GNG1106-A

Fundamentals of Engineering Computation

Assignment 1 – Electrical Engineering Case Study
Resistor Values
Software Report

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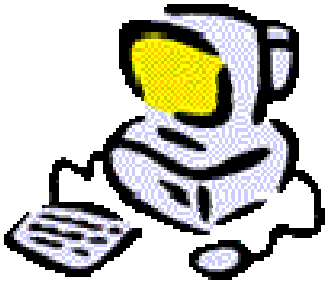


Step 1: Problem Identification and Statement

Provide a software tool that first requests from the user four color bands found on a resistor device and then translates the bands to its resistance value in kilo-Ohms (kΩ).

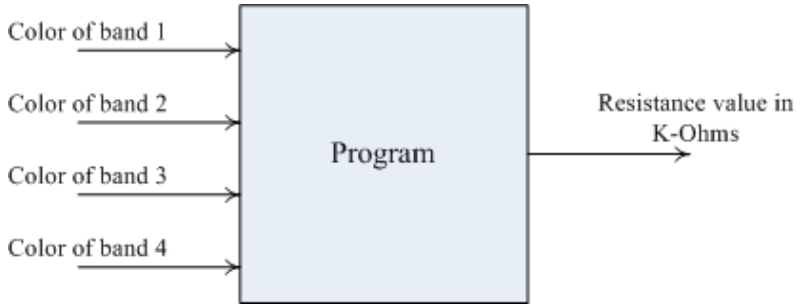
Step 2: Gathering of Information and Input/Output Description

Relevant information:

The first two bands give two digits of the resistance value. The third band serves as a power-of-ten value and is a multiplier of the resistance value defined by the first two bands. The fourth band serves as the tolerance margin of resistance value precision.

The resistance can be computed as (band1*10 + band2) X 10^{band3} +/- band4, where band1 is the number corresponding to the color of the first band, band2 is the number corresponding to the color of the 2nd band, band3 is the number corresponding to the color of the 3rd band, and band4 is the number corresponding to the color of the 4th band.

Input/output Description :



The following main menu is presented to the user.

```
Select one of the options:
1) Calculate resistance value
2) Help
3) Exit
```

When the user selects option 1, she will be presented by the following menu:

```
1) Black
2) Brown
3) Red
4) Orange
5) Yellow
6) Green
7) Blue
8) Violet
9) Gray
10) White
11) Gold
12) Silver

Select the color of band 1: 6
Select the color of band 2: 1
Select the color of band 3: 4
Select the color of band 4: 12
```

The program gives the resistance value in a message with the following format (note that if a value is greater or equal to 1000, the resistance value is expressed in kilo-ohms, otherwise in ohms):

```
The resistance value is: 50 ± 5 kΩ
```

Step 3: Design of the algorithm and hand-solved problems

Test cases (hand-solved examples):

The following table provides test cases for converting valid values (note that most colors have been used):

Band 1	Band 2	Band 3	Band 4	Resistance
White	Grey	Brown	Gold	0.98 ± 0.049 K-ohms
Blue	Orange	Green	Gold	6.3 ± 0.315 k-ohms
Yellow	Violet	Red	Silver	4.7 ± 0.47 k-ohms

Test error messages as shown below by using the values outside the range: -2, 0, 13, 200. These tests should be tested for selection of each of the three bands.

```
1) Black
2) Brown
3) Red
4) Orange
5) Yellow
6) Green
7) Blue
8) Violet
9) Gray
10) White
11) Gold
12) Silver

Select the color of band 1: -2
The selection -2 is not valid.
Select the color of band 1: 0
The selection 0 is not valid.
Select the color of band 1: 13
The selection 13 is not valid.
Select the color of band 1: 200
The selection 200 is not valid.
Select the color of band 1:
```

Exit by providing 3 for the main menu, for example:

```
Select one of the options:
1) Calculate resistance value
2) Help
3) Exit
3
Terminating …
```

