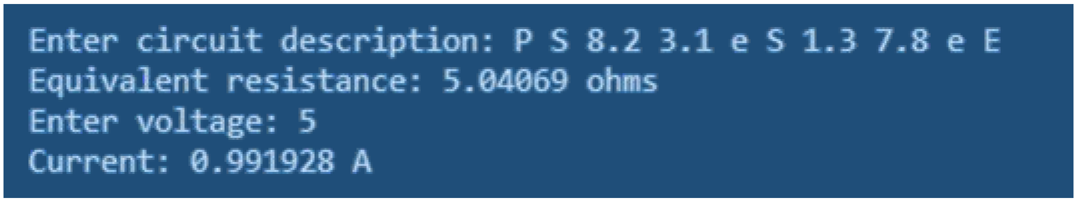
```
Enter circuit description: Z S 8.2 3.1 e 1.3 7.8 E
Wrong Circuit Description
```

Theoretical Solution:

(NOT APPLICABLE)

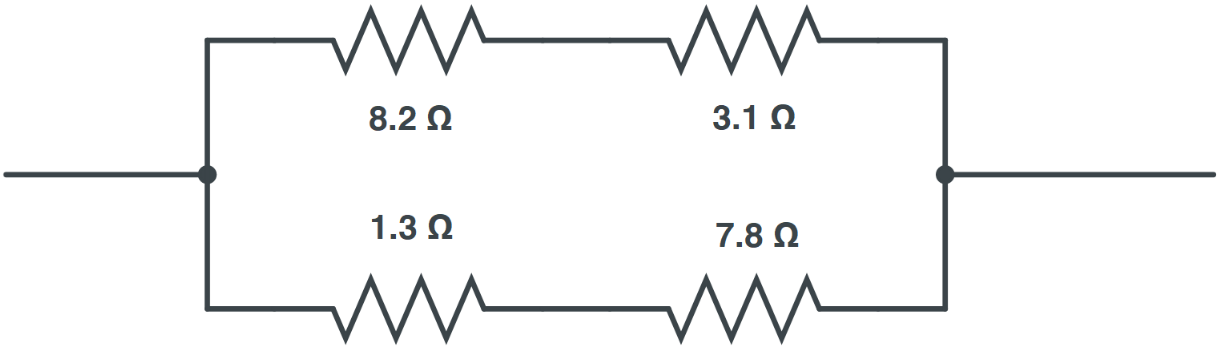
Wrong Circuit Description #PASS

❻ Circuit description: **P S 8.2 3.1 e S 1.3 7.8 e E**
Voltage applied: **5**



```
Enter circuit description: P S 8.2 3.1 e S 1.3 7.8 e E
Equivalent resistance: 5.04069 ohms
Enter voltage: 5
Current: 0.991928 A
```

Theoretical Solution:

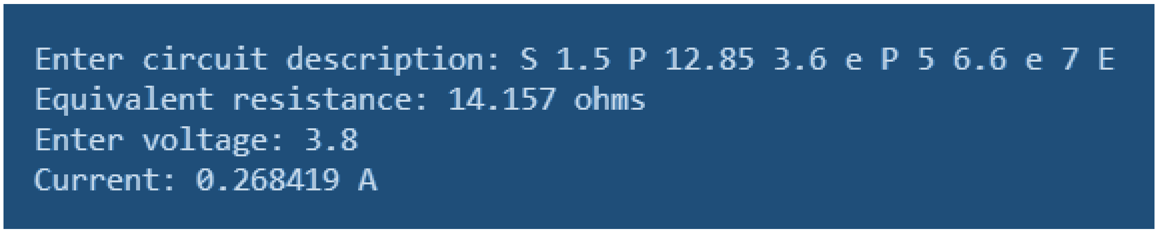


$(8.2\ \Omega + 3.1\ \Omega) \parallel (1.3\ \Omega + 7.8\ \Omega) = 5.04\ \Omega$ #PASS

