CS 420
PROGRAM 2P

Purpose

The purpose of this assignment is to give you more practice with loops.

Submission

You need to submit only one C source file called ctof.c. Do not submit any other files.

Problem

You are required to write a program to print 2 tables of temperature values converting Celsius to Fahrenheit.

The first table should display the following columns: Temperature in Celsius, Temperature in Fahrenheit, several columns of Temperature in Fahrenheit which include Wind Chill factor (one column for each wind speed starting 5mph up to 40mph in increments of 5mph).

The second table should display the following columns: Temperature in Celsius, Temperature in Fahrenheit, several columns of Temperature in Fahrenheit which include Head Index factor (one column for each relative humidity percentage starting at 40% up to 100% in increments of 10).

The headings for each column must also be printed i.e. Celsius, Fahrenheit, Wind speed (or Heat index) value. For any temperature value that's not valid for either Wind Chill calculation or Heat Index calculation print a "X" in that column.

Scenario

Wind chill is the perceived decrease in air temperature felt by the body on exposed skin due to the flow of air.

Wind chill numbers are always lower than the air temperature for values where the formula is valid. When the apparent temperature is higher than the air temperature, the heat index is used instead.

In 2001 there were corrections made to the wind chill calculations and the formula for computing this in U.S customary units are:

$$T_{\mathrm{wc}} = 35.74 + 0.6215T_{\mathrm{a}} - 35.75V^{+0.16} + 0.4275T_{\mathrm{a}}V^{+0.16}$$

where T_{wc} is the wind chill index, based on the Fahrenheit scale, T_{a} is the air temperature, measured in °F, and V is the wind speed, in mph.

Wind chill temperatures are valid for temperatures upto 50 deg Fahrenheit only and when the wind speed is 5 miles or more.

The heat index is an index that combines air temperature and relative humidity in an attempt to determine the human-perceived equivalent temperature—how hot it feels. Like the wind chill index, the heat index contains assumptions about the human body mass and height, clothing, amount of physical activity, thickness of blood, sunlight and ultraviolet radiation exposure, and the wind speed.

In the late 1970s there was a formula developed to calculate the heat index and this formula below approximates the heat index in degrees Fahrenheit, to within ±1.3 °F

$$\mathrm{HI} = c_1 + c_2T + c_3R + c_4TR + c_5T^2 + c_6R^2 + c_7T^2R + c_8TR^2 + c_9T^2R^2$$

where

HI = heat index (in degrees Fahrenheit)

T = ambient dry-bulb temperature (in degrees Fahrenheit)

R = relative humidity (percentage value between 0 and 100)

$c_1 = -42.379, c_2 = 2.04901523, c_3 = 10.14333127, c_4 = -0.22475541, c_5 = -6.83783 \times 10^{-3}, c_6 = -5.481717 \times 10^{-2},$
$c_7 = 1.22874 \times 10^{-3}, c_8 = 8.5282 \times 10^{-4}, c_9 = -1.99 \times 10^{-6}.$

Heat index formula is valid only when the temperature is 80 deg Fahrenheit or above and when the relative humidity is 40% or more.

For both computations irrelevant columns should contain a “X” (i.e. if the initial Fahrenheit temperatures are greater than 50 for Wind Chill and less than 80 for Heat Index)

Recommended procedure is to use a nested for statement to calculate and print values for each table. You must use constants for values in the program that are not expected to change.

All compiler warnings will be treated as errors.

Input & Output

Input should be taken from the user as a pair of integer values on the same line. The two inputs must be in the range -20 to 50 (both inclusive), first input must be less in value than the second. Anything outside this range is not accepted and the user needs to be prompted again for 2 inputs in the correct range. Once a valid pair of inputs is obtained the program continues. After computing and printing the two tables the program stops.

Output will be sent to standard output (the screen). Your output for all the temperature conversions may not match mine exactly due to truncate/rounding issues but they have to be close.

Sample runs of the program are also available in the public folder.

