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The purpose of this worksheet is to familiarize yourself with the general structure of a Fortran code and to fully debug the code shown on this worksheet. The Fortran source code can be downloaded from the class website.

The heat index (HI), also known as apparent temperature, is an index that combines air temperature and relative humidity to determine the temperature perceived by a human. (In other words, the heat index is a measure of how hot it feels.) The heat index is given by

$$H_i(T, R) = c_1 + c_2 T + c_3 R + c_4 T R + c_5 T^2 + c_6 R^2 + c_7 T^2 R + c_8 T R^2 + c_9 T^2 R^2, \quad (1)$$

where  $H_i$  is the heat index in degrees Fahrenheit,  $T$  the temperature in degrees Fahrenheit, and  $R$  the relative humidity (given as a percentage value between 0 and 100). The quantities  $c_i$  ( $i = 1, \dots, 9$ ) denote dimensionless constant coefficients whose values are given by<sup>2</sup>

$$\begin{aligned} c_1 &= -42.379 \\ c_2 &= 2.049015 \\ c_3 &= 10.14333 \\ c_4 &= -0.224755 \\ c_5 &= -6.83783 \times 10^{-3} \\ c_6 &= -5.481717 \times 10^{-2} \\ c_7 &= 1.22874 \times 10^{-3} \\ c_8 &= 8.5282 \times 10^{-4} \\ c_9 &= -1.99 \times 10^{-6} \end{aligned}$$

Equation (1) is valid for temperatures of  $60 \leq T$  (Fahrenheit)  $\leq 90$  and relative humidities ranging from 30% to 85%. A Fortran source code that computes  $H_i(T, R)$  for given values of  $T$  and  $R$  can be downloaded from the class website at [https://fweber.sdsu.edu/~fweber/Phys\\_317.html](https://fweber.sdsu.edu/~fweber/Phys_317.html).

### Tasks

- Download the source code and fully debug the program.
- Run the code for a temperature of  $T = 85$  Fahrenheit and a humidity of  $R = 47\%$ . (The program prompts the user to input these values from keyboard.)
- The terminal dialog when running the program should look like this:

```
Input value for temperature (in Fahrenheit):
85
Input value for relative humidity (in %):
47

Temperature: T= 85.0000000    Fahrenheit
Humidity R= 47.0000000    %
Heat index Hi(T,R)= 85.7517395    Fahrenheit
Heat index Hi(T,R)= 29.8620777    Celsius
STOP Regular program stop encountered
```

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<sup>2</sup>See, for instance, [http://en.wikipedia.org/wiki/Heat\\_index](http://en.wikipedia.org/wiki/Heat_index)

**Submission Instructions:** Email a copy of your fully debugged source code to [ewhart317@gmail.com](mailto:ewhart317@gmail.com). Put Last First WS 3 in the subject line, where Last and First is your Last and First name.

```
!-----
programm buggy_code

! Purpose: This Fortran program which computes the heat index for a given
! humidity (R) and temperature (T).
!
! History
! Version   Programmer       Date       Description
! -----   -
! 1.0       F. Weber         01/30/23   created from scratch
!
! IN args/commons          Units       Description
! -----
! T                        Fahrenheit   Temperature
! R                        Percent       Relative Humidity
!
! OUT args/commons        Units       Description
! -----
! HI                       Heat Index   Fahrenheit
!
! Special requirements: None
! ----- Variable declarations -----

implicit no
realal :: T, R, Hi
           Hi_Celsius

real :: c_1=-42.379, c_2=2.049015, c_3=10.14333  c_4=-0.224755
real :: c_5=-6.83783E-03, c_6=-5.481717E-02, c_7=1.22874E-03
real :: c_8=8.5282E-04  c_9=-1.99E-06

print, " Input value for temperature (in Fahrenheit):"
read(*,*) T
print*, " Input value for relative humidity (in %):"
read(*,*) R

Hi =  c_1 + c_2*T + c_3*R + c_4*T*R + c_5*T**2 + c_6*R**2 + c_7*T**2*R &
      + c_8*T*R**2      c_9*T**2*R**2

print*, " "
print*, "Temperature: T=", T, "Fahrenheit"
print*, "Humidity R=", R, "%"
print*  "Heat index Hi(T,R)=", Hi, "Fahrenheit"

Convert Heat Index to degrees Celsius
Hi_Celsius = (Hi - 32.0) * 5.0 // 9.0
print*  "Heat index Hi(T,R)=", Hi_Celsius, "Celsius"

stop "Regular program stop encountered"
end program heat_index
!-----
```