MA487 Hw 1, problem 8

#i.



With the exception of one reaction time, all the “Act” reaction times are less than all the “Think-Act” reaction times so it appears H\_0 is false and that mu\_TA exceeds mu\_A.

#ii.

The above plot constitutes our time series plots – no need to redo. In my opinion there are downward trends in location in both data sets although whether the trend is strong enough to invalidate statistical analysis is not clear. Regarding spread, it seems to me that the “Think-Act” series has more variability in the earlier runs. Based on these observations, neither sample is ID (identically distributed).

Since the observations are ordered we can check for independence using lag plots and a formal test of autocorrelation. YOU NEED TO DO BOTH, i.e., you need to inspect the lag plots for curvilinear trends/patterns AND see if the p-value is low.

MTB > %autotest c3.

Executing from file: C:\Program Files\Minitab\Minitab 17\English\Macros\autotest.MAC

Pearson correlation of TA2 and lagraw = 0.315

Pearson correlation of nscore and lagscore = 0.266

p-value for testing null hypothesis of no autocorrelation: 0.4470

The p-value for testing H\_0: no autocorrelation is pretty high and although there are slight increasing trends in both lag plots there is just not enough evidence to contradict H\_0 so the independence assumption appears OK.





For the A2 data we get

MTB > %autotest c14.

Executing from file: C:\Program Files\Minitab\Minitab 17\English\Macros\autotest.MAC

Pearson correlation of A2 and lagraw = 0.280

Pearson correlation of nscore and lagscore = 0.518

p-value for testing null hypothesis of no autocorrelation: 0.1390

The p-value is not small enough to reject H\_0: no autocorrelation so, even though there is some evidence of linear trends in the lag plots (see next page), we conclude the independence assumption is OK. In the context of this experiment concluding reaction times for this individual are independent means this person is not “streaky:” they don’t tend to produce several short or long reaction times in a row.





#iii.

#iv.

**Two-Sample T-Test and CI: TA2, A2**

Two-sample T for TA2 vs A2

N Mean StDev SE Mean

TA2 10 361.4 51.4 16

A2 10 274.2 26.4 8.3

Difference = μ (TA2) - μ (A2)

Estimate for difference: 87.2

95% CI for difference: (47.7, 126.7)

T-Test of difference = 0 (vs ≠): T-Value = 4.77 P-Value = 0.000 DF = 13

In spite of the fact that the ID of the IID assumption and the normality assumption appear to be violated, the p-value backed up our observation that the null hypothesis is not true and, since the test statistic t = 4.77 is positive, that mu\_TA exceeds mu\_A for subject 2.

#vi.

MTB > %boot2mean c3 c14;

SUBC> nulldiff 0.

Executing from file: C:\Program Files\Minitab\Minitab 17\English\Macros\boot2mean.MAC

Boot2mean hypothesis testing results:

p-value for testing H\_a: mu\_1 - mu\_2 < 0 : 1.000

p-value for testing H\_a: mu\_1 - mu\_2 > 0 : 0

p-value for testing H\_a: mu\_1 - mu\_2 not equal 0 : 0

Note that the p-value we need here is the last one.