06.03 Virtual Lecture Notes: Heat Index

Sweating helps prevent overheating because the water in perspiration carries heat away from the body. But when the relative humidity is high, it can feel hotter than it is because evaporation rate is reduced and less heat is removed. The heat index (also called the apparent temperature) is a way to calculate how hot it feels on days when there is also high humidity. If the temperature is less than 80° Fahrenheit and the humidity is less than 40%, there is no difference between actual and apparent temperature (until the wind chill factor comes into play). The following table clearly indicates the risk imposed by high temperatures and high humidity.

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

		Temperature (F)															
		80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
	40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
H	45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
U	50	81	83	85	88	91	95	99	103	108	113	118	124	130	137		
M	55	81	84	86	89	93	97	101	106	112	117	124	130	137			
I	60	82	84	88	91	95	100	105	110	116	123	129	137				
D	65	82	85	89	93	98	103	108	114	121	128	136					
I	70	83	86	90	95	100	105	112	119	126	134						
T	75	84	88	92	97	103	109	116	124	132							
Y	80	84	89	94	100	106	113	121	129								
	85	85	90	96	102	110	117	126	135								
%	90	86	91	98	105	113	122	131									
	95	86	93	100	108	117	127										
	100	87	95	103	112	121	132										

Caution	Extreme Caution	Danger	Extreme Danger
Fatigue Possible	Sun stroke, muscle cramps and/or heat exhaustion possible	Sun stroke, muscle cramps and/or heat exhaustion likely	Heat stroke or sun stroke

Adapted from: http://www.nws.noaa.gov/om/heat/index.shtml and
http://www.floridadisaster.org/bpr/EMTOOLS/Severe/heatwave.htm

For such a straightforward concept, the formula to calculate the Heat Index (HI) looks very complex; but it is just algebra. Temperature (T) is in degrees Fahrenheit and Relative Humidity (RH) is in percent. Closely examine the heat index formula and the nine different components.

$$HI = -42.379 + 2.04901523T + 10.14333127R - 0.22475541TR - 6.83783\times10^{-3}T^2 - 5.481717\times10^{-2}R^2 + 1.22874\times10^{-3}T^2R + 8.5282\times10^{-4}TR^2 - 1.99\times10^{-6}T^2R^2$$

Several of the terms include scientific notation (e.g., 10^{-3} and 10^{-6}), so you will need to review lesson [3] in the IMACS unit on doubles, in order to translate this formula into Java. In addition, several of the terms are raised to the second power (e.g., T^2 and R^2). You can handle exponents by simply multiplying the terms, or you can peek ahead and learn about the Math classes' **`pow()`** method. Use a calculator and determine the heat index for 92°F and 60% relative humidity. Verify your answer in the table above.