(Sample Output shown below)

```
This program converts temperature values from Celsius to Fahrenheit
and also factors in Wind Chill and Heat Index at the appropriate temperatures

Please enter the range of temperature values (in Celsius between -20 and 50) to be converted:
Input temperature range: 0 to 35


Celsius to Fahrenheit with Wind Chill factor
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Celsius	Fahrenheit	5mph	10mph	15mph	20mph	25mph	30mph	35mph	40mph
0	32.00	27.08	23.73	21.59	19.99	18.69	17.60	16.65	15.81
1	33.80	29.19	25.96	23.89	22.35	21.10	20.04	19.12	18.31
2	35.60	31.30	28.19	26.20	24.71	23.50	22.49	21.60	20.82
3	37.40	33.42	30.42	28.51	27.07	25.91	24.93	24.08	23.33
4	39.20	35.53	32.65	30.81	29.43	28.32	27.38	26.56	25.83
5	41.00	37.65	34.88	33.12	31.79	30.72	29.82	29.04	28.34
6	42.80	39.76	37.11	35.42	34.15	33.13	32.26	31.51	30.85
7	44.60	41.88	39.34	37.73	36.52	35.54	34.71	33.99	33.36
8	46.40	43.99	41.57	40.03	38.88	37.94	37.15	36.47	35.86
9	48.20	46.10	43.81	42.34	41.24	40.35	39.60	38.95	38.37
10	50.00	X	X	X	X	X	X	X	X
11	51.80	X	X	X	X	X	X	X	X
12	53.60	X	X	X	X	X	X	X	X
13	55.40	X	X	X	X	X	X	X	X
14	57.20	X	X	X	X	X	X	X	X
15	59.00	X	X	X	X	X	X	X	X
16	60.80	X	X	X	X	X	X	X	X
17	62.60	X	X	X	X	X	X	X	X
18	64.40	X	X	X	X	X	X	X	X
19	66.20	X	X	X	X	X	X	X	X
20	68.00	X	X	X	X	X	X	X	X
21	69.80	X	X	X	X	X	X	X	X
22	71.60	X	X	X	X	X	X	X	X
23	73.40	X	X	X	X	X	X	X	X
24	75.20	X	X	X	X	X	X	X	X
25	77.00	X	X	X	X	X	X	X	X
26	78.80	X	X	X	X	X	X	X	X
27	80.60	X	X	X	X	X	X	X	X
28	82.40	X	X	X	X	X	X	X	X
29	84.20	X	X	X	X	X	X	X	X
30	86.00	X	X	X	X	X	X	X	X
31	87.80	X	X	X	X	X	X	X	X
32	89.60	X	X	X	X	X	X	X	X
33	91.40	X	X	X	X	X	X	X	X
34	93.20	X	X	X	X	X	X	X	X
35	95.00	X	X	X	X	X	X	X	X

Celsius to Fahrenheit with Heat Index factor

Celsius	Fahrenheit	40%	50%	60%	70%	80%	90%	100%
0	32.00	X	X	X	X	X	X	X
1	33.80	X	X	X	X	X	X	X
2	35.60	X	X	X	X	X	X	X
3	37.40	X	X	X	X	X	X	X
4	39.20	X	X	X	X	X	X	X
5	41.00	X	X	X	X	X	X	X
6	42.80	X	X	X	X	X	X	X
7	44.60	X	X	X	X	X	X	X
8	46.40	X	X	X	X	X	X	X
9	48.20	X	X	X	X	X	X	X
10	50.00	X	X	X	X	X	X	X
11	51.80	X	X	X	X	X	X	X
12	53.60	X	X	X	X	X	X	X
13	55.40	X	X	X	X	X	X	X
14	57.20	X	X	X	X	X	X	X
15	59.00	X	X	X	X	X	X	X
16	60.80	X	X	X	X	X	X	X
17	62.60	X	X	X	X	X	X	X
18	64.40	X	X	X	X	X	X	X
19	66.20	X	X	X	X	X	X	X
20	68.00	X	X	X	X	X	X	X
21	69.80	X	X	X	X	X	X	X
22	71.60	X	X	X	X	X	X	X
23	73.40	X	X	X	X	X	X	X
24	75.20	X	X	X	X	X	X	X
25	77.00	X	X	X	X	X	X	X
26	78.80	X	X	X	X	X	X	X
27	80.60	80.35	81.35	82.54	83.94	85.53	87.32	89.31
28	82.40	81.80	83.21	85.01	87.20	89.78	92.74	96.10
29	84.20	83.49	85.39	87.86	90.91	94.53	98.73	103.51
30	86.00	85.44	87.89	91.10	95.07	99.80	105.29	111.55
31	87.80	87.64	90.71	94.72	99.68	105.58	112.42	120.21
32	89.60	90.10	93.85	98.73	104.74	111.86	120.11	129.49
33	91.40	92.81	97.32	103.13	110.24	118.66	128.37	139.39
34	93.20	95.77	101.11	107.92	116.20	125.97	137.20	149.92
35	95.00	98.99	105.21	113.09	122.61	133.78	146.60	161.07