

# ***Texas Instruments STEM Projects - UBMS***

## ➤ Need for STEMISTS in the US / Around the World

- STEM employment is growing at much faster rate than non-STEM jobs
- Top jobs include mathematicians/statisticians and computer systems and computer information jobs.

## ➤ Introduction to TI STEM Projects–

- Video 1: <https://www.youtube.com/watch?v=TUm8rlx53cA>
- Video 2: <https://www.youtube.com/watch?v=gq9m-gvqrQ4>

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# ***MOOD RING PROJECT USING TI\_84***

CHALLENGES AND PROJECT



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## ***Intro to TI-84 CE***

Basic Intro

Challenges for mood ring

Using variables and loops

Sensing temperature

Using Other loops and Projects

Skill Builders (Practice)

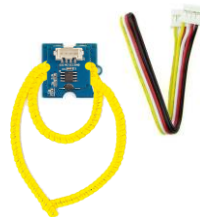
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## ***Digital Mood Ring (introduction to STEM and coding Projects for all levels)***



Bring science and coding together (no coding experience necessary) while developing a mood ring! Explore the science of color mixing while determining the right body temperature thresholds.

This is an excellent first TI-Innovator STEM and coding project. The project includes variables, loops, conditional statements, Boolean operators and other fundamental programming concepts.



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## Digital Mood Ring Challenges

**Challenge 1:** Use SET COLOR to explore using the color LED. Try to find the RGB values of all the colors in the mood chart.

**Challenge 2:** Use DispAt command to display your name at several locations on the screen.

**Challenge 3:** Use a For..EndFor loop to display the numbers 1 through 10.

**Challenge 4:** Connect a temperature sensor to the TI-Innovator Hub and display the temperature on the calculator.

**Challenge 5:** Use a loop to read and display temperature.

**Challenge 5 Extension (Optional):** Use a loop to read, display and log into list arrays for time and temperature. Graph the result.

**Challenge 6:** Use a While..End loop along with getKey function to monitor temperature and make a decision to display a message, "Hot" or "Cold."

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## Challenge 01:

- Example program

```
PROGRAM: CAA
Send("SET COLOR 255 128 0")
```

- Extension: Write a program that displays each of the colors that the mood ring will display.

```
PROGRAM: CAB
Send("SET COLOR 255 0 0")
Wait 2
Send("SET COLOR 255 0 255")
Wait 2
Send("SET COLOR 255 113 0")
Wait 2
Send("SET COLOR 0 0 0")
```

- Wait is useful to pause the program for a specified number of seconds.
- Try setting the color value to 0 0 0
- Try setting the color value to 255 255 255
- Try setting the color value to 5 5 5

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## Challenge 02:

- The alpha key toggles between alpha and normal entry. The program name prompt starts in alpha entry mode. To enter the name C2 type C alpha (to toggle to normal entry mode) 2.
- Use the Output( command (Program I/O menu). Output( takes three inputs (also known as “arguments”). The first input is the row number to display on. The second number is the column number to begin on. The third input is a text string enclosed in quotes, a numeric value, a variable name or an expression to resolve to a result to display.
- Use the ClrHome command (Program I/O menu) to give you an empty home screen to display on.
- Example program

```
PROGRAM: C2
ClrHome
Output(4,1,"HELLO, MY NAME IS:")
Output(5,1,"HOLLINGSWORTH")
```

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## Challenge 03:

- Loops are used to repeat a set of command. A For loop repeats a specified number of times. In TI-Basic the programmer defines a For loop with four arguments: a counter variable, a beginning value for the counter variable, an ending value for the counter variable and an optional step value variable.
- Use the ClrHome command (Program I/O menu) to give you an empty home screen to display on.
- Example program

```
PROGRAM: C3
ClrHome
For(N,1,10)
Output(4,1,N)
Wait 0.5
End
```

- The value for step is assumed to be 1 if a fourth optional input for step is not included in the command.
- The set of commands to be repeated are defined within the For..End block.
- For and End are found on the Program CTL Menu
- Experiment with different values to display. For example, `Output(3,1,N*2)`
- Experiment with an optional input for the step of the For loop. For example, `For(N,1,10,2)`

