

Psych 892  
Homework #1 Solutions

Consider the following set of items:

*“How true is this of you ?”*

1. I make friends easily.
2. I am always on the go.
3. I tend to cry easily.
4. I am easily frightened.
5. I like to be off and running as soon as I wake up in the morning.
6. I tend to be shy.
7. I like to keep busy all of the time.
8. I tend to be somewhat emotional.
9. I like to be with others.
10. I like to be independent of people.
11. I get upset easily.
12. I am very energetic and always like to take risky activities.
13. Compared to other students at the University of Illinois, I tend to be easily irritated.
14. I usually prefer to do things alone.
15. I prefer quiet, inactive pastimes to more active ones.

Five of the above items measure Activity Level, five measure Sociability, and five measure Emotionality.

**Section 1 (Chapter 2)**

1. Inspect the items and try to identify which items measure each attribute.

\* indicates reverse scored items

Activity Level – 2, 5, 7, 12, 15\*

Sociability – 1, 6\*, 9, 10\*, 14\*

Emotionality – 3, 4, 8, 11, 13

2. Consider the seven general guidelines for item writing (p.26 text). Make a general statement about how well these items conform to those guidelines. Are there specific items that seem to be violate any of the guidelines? If so, which ones, and how would you improve them?

The general guidelines are that item stems should be short, unambiguous, definite (not general), simple (one proposition), avoid negatives, use simple vocabulary, use conventional vocabulary.

Most of these items follow these. Several points of note are the use of words of subjectivity, such as “easily.” These can lead to inaccurate measurement of the trait because of the interpretation changing from subject to subject.

3. Four of the items need to be “reversed” scored before subscale scores can be formed. What are they?

The four reversed scored items are 15, 6, 10, and 14.

4. What is/are the advantage to including reverse-score items in a scale?

One advantage is to try and prevent subjects from responding in a stereotyped manner (such as always choosing one item response for all items).

5. The response options for the 15 items are:

1 ----- 2 ----- 3 ----- 4 ----- 5  
Hardly at all Always true

- a) What type of items are these?

These are Likert items.

- b) Give one advantage or disadvantage of using an odd number of response options for these items.

One advantage is there is a middle score that can indicate neutrality.

- c) Give one advantage or disadvantage of using a greater number (>5) of response options for these items.

One advantage of using a larger number of options is in increasing the maximum possible variance.

- d) Give one advantage or disadvantage of using dichotomous response options for these items.

On disadvantage of dichotomous response items is limiting of the total variance of the item.

- e) Comment on the response option category labels. How can they be improved?

More precise labels can be used – each option can be labeled.

## **Section 2 (Chapter 3)**

*Unless specified, use n as divisor for the variance and covariance computation.*

The following are six respondents to each of the five items from the Emotionality subscale:

Respondent	Item				
	1	2	3	4	5
1	5	2	5	5	3
2	4	3	3	3	2
3	3	3	4	2	3
4	2	2	2	2	2
5	1	5	5	5	1
6	1	1	1	3	4

6. Compute each respondent's subscale total and mean.

The subscale total and mean for each respondent is listed below:

Respondent	Total	Mean
1	20	4
2	15	3
3	15	3
4	10	2
5	17	3.4
6	10	2

7. Refer back to the response option category labels and each respondent's mean item score for the subscale. Interpret or comment on each respondent's response pattern (e.g. Is the respondent emotionally stable? Is the response pattern consistent? )

In general, more of the subtotal score indicates more instability (see wording of items)

#1 – Response pattern inconsistent

#2 – Response pattern consistent

#3 – Response pattern consistent

#4 – Response pattern consistent

#5 – Response pattern inconsistent

#6 – Response pattern inconsistent

8. Find the relative frequencies associated with the response options (1-5) for each item.

The relative frequencies for each item are listed below:

	Item 1	Item 2	Item 3	Item 4	Item 5
1	2	1	1	0	1
2	1	2	1	2	2
3	1	2	1	2	2
4	1	0	1	0	1
5	1	1	2	2	0

9. Compute sample item totals, means, variances and covariances.

The sample item totals, means, variances, and covariances are listed below:

	Item 1	Item 2	Item 3	Item 4	Item 5
total:	16	16	20	20	15
mean	2.667	2.667	3.333	3.333	2.500
variances:	2.222	1.556	2.222	1.556	0.917

Covariances:

	Item 1	Item 2	Item 3	Item 4
Item 2	-0.278			
Item 3	0.944	1.278		
Item 4	0.278	0.611	1.222	
Item 5	0.167	-1.000	-0.667	-0.333

10. Using results from (9), find sample mean and variance for the Emotionality subscale score.

The mean of the total test score is the sum of the item means, or 14.5.

The variance of the total test score is the sum of the variances plus two times the sum of the covariances, or 12.92

11. Now the responses are dichotomized. All responses smaller than four are coded as zero while others are coded as 1.

- a. The response table of dichotomous items is:

Respondent	Item 1	Item 2	Item 3	Item 4	Item 5
1	1	0	1	1	0
2	1	0	0	0	0
3	0	0	1	0	0
4	0	0	0	0	0
5	0	1	1	1	0
6	0	0	0	0	1

b. Item difficulty estimates for each item are listed below. There is a tie for most difficult item, with 2 and 5 having difficulty of 0.167.

Item 1	Item 2	Item 3	Item 4	Item 5
0.333	0.167	0.500	0.333	0.167

c. The variance and covariance for items 1 and 2 can be found below:

		Item 1		
		0	1	
Item 2	0	0.5	0.333333	0.833333
	1	0.166667	0	0.166667
		0.666667	0.333333	1

$$\text{Variance 1} = p_1(1-p_1) = 0.222$$

$$\text{Variance 2} = p_2(1-p_2) = 0.139$$

$$p_1 = 0.333$$

$$p_2 = 0.167$$

$$p_1p_2 = 0.333 \times 0.167 = 0.056$$

$$\text{Cov}(1,2) = p_{12} - p_1p_2 = 0 - 0.056 = -0.056$$

### **Section 3 (Chapter 4)**

12. What score in the above set of items (5 Emotionality subscale items) is equivalent to the scale (a) floor and (b) ceiling?

The score equivalent to the ceiling would be 25, the score equivalent to the floor is 5.

13. Would you say this survey uses an ordinal or an interval scale of measurement? Explain.

This survey is most likely on the ordinal scale. There is no true fixed zero to the score because the score reflects arbitrary numbers attached to the items. There is no guarantee that the difference between, say, 20 and 22 is the same as the difference between 1 and 3.

14. Would it be appropriate to say that someone with an Emotionality subscale score of 20 has twice the amount of the trait as someone who has a subscale score of 10. Why or why not?

Because the numbers reflect ordinal levels of measurement, it would not be appropriate to say a person with a subscale score of 20 has twice the amount of that trait that someone with a subscale score of 10 has. It can be only stated that the person with a 20 (probably) has more of the trait than the person with 10, but precisely how much is unknown.