$\because V = IR\ ,\ V = 5\ V \therefore I = 5/5.04 = 0.992\ A$ #PASS

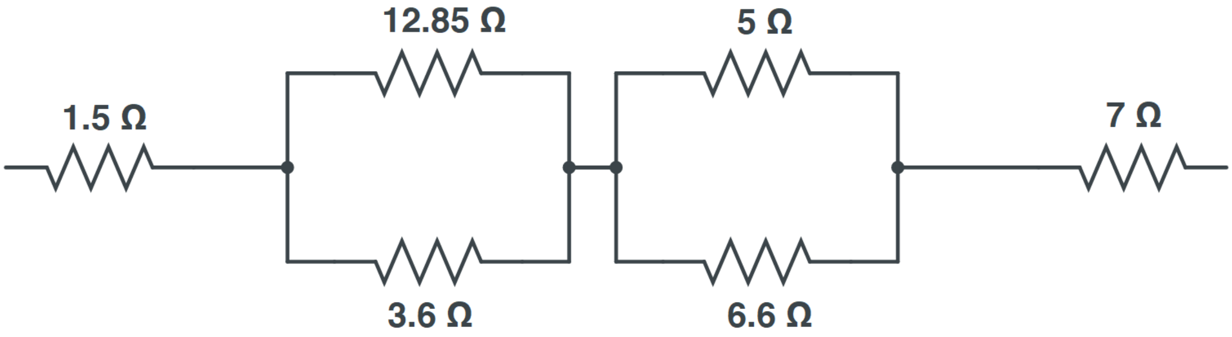
❼ (THIS IS CASE ❶ MODIFIED)

Circuit description: **S 1.5 P 12.85 3.6 e P 5 6.6 e 7 E**
Voltage applied: **3.8**



```
Enter circuit description: S 1.5 P 12.85 3.6 e P 5 6.6 e 7 E
Equivalent resistance: 14.157 ohms
Enter voltage: 3.8
Current: 0.268419 A
```

Theoretical Solution:



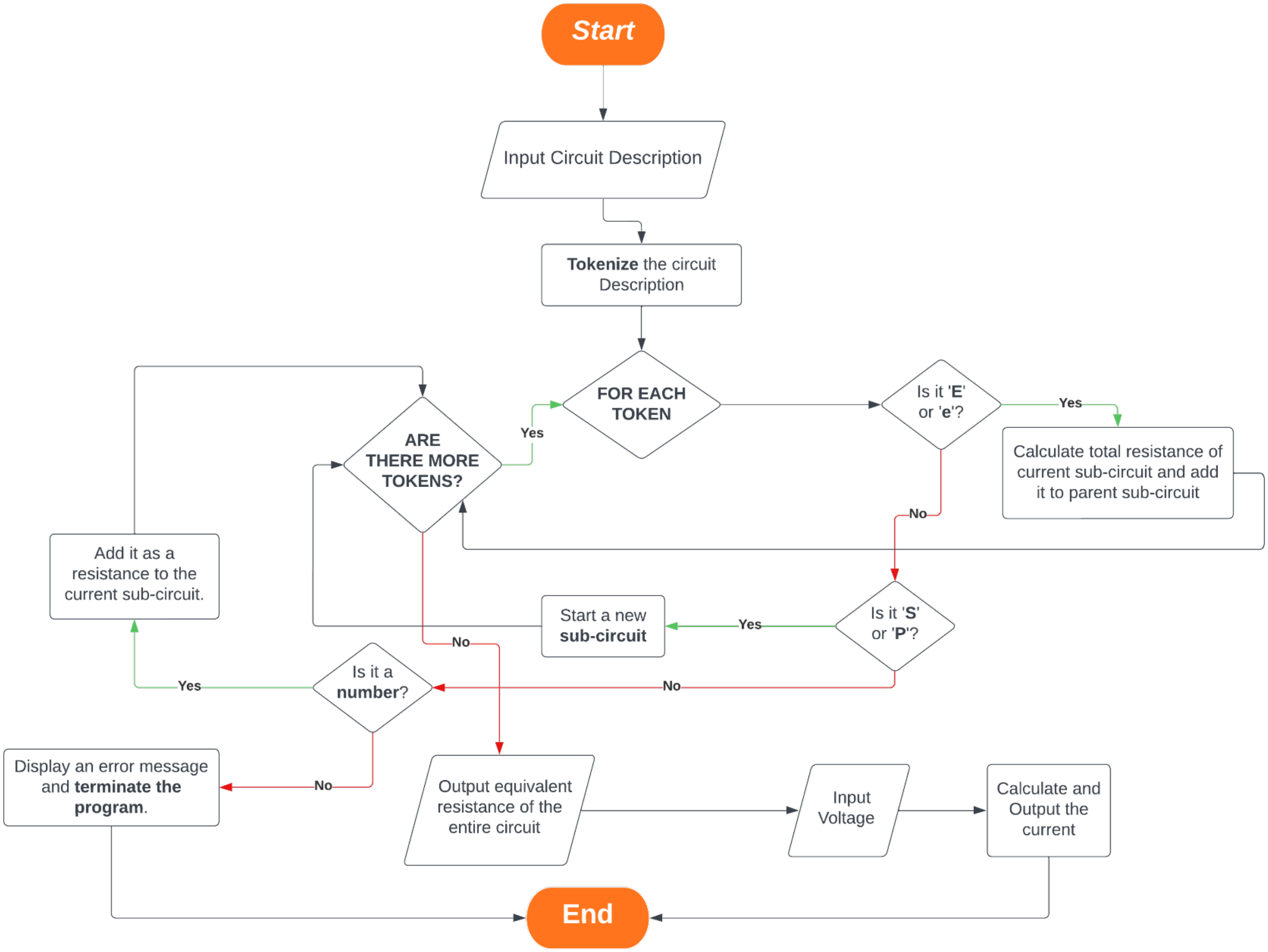
$1.5\ \Omega + (12.85\ \Omega \parallel 3.6\ \Omega) + (5\ \Omega \parallel 6.6\ \Omega) + 7\ \Omega = 14.16\ \Omega$ #PASS

