Week 4 Lab Exercises

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1 Hypothesis Test

In Table 1, the column `TeachScore` is the average verbal test score of teachers in 20 randomly selected schools in Britain. The column `VerbalScore` shows the scores of the same test for the pupils in the respective school.

1. In `R`, write code to create this data frame without relying on any external files or interactive functions (e. g., graphical windows) for data input.
2. Test the hypothesis that pupils have a better verbal expression than teachers. Show the calculation steps and results manually (without `R`). To accomplish this, choose the right distribution, do the hypothesis test, and report an estimate, confidence interval, and p-value. Do pupils have a higher verbal test score than teachers?
3. Use `R` to repeat these steps using the `t.test` function.

2 Comparing estimators

Consider three estimators of the population mean μ:

1. $\hat{\mu}_1 = n^{-1} \sum_i \lfloor x_i \rfloor$
2. $\hat{\mu}_2 = n^{-1} \sum_i \lfloor x_i \rceil$
3. $\hat{\mu}_3 = n^{-1} \sum_i x_i^2$

Compare these estimators based on three typical criteria for comparing estimators. Which estimator would you choose? Hint: You can draw random numbers from a normal distribution in `R` as part of your solution to demonstrate your answer graphically or numerically.

Salary	WhiteCollar	SES	TeachScore	MotherEduc	VerbalScore
3.83	28.87	7.20	26.60	6.19	37.01
2.89	20.10	-11.71	24.40	5.17	26.51
2.86	69.05	12.32	25.70	7.04	36.51
2.92	65.40	14.28	25.70	7.10	40.70
3.06	29.59	6.31	25.40	6.15	37.10
2.07	44.82	6.16	21.60	6.41	33.90
2.52	77.37	12.70	24.90	6.86	41.80
2.45	24.67	-0.17	25.01	5.78	33.40
3.13	65.01	9.85	26.60	6.51	41.01
2.44	9.99	-0.05	28.01	5.57	37.20
2.09	12.20	-12.86	23.51	5.62	23.30
2.52	22.55	0.92	23.60	5.34	35.20
2.22	14.30	4.77	24.51	5.80	34.90
2.67	31.79	-0.96	25.80	6.19	33.10
2.71	11.60	-16.04	25.20	5.62	22.70
3.14	68.47	10.62	25.01	6.94	39.70
3.54	42.64	2.66	25.01	6.33	31.80
2.52	16.70	-10.99	24.80	6.01	31.70
2.68	86.27	15.03	25.51	7.51	43.10
2.37	76.73	12.77	24.51	6.96	41.01

Table 1: Verbal expression data