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## Challenge 04:

- The Hub Connect commands provide the hub with information about the type of device plugged into external ports and how to communicate with that device.
- The Read command instructs the Hub to read a value from a device plugged into a specified port. The Hub places the value in a memory location on the Hub, waiting for the calculator to "get" the value.
- The Get command gets the value from the Hub memory location for values read and stores the value to a specified variable.
- Note that multiple Output( commands can be used to build a message combining text and values on a row.
- Use the ClrHome command (Program I/O menu) to give you an empty home screen to display on.
- Example program

```
PROGRAM: C4
ClrHome
Send("CONNECT TEMPERATURE 1 TO IN 1")
Send("READ TEMPERATURE 1")
Get(T)
Output(4,1,"TEMPERATURE= ")
Output(4,14,T)
```

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## Challenge 05:

*[Self-study]*

- Display the sample number (counter value) in addition to the temperature.
- Note that multiple Output commands can be used to build a message on a row. Make sure to count the number of characters to determine where messages should begin. Note: Find the degree symbol on the angle menu (2<sup>nd</sup> function of the apps key) and the equal symbol on the test menu (2<sup>nd</sup> Math).
- Example program

```
PROGRAM: C5
ClrHome
Send("CONNECT TEMPERATURE 1 TO IN 1")
For(N,1,10)
Send("READ TEMPERATURE 1")
Get(T)
Output(4,1,"SAMPLE NUMBER= ")
Output(4,16,N)
Output(5,1,"TEMPERATURE (°C)= ")
Output(5,18,T)
Wait 2
End
```

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## Challenge 06:

[Self-study]

- While loops are useful when you would like a set of commands to be executed when a certain condition is true.
  - The While loop test checks to see if the variable named K is not equal to 45. If K is not equal to 45 then the commands in the loop are run. If K is equal to 45 then the program exits the While loop and moves to the next command after the End statement. In the example, the variable named K is initially set to be 0. This assures that the While loop will run at least once.
  - In the While loop a function called getKey is used to update the value stored in the variable named K. getKey is a TI-84 function that is useful for keyboard controlled While loops. getKey stores a 2-digit code value for the last key that you pressed while a program is running. The first digit is the row on the keyboard of the key, counting from the top. The second digit is the column of the key location on the keyboard. In this example, there is a check to see if the clear key, code value of 45, has been pressed.

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## Challenge 06(contd.):


[Self-study]

- Example program:

```

PROGRAM: C6
ClrHome
Send("CONNECT TEMPERATURE 1 TO IN 1")
0→K
While K≠45
Send("READ TEMPERATURE 1")
Get(T)
Output(4,1,"TEMPERATURE (°C)= ")
Output(4,18,T)
If T<22
Then
Send("SET COLOR 0 0 255")
Output(5,1,"IT IS COLD")
End
If T≥22
Then
Send("SET COLOR 255 0 0")
Output(5,1,"IT IS HOT ")
End
getKey→K
Wait 0.5
End

```



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## ***Final Project: See if you can do it!***

- You are supposed to practice the above given challenges and once completed, try out the mood ring project.
- **Final Challenge:** Build a mood ring to repeatedly read the temperature sensor, determine the mood of the person, display the temperature value and display the mood.

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## ***Planning your program***

Important steps in your program	TI-Basic commands to implement steps in your program
1.	
2.	
3.	
4.	
5...	

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## ***Skill Builders***

### **Basics:**

<https://education.ti.com/en/activities/ti-codes/84>

The above link can be used to learn more about programming TI-84 CE and TI-Nspire Calculators.

Each steps are explained with interactive features and easily explained for student's convenience.

### ***Digital Mood Ring Project (All challenges):***

[https://www.youtube.com/watch?v=nv\\_s8HklwE&list=PL17Fe0ZmhCR-PAuv5pw85vxrtLu5YGeWl&index=4](https://www.youtube.com/watch?v=nv_s8HklwE&list=PL17Fe0ZmhCR-PAuv5pw85vxrtLu5YGeWl&index=4)

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Questions?



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