Homework Assignment 1

HWA2_1. Recall that the CTT model is $X = T + E$. Assuming that the CTT assumptions are all true, answer the following questions based on the model.

HWA2_1_1. If $X = 12$ and $E = -3$, $T =$ __.

1) 15
2) 13
3) 11
4) 10
5) 9

HWA2_1_2. If $Var(T) = 15$, $Var(X) = 20$, $Var(E) =$ __.

1) 35
2) 20
3) 15
4) 10
5) 5

HWA2_1_3. If $Var(E) = 8$, $Var(X) = 20$, $\rho^2_{XT} =$ __.

1) .4
2) .5
3) .6
4) .7
5) .8

HWA2_1_4. Suppose X and X' are scores on two parallel tests. If $\rho_{XX'} = 0.8$, and $Var(X) = 20$, $Var(T) =$ __. $Var(E) =$ __, and $SEM =$ __.

1) 20
2) 16
3) 8
4) 4
5) 2

Write your answer as a six-digit number.

HWA2_2. Suppose that a single test was administered to a group of 6 examinees, A, B, C, D, E, and F, for 5 times. The following table includes their test scores across the 5

administrations. In addition, each number in the column "Mean" indicates the average across the 5 administrations for the examinee. Each number in the row "Variance" indicates the variance of test scores for each administration.

	Administration					
Examinee	1	2	3	4	5	Mean
A	21	18	20	19	22	20
B	15	18	14	14	14	15
C	20	23	20	23	24	22
D	9	11	12	9	9	10
E	17	18	19	21	15	18
F	23	24	26	28	24	25
Variance	25.5	21.5	24.7	45.2	38.8	

HWA2_2_1. It is known that the average of repeated observed scores for a particular examinee is a good estimate of this examinee's true score (i.e., CTT Assumption #2). Based on this idea and the above table, the estimated true score for A is __, and the estimated true score for E is __.

1) 18
2) 19
3) 20
4) 21.
5) 22

HWA2_2_2. Using the mean of scores on repeated administrations as the estimate of the true score for each examinee, $Var(T)$ = __.

1) 25.5
2) 21.3
3) 28.3
4) 24.7
5) 38.8

HWA2_2_3. There are five $Var(X)$ corresponding to the five test administrations. A reasonable way to obtain the estimate of $Var(X)$ is to take the average of these five Var(x)s. Therefore, the estimated $Var(X)$ is __.

1) 28.3
2) 25.5
3) 24.7
4) 31.1

HWA2_2_4. One definition of reliability is $r_{XX'} = Var(T)/Var(X)$: Based on this definition, and the information we obtained from the above questions, the estimated reliability of the test is ._1.

1) 6
2) 7
3) 8
4) 9

Write your answer as a five-digit number.

HWA2_3. Following HWA2_2, another way to obtain the reliability of the test is simply using the test-retest technique, although we have more than two test administrations. Since we have 5 administrations, there will be 10 correlations, as follows.

	Ad1	Ad2	Ad3	Ad4	Ad5
Ad1	1.00	.90	.93	.92	.95
Ad2		1.00	.85	.92	.89
Ad3			1.00	.97	.87
Ad4				1.00	.87
Ad5					1.00

HWA2_3_1. The correlation between the test scores of Ad1 and Ad4 is __.

1) .85
2) .92
3) .95
4) .97

HWA2_3_2. Although each of the correlations in the table could be an estimate of the reliability of the test, it is more robust to take the average of the 10 correlations as the estimate of the reliability. Following this rule, the estimated reliability is ._07.

1) 9
2) 8
3) 7
4) 6
5) 5

Write your answer as a two-digit number.

HWA2_4. The following are the test scores of 10 examinees on a test of six items.

	Item					
Examinee	1	2	3	4	5	6
1	0	0	0	0	0	0
2	0	0	0	0	1	0
3	1	0	1	1	1	0
4	1	1	1	1	1	1
5	1	1	1	1	1	1
6	0	0	1	0	0	0
7	0	0	1	1	1	0
8	0	0	0	1	0	0
9	1	0	1	1	1	0
10	0	1	0	1	0	1

A researcher was interested in finding the internal consistency as an estimate of the reliability of the test. He additionally calculated the correlations between the items, as shown in the following table.

	I1	I2	I3	I4	I5	I6
I1	1.00	.36	.67	.53	.67	.36
I2		1.00	.09	.43	.09	1.00
I3			1.00	.36	.58	.09
I4				1.00	.36	.43
I5					1.00	.09
I6						1.00

These correlations are called item-level reliability estimates because each item is treated as a subset.

HWA2_4_1. Although each of the correlations can be seen as an estimate of the item-level reliability, we prefer taking the average across all of them as the estimate of the item-level reliability. Therefore, the estimated item-level reliability is ._07.

1) 6
2) 5
3) 4
4) 3
5) 2

HWA2_4_2. If we use the answer of HWA2_4_1 as an estimate of the reliability of the whole test, it would be an __ for the true reliability of the test because __.

1) underestimate
2) overestimate
3) the subtests used in HWA2_4_1 are shorter the original test
4) the subtests used in HWA2_4_1 are not reliable

HWA2_4_3. If the researcher would like to calculate the Cronbach's alpha for the test, then based on the Spearman Brown formula, each subset consists of __ item and the *n* in the Spearman Brown formula is __.

1) 1
2) 3
3) 5
4) 6
5) 7

HWA2_4_4. The estimated reliability of the whole six-item test is ._05.

1) 6
2) 7
3) 8
4) 9

Write your answer as a six-digit number.