$\because V = IR\ ,\ V = 3.8\ V \therefore I = 3.8/14.16 = 0.268\ A$ #PASS

FLOWCHART:

Basic Flowchart:

This flowchart is simplified, doesn't include **all** the code details, but makes it easier to follow the code logic, which is the basic purpose of a flowchart.



Start
Input Circuit Description
Tokenize the circuit Description
FOR EACH TOKEN
Is it 'E' or 'e'?
Yes
Calculate total resistance of current sub-circuit and add it to parent sub-circuit
No
ARE THERE MORE TOKENS?
Yes
Add it as a resistance to the current sub-circuit.
Is it 'S' or 'P'?
Yes
Start a new sub-circuit
No
Is it a number?
Yes
No
Display an error message and terminate the program.
No
Output equivalent resistance of the entire circuit
Input Voltage
Calculate and Output the current
End

The flowchart accurately depicts the main purpose of the program, the flow of the code and the logic behind it.

It does not include every step taken in a code-ish manner, but it includes the major steps and their flow to be easily understood by someone who is relatively unrelated to coding.

A detailed representation of the code is shown in the following page…

Detailed Process:

This is the detailed flow of the process; I did not represent it in a flowchart because doing so would contradict the main purpose of flowcharts; simplicity.

```
1. Start
2. Output: "Enter circuit description: "
3. Input circuit description
4. Tokenize circuit description using whitespace as delimiter
5. Initialize empty vectors: resistances, types
6. Start loop: For each token
    - Is the token 'E' or 'e'?
        - Yes:
            - If types vector is not empty:
                - Pop last element from types vector, assign it to 'type'
                - Calculate the total resistance of the current sub-circuit based on 'type' (using
                  calculate_resistance function)
                - Clear resistances vector
                - Add the calculated resistance to resistances vector
            - Go to the next iteration (continue to next token)
        - No: Go to the next step
    - Is the token 'S' or 'P'?
        - Yes:
            - Push token to types vector
            - Go to the next iteration (continue to next token)
        - No: Go to the next step
    - Is the token a number (using is_number function)?
        - Yes:
            - Convert token to double, add it to resistances vector
            - Go to the next iteration (continue to next token)
        - No:
            - Output: "Wrong Circuit Description"
            - End program (return 1)
7. End loop
8. Output: "Equivalent resistance: " + first element of resistances vector + " ohms"
9. Output: "Enter voltage: "
10. Input voltage
11. Calculate current = voltage / first element of resistances vector
12. Output: "Current: " + current + " A"
13. End program (return 0)
14. End
```

GitHub

SCAN THE QR CODE FOR:

- Complete project progress
- Current and previous versions of code
- Source files
- First access to any edits and project extras
- PDFs including:
  - Given tasks.
  - My documentation.
    (LIGHT & DARK themed)

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OR VISIT THE LINK:

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