EGR125

Introduction to Engineering Methods (C++) File: N125P3\_4A

Programming Assignment #3/4: Resistor Color Code Class

# Background:

Resistance is a measure of the opposition of the flow of charge through a material (measured in Ohms, Ω). A resistor is an electrical circuit element that has been manufactured to have a particular value of resistance. Carbon resistors are often color coded using 12 different colors which appear in 4 bands on a resistor, as shown below.

A B C D

The numerical value of the resistance, R, is determined using the four bands as follows: R = AB x 10C, with a tolerance (accuracy) of D,

where the values of A, B, C, and D are derived from the tables below.

## Bands A, B, and C Band D

|  |  |
| --- | --- |
| **Color** | **Numeric Value** |
| Black | 0 |
| Brown | 1 |
| Red | 2 |
| Orange | 3 |
| Yellow | 4 |
| Green | 5 |
| Blue | 6 |
| Violet | 7 |
| Gray | 8 |
| White | 9 |
| Silver | -1 |
| Gold | -2 |

|  |  |
| --- | --- |
| **Color** | **Tolerance** |
| Gold | 5 % |
| Silver | 10 % |
| None | 20 % |

## Notes:

1. Band A may not be black, gold, or silver.
2. Band B may not be gold or silver.

## Examples:

1. Yellow, violet, blue, none R = 47 x 106 = 47000000  (or 47 M), 20%
2. Green, brown, red, gold R = 51 x 102 = 5100  (or 5.1 k), 5%
3. Blue, green, gold, silver R = 56 x 10-1 = 5.6 , 10%

The tolerance gives the maximum deviation from the nominal value for a good component. If the tolerance is 5%, the maximum possible value is 5% above the nominal value and the minimum possible value is 5% below the nominal value.

**Example:** If R = 1500 , 5% tolerance, then Rmin = 0.95R = 1425  and Rmax = 1.05R = 1575 

# Program Description:

Write a C++ program that begins by giving the user two options:

* 1. The user can enter a desired resistor value and tolerance and the program will determine the closest standard resistance value and the corresponding 4 color codes.

The program must also satisfy a number of specific requirements as listed below.

# Program Requirements:

1. Write and use **class Resistance** as described below:
   * Data members: Include data members for
     + Resistance
     + Tolerance
     + 4 color bands (strings)
   * Member functions: Include member functions for
     + Constructor “Resistance” (input – Resistance and Tolerance, populate all data members, calls “Get Standard Resistance” member function)
     + Get Resistance
     + Get Tolerance
     + Get Rmax
     + Get Rmin
     + Get Standard Resistance (return standard resistance value given resistance and tolerance). This should be done using the three resistance value data files provided. Round UP if the desired resistance value is exactly halfway between two standard values.
   * Additional member function requirements:
     + Do not use global variables. All function inputs should be passed as arguments and all function outputs should be passed through reference parameters (other than the return type used as described above).
     + Do not print/display results inside the functions. All input prompts and all results should be printed from the main function.
   * File structure: Use separate header and implementation files for class Resistance.
2. Non-member functions can be used, but are not required.
3. Give the user options to re-run the program and to re-enter values if any invalid inputs are used. Valid/invalid inputs are described below:
   * Allow input resistance values from 10 ohms to 1,000,000 ohms (1 M).
   * Only allow tolerances of 5%, 10%, or 20%

# Sample Program Outputs

## Example 1:

Please enter the desired resistance value in ohms: 280000

Please enter the desired tolerance as a percentage (5, 10, or 20): 5 Results:

Closest standard value = 270000 ohms Color band A: red

Color band B: violet Color band C: yellow Color band C: gold

**Example 2):**

Please enter the desired resistance value in ohms: 200000000 Please enter the desired tolerance as a percentage (5, 10, or 20): 5 Results:

Invalid input

# Report:

Follow the guidelines listed in Format for Programming Projects (available on the instructor’s web page). Include all required test cases described below.

# Testing your program:

Test your program for the following cases and copy the results into a simple text file. Print the text file and turn it in with your report.

1. A negative resistance
2. A resistance value > 1,000,000 ohms
3. A resistance value < 10 ohms
4. An invalid tolerance
5. Each of the following resistance values and tolerances

|  |  |
| --- | --- |
| 270 ohms, 5%  3399.9 ohms, 5%  44444 ohms, 5%  6300000 ohms, 5% | 50 ohms, 10%  3000 ohms, 10%  20000 ohms, 10%  270 ohms, 20%  3900 ohms, 20%  56000 ohms, 20%  820000 ohms, 20% |

# Want to check your results?

There are several online resistor color code calculators, such as: <http://www.dannyg.com/examples/res2/resistor.htm>