

EAS372 Assignment 2 Due: Tues 12 March, 2013

Format: Please submit a tidy, organized report *in hard copy*, covering the exercise below. Report should be single-sided, double spaced with font size 12 pt. The page limit is **two**, not counting figures and tables.

Task: Assess the skill of Environment Canada’s NWP-based 5-day forecasts of maximum and minimum temperatures, by computing Heidke Skill Scores (HSS) for the max and min forecasts, based on a one month database of forecasts (February 2013). You will be assigned one of the stations from Table (1).

Procedure: Starting Sunday 27 Jan. 2013, record a one month time series of Environment Canada forecasts for the daily maximum and minimum temperatures on **day 5** at the station assigned to you from Table (1). Obtain these data from

http://www.weatheroffice.gc.ca/canada_e.html

using a consistent time-issued (e.g. around 05:30 AM or 11:00 AM or 4:00 PM, according to your preference). In the example of Figure (1), the relevant **day 5** numbers¹ are: (-1°C , -12°C). The first entry in your data tabulation will be for 1 February 2013, and you will (eventually) have a complete month of forecasts, along with the corresponding verification (values of the true maximum and minimum on the given day).

Classify each forecast and each corresponding observation as being a forecast of the below normal, normal or above normal condition, according to the appropriate row of Table (1) for your station. For each day, and for both the minimum and the maximum, this will give you the category *predicted* (by NWP) and the category observed. Fill in the 3×3 contingency tables (Table 2 is a blank sample), and compute the Heidke Skill Scores

$$\text{HSS} = \frac{R - E}{T - E}$$

¹Terminology as to what constitutes “day 5” varies from one forecaster to another. The intent here is that the forecast lead time be approximately 5×24 hours, thus the day the forecast is issued counts as day 0.

(R the number of correct NWP forecasts, $T = 28$ the total number of forecasts, $E \leq T$ the number of occasions on which a climatological forecast would have been correct) for your set of max- and min- forecasts. To compute HSS you also need to create the contingency tables based on climatological forecasts (on the basis of Table 1), for which (by definition) the forecasts *always* lie in the normal category (non-zero entries in row 2, alone).



Figure 1: An example of the Environment Canada public weather forecast for Edmonton.

Location	$T_{min}^{33\%}$	$T_{min}^{66\%}$	$T_{max}^{33\%}$	$T_{max}^{66\%}$	Xtrm lo T_{min}	Xtrm hi T_{max}	Period (inclusive)
Vancouver	0.0	3.3	7.2	9.4	-11.2	18.4	1960-2011
Whitehorse	-22.1	-12.5	-11.4	-2.2	-51.2	11.7	1960-2007
Yellowknife	-33.8	-24.1	-23.3	-14.8	-46.8	6.2	1960-2007
Edmonton City	-16.4	-8.6	-6.9	+1.8	-38.9	14.0	1960-2012
Calgary	-14.8	-7.2	-2.8	+5.0	-37.5	19.6	1960-2011
Regina	-21.8	-13.3	-10.5	-2.5	-41.0	11.3	1960-2007
Winnipeg	-24.4	-15.6	-12.8	-5.0	-45.0	9.0	1960-2007
Toronto Pearson	-12.8	-6.5	-3.3	+1.5	-27.7	14.9	1960-2011
Montreal Trudeau	-16.1	-9.9	-6.4	-0.6	-31.7	15.0	1960-2012
Halifax Stanfield	-13.3	-7.7	-2.8	+0.8	-27.3	11.8	1961-2011

Table 1: Climatological upper and lower temperature limits ($^{\circ}\text{C}$) defining three equiprobable classes (below normal, normal, above normal) for February daily temperature maximum and minimum (also given, but not needed for the assignment, are the lowest T_{min} and the highest T_{max}). For example, the below normal class for February minimum temperatures at Edmonton is $T_{min} < -16.4^{\circ}\text{C}$, and over the period of record 33% of the observed minimum temperatures on February days have fallen in this class; the normal band is $-16.4 \leq T_{min} < -8.6^{\circ}\text{C}$, and again, 33% of observed February minimum temperatures belong in this class. The given class boundaries are termed “percentiles,” and those given here have been derived from the entire available record for each station by Andrew Giles (Environment Canada, Kelowna).

	OBSV			Row Total
	Below	Normal	Above	
NWP	Below			
5 day	Normal			
FCST	Above			
	Column Total			28

Table 2: Blank contingency table for EC 5-day (lead time) forecast of daily February minimum temperature (categorized below normal, normal, above normal). Note: the EC forecast is based on numerical weather prediction. In some EC offices, forecasters do not intervene in forecasts beyond the three day range (Edward Hudson, Environment Canada, pers. comm); however policies on this do differ from office to office.