

QQQ – Further Statistics 2 – Chapter 2 – Correlation (Version 1)

Total Marks: 23

(23 = Platinum, 21 = Gold, 18 = Silver, 16 = Bronze)

1. An estate agent in *Tornep* believes that houses further from the railway station are more expensive than those that are closer. She took a random sample of 22 three-bedroom houses in *Tornep* and calculated the product moment correlation coefficient between the house price and the distance from the station to be 0.3892

Stating your hypotheses clearly, use a 5% level of significance to test the estate agent's belief. State the critical region used in your test. **(3)**

(Total 3 marks)

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2. Abena and Meghan are both given the same list of 10 films.

Each of them ranks the 10 films from most favourite to least favourite.

For the differences, d , between their ranks for these 10 films, $\sum d^2 = 84$

(a) Calculate Spearman's rank correlation coefficient between Abena's ranks and Meghan's ranks. **(1)**

A test is carried out at the 5% level of significance to see if there is agreement between their ranks for the films.

The hypotheses for the test are

$$H_0 : \rho_S = 0 \quad H_1 : \rho_S > 0$$

(b) (i) Find the critical region for the test.

(ii) State the conclusion of the test. **(2)**

An 11th film is added to the list. Abena and Meghan both agree that this film is their least favourite.

A new test is carried out at the 5% level of significance using the same hypotheses.

(c) Determine the conclusion of this test. You should state the test statistic and the critical value used. **(4)**

(Total 7 marks)

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3. Phil measures the concentration of a radioactive element, c , and the amount of dissolved solids, a , of 8 random samples of groundwater. His results are shown in the table below.

Sample	A	B	C	D	E	F	G	H
c	625	700	650	645	720	600	825	665
a	1.28	1.30	1.00	1.20	1.55	1.15	1.40	1.45

Given that

$$S_{cc} = 34\,787.5 \quad S_{aa} = 0.217\,287\,5 \quad S_{ca} = 47.7625$$

- (a) calculate, to 3 decimal places, the product moment correlation coefficient between the concentration of the radioactive element and the amount of dissolved solids for these groundwater samples. (1)
- (b) Use your value of the product moment correlation coefficient to test whether or not there is evidence of a positive correlation between the concentration of this radioactive element and the amount of dissolved solids in groundwater. Use a 5% significance level. State your hypotheses clearly. (3)
- (c) Calculate, to 3 decimal places, Spearman's rank correlation coefficient between the concentration of the radioactive element and the amount of dissolved solids. (5)
- (d) Use your value of Spearman's rank correlation coefficient to test for evidence of a positive correlation between the concentration of the radioactive element and the amount of dissolved solids. Use a 5% significance level. State your hypotheses clearly. (3)
- (e) Using your conclusions in part (b) and part (d), comment on the possible relationship between these variables. (1)

(Total 13 marks)