# Determine whether memory recall is affected by age

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A memory test was conducted to a group of 10 individuals.

Specific Problem: Is there a significant relationship regarding age and memory recall?

Hypothesis:
- $H_0$ - There is no significant relationship regarding age and memory recall.
- $H_1$ - There is a significant relationship regarding age and memory recall.

Level of Significance: .05 or 5%

Given Data:

| Individual | Age: X | Memory Recall: Y |
|---|---|---|
| A | 50 | 83 |
| B | 54 | 82 |
| C | 51 | 80 |
| D | 46 | 80 |
| E | 49 | 78 |
| F | 53 | 77 |
| G | 43 | 76 |
| H | 47 | 76 |
| I | 46 | 72 |
| J | 41 | 71 |

# Pearson r

| Individual | Age: X | Memory Recall: Y | $X^2$ | $Y^2$ | XY |
|---|---|---|---|---|---|
| A | 50 | 83 | 2500 | 6889 | 4150 |
| B | 54 | 82 | 2916 | 6724 | 4428 |
| C | 51 | 80 | 2601 | 6400 | 4080 |
| D | 46 | 80 | 2116 | 6400 | 3680 |
| E | 49 | 78 | 2401 | 6084 | 3822 |
| F | 53 | 77 | 2809 | 5929 | 4081 |
| G | 43 | 76 | 1849 | 5776 | 3268 |
| H | 47 | 76 | 2209 | 5776 | 3572 |
| I | 46 | 72 | 2116 | 5184 | 3312 |
| J | 41 | 71 | 1681 | 5041 | 2911 |
| n=10 | $\sum_{i=1}^{n} X_i = 480$ | $\sum_{i=1}^{n} Y_i = 775$ | $\sum_{i=1}^{n} X_i^2 = 23198$ | $\sum_{i=1}^{n} Y_i^2 = 60203$ | $\sum_{i=1}^{n} XY = 37304$ |
| | $\overline{X} = 48$ | $\overline{Y} = 77.5$ | | | |

Pearson r, A.

$$r = \frac{\sum_{i=1}^{n} XY - n(\overline{X})(\overline{Y})}{\sqrt{(\sum_{i=1}^{n} X_i^2 - n(\overline{x})^2)(\sum_{i=1}^{n} Y_i - n(\overline{y})^2)}} \tag{1}$$

$$r = \frac{37304 - 10(48)(77.5)}{\sqrt{(23198 - 10(48)^2)(60203 - 10(77.5)^2)}}$$
$$r = \frac{104}{\sqrt{22199}}$$
$$r = \frac{104}{148.9932884}$$
$$r = 0.698018018$$

Pearson r, B.

$$r = \frac{n(\sum_{i=1}^{n} XY) - (\sum_{i=1}^{n} X_i)(\sum_{i=1}^{n} Y_i)}{\sqrt{(n(\sum_{i=1}^{n} X_i^2)(\sum_{i=1}^{n} X_i)^2)(n(\sum_{i=1}^{n} Y_i^2)(\sum_{i=1}^{n} Y_i)^2)}} \tag{2}$$

$$\begin{aligned} r &= \frac{10(37304) - (480)(775)}{\sqrt{(10(23198) - (480)^2)(10(60203) - (775)^2)}} \\ r &= \frac{1040}{\sqrt{2219900}} \\ r &= \frac{1040}{1489.932884} \\ r &= 0.698018018 \end{aligned}$$

The computed r is 0.0698018018 and the table value r at 0.05 level of significance is

$$df = n - 2 = 10 - 2 = 8 = 0.632$$

since the computed value of r is greater than the table value of r at 0.05 level of significance,

$$0.698018018 > 0.632$$

therefore, the null hypothesis is rejected, indicating that there is a significant relationship regarding age and memory recall in this study.

## Spearman, rho

| Individual | Age: X | Memory Recall: Y | Rank of X($R_x$) | Rank of Y($R_y$) |
|---|---|---|---|---|
| A | 50 | 83 | 4 | 1 |
| B | 54 | 82 | 1 | 2 |
| C | 51 | 80 | 3 | 3.5 |
| D | 46 | 80 | 7.5 | 3.5 |
| E | 49 | 78 | 5 | 5 |
| F | 53 | 77 | 2 | 6 |
| G | 43 | 76 | 9 | 7.5 |
| H | 47 | 76 | 6 | 7.5 |
| I | 46 | 72 | 7.5 | 9 |
| J | 41 | 71 | 10 | 10 |

$n = 10$

| Difference Bet. $R_x - R_y(D)$ | $D^2$ |
|---|---|
| 3 | 9 |
| -1 | 1 |
| -.5 | .25 |
| 4 | 16 |
| 0 | 0 |
| -4 | 16 |
| 1.5 | 2.25 |
| -1.5 | 2.25 |
| -1.5 | 2.25 |
| 0 | 0 |

$$\sum_{i=1}^{n} D^2 = 49$$

$$\rho = 1 - \frac{6(\sum_{i=1}^{n} D^2)}{n(n^2-1)} \tag{3}$$

$$\rho = 1 - \frac{6(49)}{10(10-1)}$$
$$\rho = 1 - \frac{294}{990}$$
$$\rho = 1 - 0.296969697$$
$$\rho = 0.70303030303$$

The computed rho = 0.945454545 and the table value rho with 0.05 level of significance is 0.5636, since the computed rho is greater than the table value rho,

$$0.70303030303 > .5636 \tag{4}$$

therefore we conclude that our null hypothesis is rejected which means that there is a significant relationship regarding age and memory recall.