Algorithm design:

```
Assign true to flag
Repeat
        Print "Select one of the options:"
        Print "1) Calculate resistance value"
        Print "2) Help"
        Print "3) Exit"
        Read value into selection

        If selection is equal to 1
                Print "1) Black"
                Print "2) Brown"
                Print "3) Red"
                Print "4) Orange"
                Print "5) Yellow"
                Print "6) Green"
                Print "7) Blue"
                Print "8) Violet"
                Print "9) Gray"
                Print "10) White"
                Print "11) Gold"
                Print "12) Silver"
                Repeat
                        Print "Please select a color for band 1: "
                        Read value into band1
                        If band1 is less than 1 OR band1 is greater than 10
                                Print "The selection ", band1," is not valid"
                While band1 is less than 1 OR band1 is greater than 10
                Repeat
                        Print "Please select a color for band 2: "
                        Read value into band2
                        If band2 is less than 1 OR band2 is greater than 10
                                Print "The selection ", band2," is not valid"
                While band2 is less than 1 OR band2 is greater than 10
                Repeat
                        Print "Please select a color for band 3: "
                        Read value into band3
                        If band3 is less than 1 OR band3 is greater than 12
                                Print "The selection ", band3," is not valid"
                While band3 is less than 1 OR band3 is greater than 12
                Repeat
                        Print "Please select a color for band 4: "
                        Read value into band4
                        If band4 is less than 11 OR band4 is greater than 12
                                Print "The selection ", band4," is not valid"
                While band4 is less than 11 OR band4 is greater than 12
```

```
            Assign ((band1-1)*10 + band2-1)|1000 to resistance
            Assign 0 to count
            Repeat while count less than band3-1
                  Assign resistance * 10 to resistance
                  Assign count+1 to count
            If band4 is equal to 11
                  Print "Resistance value is", resistance, "+|-", resistance*0.05,
                  "kilo-ohms"
            Else
                  Print "Resistance value is", resistance, "+|-", resistance*0.1, "kilo-
                  ohms"
            Assign flag to true
      Else If selection is equal to 2
            Print "This program computes the resistance value given the brands names"
            Assign flag to true
      Else
            Print "Terminating …"
            Assign flag to false
While flag is equal to true
```

Step 4: Implementation

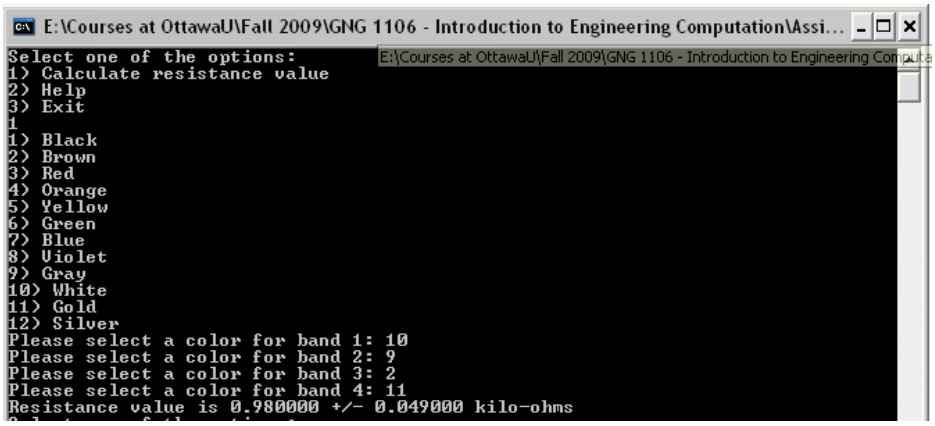
```
/*-------------------------------------------------------------------------
File: Assignment1.c
Description: Electrical Engineering Case study. The software program
             allows the user to convert the color band on resistors
             to a resistance value.
-------------------------------------------------------------------------*/
#include <stdio.h>
#include <stdlib.h>

/* Use constant definitions to define values for TRUE and FALSE */
#define TRUE 1
#define FALSE -1

/*-------------------------------------------------------------------------
Function: main

Description: This function provides all code for converting the values.
             It will present the main menu, prompt the user for four
             values after presenting a menu to select colors.  The
             selection are converted to values associated to the colors
             by subtracting one). A resistance value is then computed
             and printed.
-------------------------------------------------------------------------*/
int main()
{
    int flag;
    int selection, band1, band2, band3, band4;
    int count;
    double resistance;

    flag = TRUE;
    do
    {
       printf("Select one of the options:\n");
       printf("1) Calculate resistance value\n");
       printf("2) Help\n");
       printf("3) Exit\n");
       scanf("%d",&selection);

       if(selection == 1)
           {
            printf("1) Black\n");
            printf("2) Brown\n");
            printf("3) Red\n");
            printf("4) Orange\n");
            printf("5) Yellow\n");
            printf("6) Green\n");
            printf("7) Blue\n");
            printf("8) Violet\n");
            printf("9) Gray\n");
            printf("10) White\n");
            printf("11) Gold\n");
            printf("12) Silver\n");

            do /* Selecting a color for band 1 */
            {
              printf("Please select a color for band 1: ");
              scanf("%d",&band1);
              if((band1<1) || (band1>10))
                   printf("The selection %d is not valid\n",band1);
            }
            while((band1<1) || (band1>10));
```

