ISE 2211 • Exam IV • 12 March 2021 NAME SOLUTION

On the last exam, we explored cold weather and foul language; two things that often go together. We know the mean low temperature for February 17th over $n = 11$ calendar years is 25.77 °F with a standard deviation of 11.27 °F, and population standard deviation is unknown. According to the same source of data used to determine these sample parameters (https://www.usclimatedata.com/climate/dayton/ohio/united-states/usoh0245), the average low temperature on February 17th is 23.4 °F. Test the following hypotheses on this mean low temperature using the *p*-value approach, and state your final conclusion with respect to a significance level of $\alpha = 0.05$. Roughly sketch the appropriate distribution, shading the region corresponding to the *p*-value.

H_0: $\mu = 23.4$ °F

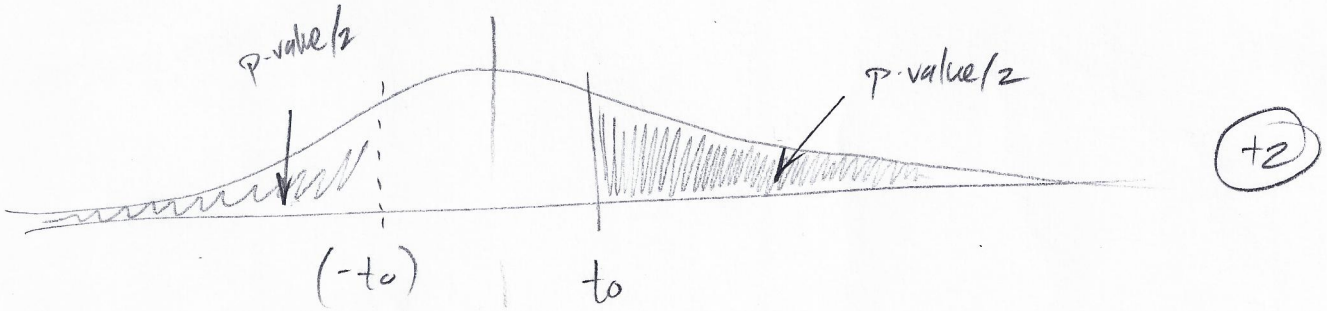
H_0: $\mu \neq 23.4$ °F

+ $n < 30$

$\therefore$ T-distribution

$$t_0 = \frac{\bar{x} - \mu_0}{s/\sqrt{n}} \quad (+1)$$

$$= \frac{25.77 - 23.4}{11.27/\sqrt{11}} = 0.6975 \quad (+1)$$



(+2)

from table @ $v = 10$ degrees of freedom:

(+2) $t_{10,.40} = 0.260$

$t_{10,.25} = 0.700$

$\therefore .25 < \frac{\text{p-value}}{2} < .40$ (+1)

$.50 < \text{p-value} < .80$ (+1)

really, p-value ≈ 0.50!

$P \gg 0.05$ (+1)

$\therefore$ fail to reject H_0 (+1)

Let's go back to the original data from *Exam III*.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Low Temp	16	37	19.9	21.9	50.0	27.0	12.0	12.2	(no data)	29.1	30.2	28.2

It has been declared (by me) that any low temperature below 32.0 °F is...wait for it...freezing. I also say it is freezing like 90% of the time around here and this is not cool. Test the following hypotheses on the proportion of freezing low temperatures using the fixed level of significance approach at $\alpha = 0.05$. Roughly sketch the appropriate distribution, showing your test statistic, critical value(s), and critical region(s). Don't forget to clearly state your final conclusion regarding the null hypothesis, and explicitly state whether it may be suggested that Joe Tritschler is right on or way off.

H_0: $p = 90\%$

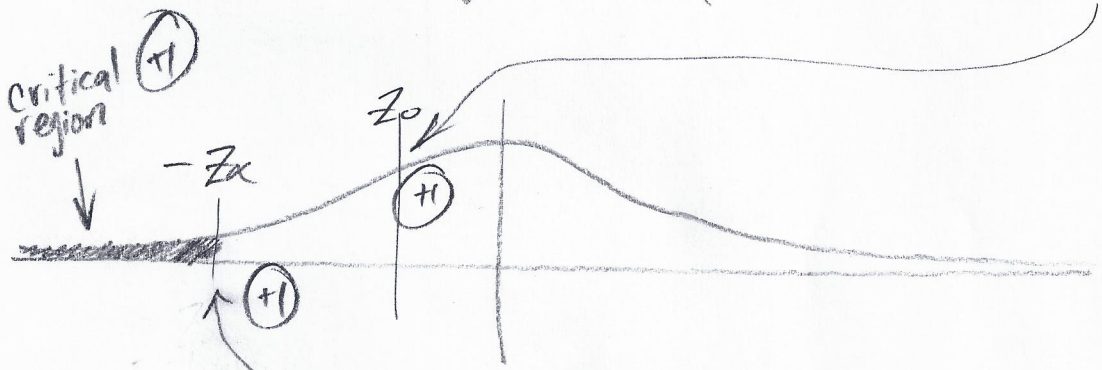
H_1: $p < 90\%$

low temps below 32°

$X = 9$ out of $n = 11$ (+2)

$$Z_0 = \frac{X - n p_0}{\sqrt{n p_0 (1 - p_0)}}$$

$$= \frac{9 - 11(.9)}{\sqrt{11 \cdot .9 (.1)}} = -0.9045 \quad (+1)$$



critical value (lower one-sided): $-Z_\alpha = -Z_{.05} = -1.645$ (bottom row of t-table!)

(+2)

$Z_0 \not< Z_\alpha$ (+1)

∴ fail to reject H_0 (+1)

Joe Tritschler is right on (as always) (+1)