

Coefficient α (Part I)

```
library(psych)
library(modelsummary) # for summarizing data
```

[illegible]

```

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```

In the first part, we will first simulate some data with the true scores being known, and compute the reliability. We will then “brainwash” ourselves regarding any knowledge of the true scores, and estimate the α reliability.

```

# Simulate true scores
set.seed(2033)
num_persons <- 100
num_items <- 3
true_score <- round(
  rnorm(num_persons, mean = 3.5, sd = 1),
  digits = 2)
# Simulate observed scores
item1 <- round(
  true_score + runif(num_persons, min = -1, max = 1)
)
item2 <- round(
  true_score + runif(num_persons, min = -1.5, max = 1.5)
)
item3 <- round(
  true_score + runif(num_persons, min = -2, max = 2)
)
item_data <- data.frame(true_score, item1, item2, item3)
item_data

```

	true_score	item1	item2	item3
1	2.58	3	4	2
2	3.20	4	3	3

3	1.82	3	1	0
4	3.03	4	4	3
5	3.52	3	4	6
6	4.16	4	4	6
7	3.71	3	4	2
8	2.49	2	3	1
9	2.64	3	2	1
10	1.81	2	1	0
11	3.18	2	3	2
12	4.14	3	5	4
13	3.40	2	2	3
14	2.97	2	4	2
15	4.00	3	5	5
16	4.92	5	4	5
17	3.23	3	2	4
18	4.06	5	3	2
19	4.76	4	6	5
20	2.76	3	3	1
21	2.91	4	2	2
22	3.68	4	5	2
23	3.72	4	4	3
24	2.60	2	1	3
25	4.33	5	4	5
26	2.54	3	2	4
27	3.50	4	2	4
28	4.08	4	3	3
29	3.71	4	4	3
30	4.43	5	5	6
31	3.34	3	5	2
32	3.95	5	3	3
33	5.27	5	5	4
34	2.97	3	4	2
35	2.11	2	1	1
36	3.47	3	4	2
37	2.54	2	2	4
38	2.00	2	3	1
39	3.54	4	5	2
40	3.83	4	3	3
41	3.47	3	4	2
42	4.14	5	5	3
43	2.01	2	2	4
44	5.22	6	6	6
45	2.96	4	4	2

46	1.54	1	1	3
47	4.26	5	5	3
48	2.53	3	3	3
49	3.71	4	5	6
50	3.29	4	5	5
51	4.25	5	4	4
52	4.29	4	4	5
53	2.63	3	3	5
54	4.85	5	6	5
55	3.23	3	3	3
56	2.74	2	2	4
57	2.75	2	3	1
58	3.46	3	3	3
59	2.98	3	4	4
60	4.50	5	4	5
61	4.69	6	4	3
62	4.99	4	6	4
63	3.94	5	3	5
64	3.29	4	3	2
65	3.87	4	5	3
66	4.72	5	3	5
67	4.17	4	3	5
68	5.01	6	4	4
69	3.18	3	4	3
70	3.34	4	3	2
71	4.93	5	5	4
72	2.40	3	2	2
73	1.89	2	2	2
74	3.07	3	3	3
75	5.11	6	6	5
76	4.50	4	5	6
77	3.03	4	2	5
78	3.67	4	3	2
79	2.65	3	1	2
80	4.48	5	6	4
81	1.64	1	0	2
82	2.96	3	2	3
83	2.56	2	3	3
84	4.30	5	6	4
85	4.33	5	4	4
86	3.25	2	3	5
87	3.07	4	3	1
88	3.12	3	2	3

89	2.85	4	2	2
90	3.64	3	5	3
91	3.90	3	3	2
92	3.10	3	4	2
93	1.68	1	1	3
94	3.43	3	5	2
95	2.33	2	3	2
96	1.52	1	3	1
97	4.16	5	5	6
98	2.66	3	2	3
99	2.98	3	4	5
100	3.88	3	4	3

```
datasummary(item1 + item2 + item3 ~ Mean + Var + Histogram,
            data = item_data)
```

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```

	Mean	Var	Histogram
item1	3.50	1.42	
item2	3.47	1.89	
item3	3.22	2.15	

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```

Q1: The three items share the same true scores. Are the items parallel, tau-equivalent, essentially tau-equivalent, or congeneric? Why?

Answer:

Next, we consider the composite of the three items by summing the scores for each person.

```
sum_scores <- rowSums(item_data[c("item1", "item2", "item3")])
```

Each item has a true score. The true score for the item sum is the sum of the item true scores.

```
# Same true score for each item  
true_score_sum <- true_score + true_score + true_score
```

Q2: What is the variance of the sum scores?

```
# Your R code
```

Answer:

Q3: What is the variance of the true scores for the item sums?

```
# Your R code
```

Answer:

Q4: From Q2 and Q3, what is the reliability of the sum scores?

Answer:

Q5: What is the reliability estimates (and the corresponding confidence intervals) of the sum scores, using the `psych::alpha()` function?

```
# Your code
```

Answer: