FOUNDATION

4.2 Spearman's Rank Interpretation: 1-hour Pack

Total Marks

EDEXCEL 1ST0 · Calculator allowed · about 60 minutes

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 The Spearman rank correlation coefficient between age of car and price for a group is $r_s = 0.64$.

(a) Describe the correlation. Use: very strong (0.8 or more in size), strong (0.6 up to 0.8), moderate (0.4 up to 0.6), weak (under 0.4).

(b) What does the sign of r_s tell you about how the ranks of age of car and price are related?

(Total for Question 1 is 3 marks)

2 8 people have a height and a jump distance.

height: 63, 91, 90, 49, 29, 36, 75, 43
jump distance: 72, 32, 20, 90, 45, 13, 39, 25

(a) Rank each set from 1 (smallest).

(b) Work out the sum of the squared differences in ranks, sum of d^2.

(c) Use $r_s = 1 - 6 \times (\text{sum of } d^2) / (n(n^2 - 1))$ to work out the Spearman rank correlation coefficient, to 2 decimal places.

(Total for Question 2 is 5 marks)

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3 A study finds that the product moment correlation coefficient between the amount of time spent revising and the test score is r = -0.76.

(a) Describe the correlation. Use these descriptions: strong is |r| of 0.7 or more, moderate is from 0.4 up to 0.7, weak is below 0.4.

(b) A student says that a change in the amount of time spent revising causes a change in the test score. Comment on this claim.

(Total for Question 3 is 4 marks)

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4 6 people have a height and a jump distance.

height: 73, 55, 45, 13, 96, 58
jump distance: 35, 72, 36, 78, 68, 63

(a) Rank each set from 1 (smallest).

(b) Work out the sum of the squared differences in ranks, sum of d^2.

(c) Use $r_s = 1 - 6 \times (\text{sum of } d^2) / (n(n^2 - 1))$ to work out the Spearman rank correlation coefficient, to 2 decimal places.

(Total for Question 4 is 5 marks)

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5 A study finds that the product moment correlation coefficient between the number of umbrellas sold and the number of traffic accidents is r = 0.38.

(a) Describe the correlation. Use these descriptions: strong is |r| of 0.7 or more, moderate is from 0.4 up to 0.7, weak is below 0.4.

(b) A student says that a change in the number of umbrellas sold causes a change in the number of traffic accidents. Comment on this claim.

(Total for Question 5 is 4 marks)

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6 The Spearman rank correlation coefficient between price and customer rating for a group is r_s = -0.14.

(a) Describe the correlation. Use: very strong (0.8 or more in size), strong (0.6 up to 0.8), moderate (0.4 up to 0.6), weak (under 0.4).

(b) What does the sign of r_s tell you about how the ranks of price and customer rating are related?

(Total for Question 6 is 3 marks)

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7 A study finds that the product moment correlation coefficient between the number of umbrellas sold and the number of traffic accidents is r = -0.47.

(a) Describe the correlation. Use these descriptions: strong is |r| of 0.7 or more, moderate is from 0.4 up to 0.7, weak is below 0.4.

(b) A student says that a change in the number of umbrellas sold causes a change in the number of traffic accidents. Comment on this claim.

(Total for Question 7 is 4 marks)

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8 A study finds that the product moment correlation coefficient between the number of fire engines at a fire and the damage caused is r = -0.66.

(a) Describe the correlation. Use these descriptions: strong is |r| of 0.7 or more, moderate is from 0.4 up to 0.7, weak is below 0.4.

(b) A student says that a change in the number of fire engines at a fire causes a change in the damage caused. Comment on this claim.

(Total for Question 8 is 4 marks)

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9 For the number of goals scored by some teams in a season, the values are 10, 8, 10, 20, 8. Rank them from 1 (smallest). Where values are equal, give each the mean of the ranks they share.

Write down the ranks in the same order as the values.

(Total for Question 9 is 3 marks)

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10 A study finds that the product moment correlation coefficient between the number of hours of TV watched and a person's weight is r = -0.76.

(a) Describe the correlation. Use these descriptions: strong is |r| of 0.7 or more, moderate is from 0.4 up to 0.7, weak is below 0.4.

(b) A student says that a change in the number of hours of TV watched causes a change in a person's weight. Comment on this claim.

(Total for Question 10 is 4 marks)

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11 A study finds that the product moment correlation coefficient between the number of ice creams sold and the number of sunburn cases is r = -0.76.

(a) Describe the correlation. Use these descriptions: strong is |r| of 0.7 or more, moderate is from 0.4 up to 0.7, weak is below 0.4.

(b) A student says that a change in the number of ice creams sold causes a change in the number of sunburn cases. Comment on this claim.

(Total for Question 11 is 4 marks)

12 8 people have a maths mark and a physics mark.

maths mark: 62, 58, 65, 86, 34, 16, 38, 46
physics mark: 63, 79, 74, 75, 71, 22, 87, 25

(a) Rank each set from 1 (smallest).

(b) Work out the sum of the squared differences in ranks, sum of d^2.

(c) Use $r_s = 1 - 6 \times (\text{sum of } d^2) / (n(n^2 - 1))$ to work out the Spearman rank correlation coefficient, to 2 decimal places.

(Total for Question 12 is 5 marks)

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13 A study finds that the product moment correlation coefficient between the number of fire engines at a fire and the damage caused is r = 0.72.
(a) Describe the correlation. Use these descriptions: strong is |r| of 0.7 or more, moderate is from 0.4 up to 0.7, weak is below 0.4.
(b) A student says that a change in the number of fire engines at a fire causes a change in the damage caused. Comment on this claim.