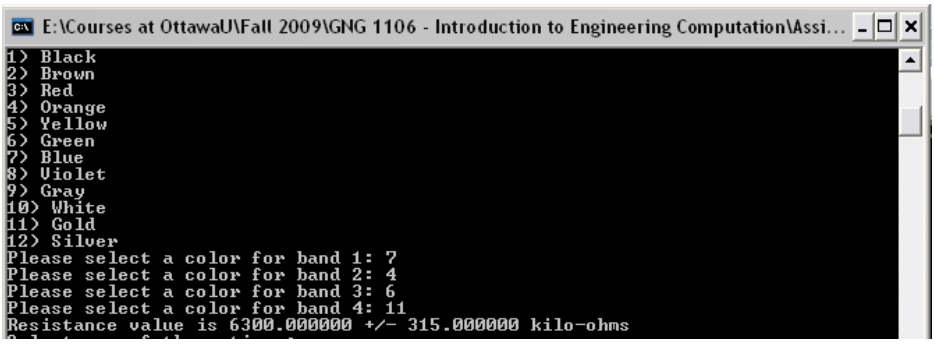
```
            do /* Selecting a color for band 2 */
            {
              printf("Please select a color for band 2: ");
              scanf("%d",&band2);
              if((band2<1) || (band2>10))
                   printf("The selection %d is not valid\n",band2);
            }
            while((band2<1) || (band2>10));

            do /* Selecting a color for band 3 */
            {
              printf("Please select a color for band 3: ");
              scanf("%d",&band3);
              if((band3<1) || (band3>12))
                   printf("The selection %d is not valid\n",band3);
            }
            while((band3<1) || (band3>12));

            do /* Selecting a color for band 4 */
            {
              printf("Please select a color for band 4: ");
              scanf("%d",&band4);
              if((band4<1) || (band4>12))
                   printf("The selection %d is not valid\n",band4);
            }
            while((band4<11) || (band4>12));

            /* Compute the resistance value and print */
            resistance = ((band1-1)*10.0 + (band2-1))/1000;

            for(count=0 ; count < band3-1 ; count++)
                  resistance = resistance*10.0;

            if(band4 == 11)  /* tolerance is 5% */
                  printf("Resistance value is %f +/- %f kilo-
                  ohms\n",resistance, resistance*0.05);
            else    /* tolerance is 10% */
                  printf("Resistance value is %f +/- %f kilo-
                  ohms\n",resistance, resistance*0.1);

            flag = TRUE;
           }
  else if (selection == 2)
    {
      printf("This program computes the resistance value given the
      brands names\n");
      flag = TRUE;
    }
 Else (selection == 3)
    {
      printf("Terminating ...\n");
      flag = FALSE;
    }
}
while(flag == TRUE); /* flag set to false when user selects exit */


    system("PAUSE");  /*pause before terminating*/
    return 0;
}
```

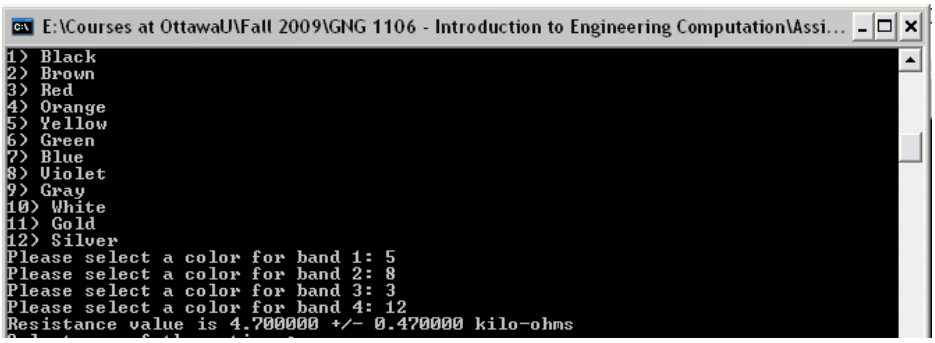
Step 5: Software Testing and Verification

Valid values:

