Correlation Practice Questions

Example 1

A psychology student makes some casual observations and suspects that people marry individuals with similar levels of intelligence. His research supervisor gives him a data set of intelligence scores from 10 individuals and their spouses. Determine if the there is a positive relationship between the IQ scores of spouses at an alpha level of .05.
IQ scores for spouses

Pair Number	Female	Male
1	127	140
2	92	83
3	110	102
4	136	122
5	83	88
6	98	115
7	106	95
8	123	113
9	109	117
10	118	123

Solution 1

Step 1: Ho: $\rho \leq 0$

Ha: $\rho > 0$

Step 2: $r = \frac{SS_{XY}}{\sqrt{(SS_{XX})(SS_{YY})}}$

Step 3: To find the rejection region for r, use the table for the Pearson Product Moment Coefficient with n-2 degrees of freedom (n is the number of pairs of scores). This will be a one-tailed test because the researcher expects a positive relation for the intelligence test scores of spouses. Therefore, reject Ho if the obtained value of r is greater than or equal to .5494

Step 4: A. Make a table of squared values and cross products:

Pair	Female X	Male Y	Female^2 X^2	Male^2 Y^2	Female X Male XY
1	127	140	16129	19600	17780
2	92	83	8464	6889	7636
3	110	102	12100	10404	11220
4	136	122	18496	14884	16592
5	83	88	6889	7744	7304
6	98	115	9604	13225	11270
7	106	95	11236	9025	10070
8	123	113	15129	12769	13899
9	109	117	11881	13689	12753
10	118	123	13924	15129	14514
Σ	1102	1098	123852	123358	123038

$$SS_{XY} = \sum XY - \frac{(\sum X)(\sum Y)}{n}$$

$$SS_{XY} = 123\,038 - \frac{(1102)(1098)}{10} = 2038.4$$

$$SS_{YY} = \sum Y^2 - \frac{(\sum Y)^2}{n}$$

$$SS_{YY} = 123\,358 - \frac{1098^2}{10} = 2797.6$$

$$SS_{XX} = \sum X^2 - \frac{(\sum X)^2}{n}$$

$$SS_{XX} = 123\,852 - \frac{(1102)^2}{10} = 2411.6$$

C. Solve for r: $r = \frac{SS_{XY}}{\sqrt{(SS_{XX})(SS_{YY})}}$ $r = \frac{20384}{\sqrt{(24116)(2797.6)}} = .785$

Step 5: The obtained value of r exceeds the critical value. Reject Ho and accept Ha. Conclude that IQ scores are significantly correlated for spouses.

Example 2:

Verbal ability consists of at least two components: Verbal comprehension (e.g. reading ability) and verbal fluency (e.g. writing ability). A researcher measures these two components in a sample of 8 seventh-grade children and obtains the following scores.

Comprehension	Fluency
57	40
74	46
42	38
48	36
75	54
62	42
76	50
69	25

Is there a significant correlation between the two variables (α .05)?

Solution 2

Step 1: Ho: $\rho = 0$
Ha: $\rho \pm 0$

Step 2: Correlation $r = \frac{SS_{XY}}{\sqrt{(SS_{XX})(SS_{YY})}}$

Step 3: $\alpha = .05$, but because it's two tailed
$\alpha = .025$, $df = n - 2 = 6$
r critical = .70673

Step 4: $\sum x = 503$, $(\sum x)^2 = 253\ 0089$
$\sum y = 331$ $(\sum y)^2 = 109\ 561$
$\sum x^2 = 32\ 799$ $\sum y^2 = 14\ 261$

$$SS_{XX} = \sum X^2 - \frac{(\sum X)^2}{n}$$

$$SS_{XX} = 327 - \frac{(503)^2}{8} = 1172.875$$

$$SS_{YY} = \sum Y^2 - \frac{(\sum Y)^2}{n}$$

$$SS_{YY} = 14\ 261 - \frac{(331)^2}{8} = 565.875$$

$$SS_{XY} = \sum XY - \frac{(\sum X)(\sum Y)}{n}$$

$$SS_{XY} = 21\ 187 - \frac{(503)(331)}{8} =$$

$$r = \frac{SS_{XY}}{\sqrt{(SS_{XX})(SS_{YY})}} = r = \frac{375.375}{\sqrt{(1172.875)(565.875)}} = .46076$$

Step 5: Decision
Obtained r < critical r
Therefore we conclude that there is insufficient evidence that verbal comprehension measure and verbal fluency measure significantly correlate

Example 3

A clinical psychologist conducts some research to determine if an individual's self-perception matches his or her spouse's opinion of him or her. Based on observations made during marital counseling sessions, the psychologist believes that people with positive self-concepts tend to select spouses who think highly of them. However, he is not sure if the flip-side of the situation might also occur (i.e., people with negative self-concepts select spouses who think poorly of them). Married couples are assessed for self-concept and perceptions of their spouses. Self-concept is assessed on a 20-point scale ranging from 0 for a very low self-concept to 20 for a very high self-concept. The measure of perceptions of one's spouse also ranges from 0 to 20 points. Test the relationship between self-concept and spousal perception at an alpha level of .05.

Self-Concept	Perception by Spouse		Self-Concept	Perception by Spouse
15	18		15	17
8	4		17	13
6	10		11	8
18	17		13	14
14	18		16	16
19	14		17	16
7	9		19	12
13	10		10	15
12	18		6	12
15	8		8	10

Solution 3

Step 1: Ho: $\rho = 0$
Ha: $\rho \neq 0$

Step 2: $r = \frac{SS_{XY}}{\sqrt{(SS_{XX})(SS_{YY})}}$

Step 3: To find the rejection region for r, df = 20-2 = 18, $\alpha = .025$
r critical = .44373

Step 4:

SS self concept: 348.95, SSperception = 306.95, SSxy = 164.950

$r = \frac{SS_{XY}}{\sqrt{(SS_{XX})(SS_{YY})}}$ $r = \frac{164.950}{\sqrt{(348.95)(306.95)}} = .504$

Step 5:
Decision, reject Ho since r-obtained of .504 is greater than r-critical of .44373. The effect size is 0.254.