(Total for Question 13 is 4 marks)

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14 A study finds that the product moment correlation coefficient between the number of lifeguards on a beach and the number of people swimming is r = 0.45.
(a) Describe the correlation. Use these descriptions: strong is |r| of 0.7 or more, moderate is from 0.4 up to 0.7, weak is below 0.4.
(b) A student says that a change in the number of lifeguards on a beach causes a change in the number of people swimming. Comment on this claim.

(Total for Question 14 is 4 marks)

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15 For the scores given by a judge to some entries, the values are 16, 6, 10, 14, 5, 15, 6. Rank them from 1 (smallest). Where values are equal, give each the mean of the ranks they share. Write down the ranks in the same order as the values.

(Total for Question 15 is 3 marks)

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Mark scheme · 4.2 Spearman's Rank Interpretation: 1-hour Pack

Question 1

positive	**B1**
strong	**B1**
as ranks of one increase the ranks of the other increase oe	**B1**

Answer: (a) strong positive; (b) as ranks of age of car increase, ranks of price increase

Question 2

ranks 5, 8, 7, 4, 1, 2, 6, 3 and 7, 4, 2, 8, 6, 1, 5, 3	**B1**
difference in ranks squared and summed	**M1**
sum of $d^2 = 88$	**A1**
1 - 6 x 88 / (8 x 63)	**M1**
-0.05 cao	**A1**

Answer: (a) 5, 8, 7, 4, 1, 2, 6, 3 and 7, 4, 2, 8, 6, 1, 5, 3; (b) 88; (c) -0.05

Question 3

negative	**B1**
strong	**B1**
correlation does not prove causation	**B1**
a third factor, such as natural ability or prior learning, may affect both	**B1**

Answer: (a) strong negative correlation; (b) correlation does not imply causation; a third factor such as natural ability or prior learning may be the cause

Question 4

ranks 5, 3, 2, 1, 6, 4 and 1, 5, 2, 6, 4, 3	**B1**
difference in ranks squared and summed	**M1**
sum of $d^2 = 50$	**A1**
1 - 6 x 50 / (6 x 35)	**M1**
-0.43 cao	**A1**

Answer: (a) 5, 3, 2, 1, 6, 4 and 1, 5, 2, 6, 4, 3; (b) 50; (c) -0.43

Question 5

positive	**B1**
weak	**B1**
correlation does not prove causation	**B1**
a third factor, such as rainy weather, may affect both	**B1**

Answer: (a) weak positive correlation; (b) correlation does not imply causation; a third factor such as rainy weather may be the cause

Question 6

negative	**B1**
weak	**B1**
as ranks of one increase the ranks of the other decrease oe	**B1**

Answer: (a) weak negative; (b) as ranks of price increase, ranks of customer rating decrease

Question 7

negative	**B1**
moderate	**B1**
correlation does not prove causation	**B1**
a third factor, such as rainy weather, may affect both	**B1**

Answer: (a) moderate negative correlation; (b) correlation does not imply causation; a third factor such as rainy weather may be the cause

Question 8

negative	**B1**
moderate	**B1**
correlation does not prove causation	**B1**
a third factor, such as the size of the fire, may affect both	**B1**

Answer: (a) moderate negative correlation; (b) correlation does not imply causation; a third factor such as the size of the fire may be the cause

Question 9

ranks the values (consistent direction)	**M1**
tied values share the mean of their ranks	**A1**
3.5, 1.5, 3.5, 5, 1.5 cao	**A1**

Answer: 3.5, 1.5, 3.5, 5, 1.5

Question 10

negative	**B1**
strong	**B1**
correlation does not prove causation	**B1**
a third factor, such as overall lifestyle, may affect both	**B1**

Answer: (a) strong negative correlation; (b) correlation does not imply causation; a third factor such as overall lifestyle may be the cause

Question 11

negative	**B1**
strong	**B1**
correlation does not prove causation	**B1**
a third factor, such as hot weather, may affect both	**B1**

Answer: (a) strong negative correlation; (b) correlation does not imply causation; a third factor such as hot weather may be the cause

Question 12

ranks 6, 5, 7, 8, 2, 1, 3, 4 and 3, 7, 5, 6, 4, 1, 8, 2	**B1**
difference in ranks squared and summed	**M1**
sum of $d^2 = 54$	**A1**
1 - 6 x 54 / (8 x 63)	**M1**
0.36 cao	**A1**

Answer: (a) 6, 5, 7, 8, 2, 1, 3, 4 and 3, 7, 5, 6, 4, 1, 8, 2; (b) 54; (c) 0.36

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Question 13

positive	**B1**
strong	**B1**
correlation does not prove causation	**B1**
a third factor, such as the size of the fire, may affect both	**B1**

Answer: (a) strong positive correlation; (b) correlation does not imply causation; a third factor such as the size of the fire may be the cause

Question 14

positive	**B1**
moderate	**B1**
correlation does not prove causation	**B1**
a third factor, such as the number of visitors, may affect both	**B1**

Answer: (a) moderate positive correlation; (b) correlation does not imply causation; a third factor such as the number of visitors may be the cause

Question 15

ranks the values (consistent direction)	**M1**
tied values share the mean of their ranks	**A1**
7, 2.5, 4, 5, 1, 6, 2.5 cao	**A1**

Answer: 7, 2.5, 4, 5, 1, 6, 2.5

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