2022-2 Machine Learning Homework #2

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(Deadline : October 8, 2022)

Submit your homework report by email (`dkkang@gmail.com`).
Do not waste too much time to make the report fancy.

1. For the following data: ($\alpha = 0.05$)

Data	**Algorithm A**	**Algorithm B**
anneal	93.99	76.17
Balance-scale	91.36	91.04
Breast-cancer	71.68	72.38
Breast-w	97.28	95.99
Credit-a	85.94	84.49
Dermatology	97.81	93.17
Diabetes	77.47	69.92
Glass	77.1	71.96
Heart-c	85.81	84.49
Heart-h	86.39	83.33
Heart-statlog	83.7	81.85
Hepatitis	89.03	79.35
Hypothyroid	95.68	92.29
Ionosphere	92.02	90.31
Kr-vs-kp	87.89	79.72
Labor	91.23	91.23
Letter	72.84	77.71
Lymph	85.81	81.08
Primary-tumor	50.15	29.5
Sick	97.48	93.88
Sonar	99.04	88.94
Splice	95.36	52.04
Vehicle	66.67	69.62
Vote	90.11	90.57
Waveform-5000	64.04	63.92

   (a) Perform Shapiro–Wilk test on the differences of two datasets using R.
   (b) Perform paired t test by hand.
   (c) Perform paired t test using R.
   (d) Perform Wilcoxon Signed-Rank Test by hand.
   (e) Perform Wilcoxon Signed-Rank Test using R.
   (f) Perform Sign Test (Binomial test) using R.

   You have to explain (1) what is the null hypothesis, (2) whether it is rejected or not, (3) and how do you know that it is rejected.

2. For the following data: ($\alpha = 0.05$)

Data	Algorithm A	Algorithm B	Algorithm C	Algorithm D
anneal	93.99	76.17	97.77	97.44
Balance-scale	91.36	91.04	89.6	89.6
Breast-cancer	71.68	72.38	71.68	72.03
Breast-w	97.28	95.99	97	97
Credit-a	85.94	84.49	87.54	87.1
Dermatology	97.81	93.17	98.09	97.81
Diabetes	77.47	69.92	76.04	76.04
Glass	77.1	71.96	78.97	78.97
Heart-c	85.81	84.49	84.82	85.48
Heart-h	86.39	83.33	86.05	85.37
Heart-statlog	83.7	81.85	84.07	83.7
Hepatitis	89.03	79.35	89.68	89.68
Hypothyroid	95.68	92.29	95.86	95.89
Ionosphere	92.02	90.31	93.45	93.45
Kr-vs-kp	87.89	79.72	91.24	91.27
Labor	91.23	91.23	82.46	85.96
Letter	72.84	77.71	85.2	85.2
Lymph	85.81	81.08	85.81	86.49
Primary-tumor	50.15	29.5	49.56	50.15
Sick	97.48	93.88	97.51	97.38
Sonar	99.04	88.94	99.04	99.04
Splice	95.36	52.04	96.21	95.67
Vehicle	66.67	69.62	73.52	73.52
Vote	90.11	90.57	94.25	94.25
Waveform-5000	64.04	63.92	64.02	64.02

(a) Perform Friedman Test by hand.

(b) Perform Friedman Test using R.

(c) If needed, perform Nemenyi post-hoc test by hand. (You don't have to do Nemenyi post-hoc test, if not needed from Friedman Test.)

(d) If needed, perform Nemenyi post-hoc test using R. Draw Friedman test graph using R. (Again, you don't have to do Nemenyi post-hoc test, if not needed from Friedman Test.)

You have to explain (1) what is the null hypothesis, (2) whether it is rejected or not, (3) and how do you know that it is rejected.

3. Run the Friedman test for the following result. ($\alpha = 0.05$) Draw Box and whisker plot to show the critical difference(CD).

Experiment #	A	B	C	D	E
1	19.119	17.200	22.692	18.927	17.199
2	17.773	16.389	23.267	17.695	16.381
3	19.780	17.715	24.193	18.776	17.715
4	16.841	16.367	23.162	16.824	16.367
5	18.782	16.820	23.210	18.779	16.796
Average	18.459±1.037	16.898±0.511	23.3045±0.489	18.200±0.818	**16.892±0.513**