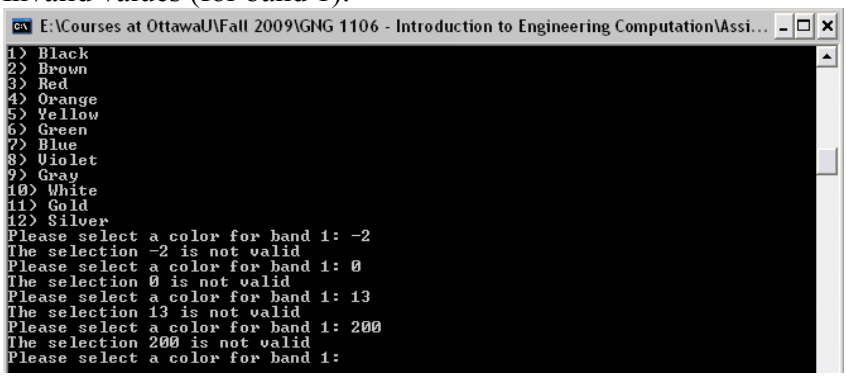
Band 1	Band 2	Band 3	Band 4	Resistance
White	Grey	Brown	Gold	0.98 ± 0.049 K-ohms
Blue	Orange	Green	Gold	6.3 ± 0.315 k-ohms
Yellow	Violet	Red	Silver	4.7 ± 0.47 k-ohms



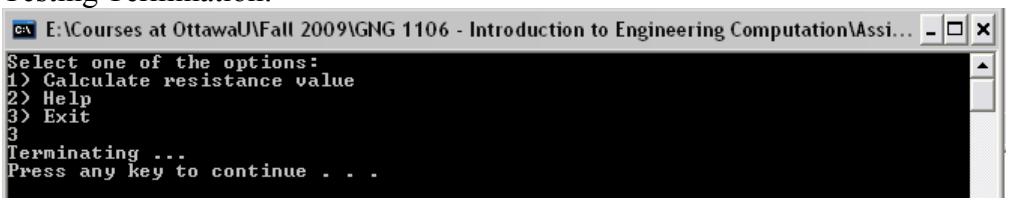




Invalid values (for band 1):

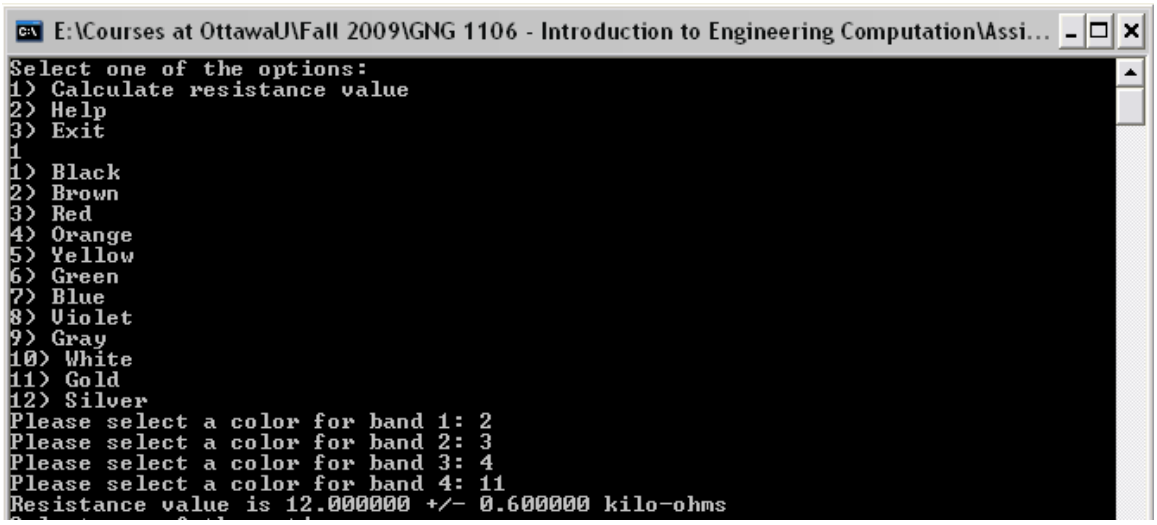


Testing Termination:



User Guide

The software program provides the means to translate the colors of the three bands on a resistor to its resistance value. Select colors for each band by entering corresponding number of the presented menu as shown below.



To terminate select “Exit” from the main menu.