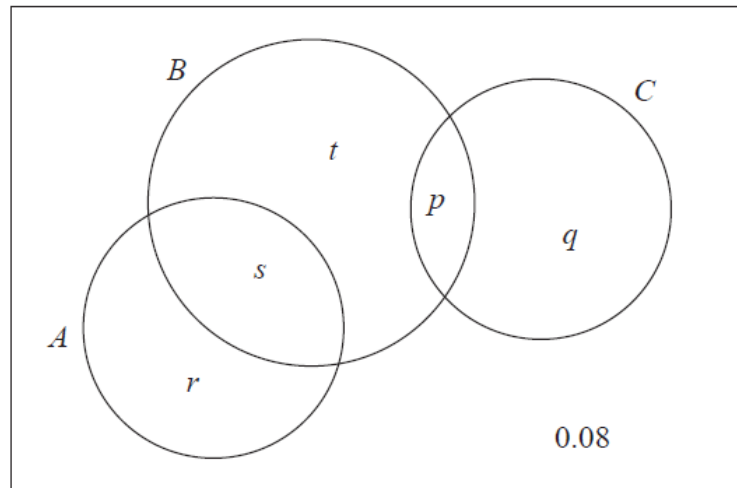


## Statistics 15 – Bivariate Data

Please **complete** this homework by \_\_\_\_\_. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop in session.

**Section 1 – Review of previous topics. Please complete all questions.**

**Q1.** The Venn diagram shows three events  $A$ ,  $B$  and  $C$ , where  $p$ ,  $q$ ,  $r$ ,  $s$  and  $t$  are probabilities.



$P(A) = 0.5$ ,  $P(B) = 0.6$  and  $P(C) = 0.25$  and the events  $B$  and  $C$  are independent.

- Find the value of  $p$  and the value of  $q$ .
- Find the value of  $r$ .
- Hence write down the value of  $s$  and the value of  $t$ .
- State, giving a reason, whether or not the events  $A$  and  $B$  are independent.

**Q2.**

If  $X \sim \text{Bin}(10, 0.6)$ , use the Binomial function on your calculator to find:

- $P(X=6)$
- $P(X \leq 2)$
- $P(1 < X \leq 3)$

Section 2 – Consolidation of this week’s topic. Please complete all questions.

**Q1.**

A biologist is comparing the intervals ( $m$  seconds) between the mating calls of a certain species of tree frog and the surrounding temperature ( $t$  °C). The following results were obtained.

$t$ °C	8	13	14	15	15	20	25	30
$m$ secs	6.5	4.5	6	5	4	3	2	1

- (a) Draw a scatter graph of this information (2)
- (b) The equation of the regression line of  $m$  on  $t$  is  $m = 8.47 - 0.256t$ . Add this to your scatter graph (2)
- (c) Use the equation of the regression line to calculate an estimate for the time interval between mating calls when the surrounding temperature is 10 °C. (1)
- (d) Comment on the reliability of this estimate, giving a reason for your answer. (1)

**Q2.**

The age,  $t$  years, and weight,  $w$  grams, of each of 10 coins were recorded and the equation of the regression line was found to be  $w = 11.6 - 0.0263t$

- (a) State, with a reason, which variable is the explanatory variable. (2)
- (b) Using this model, estimate (2)
- the weight of a coin which is 5 years old,
  - the effect of an increase of 4 years in age on the weight of a coin.

**Q3.**

A scientist is researching whether or not birds of prey exposed to pollutants lay eggs with thinner shells. He collects a random sample of egg shells from each of 6 different nests and tests for pollutant level,  $p$ , and measures the thinning of the shell,  $t$ . The results are shown in the table below.

$p$	3	8	30	25	15	12
$t$	1	3	9	10	5	6

- (a) Draw a scatter diagram to represent these data. (2)
- (b) Explain why a linear regression model may be appropriate to describe the relationship between  $p$  and  $t$ . (1)
- (c) The equation of the regression line of  $t$  on  $p$  is found to be  $t = 0.741 + 0.318p$ , draw the regression line on your scatter diagram. (2)
- The scientist reviews similar studies and finds that pollutant levels above 16 are likely to result in the death of a chick soon after hatching.
- (d) Using the equation for the regression line to calculate an estimate for the minimum thinning of the shell that is likely to result in the death of a chick. (2)

**Q4.**

The table shows the daily maximum mean windspeed,  $w$  (kn) and the daily Maximum gust,  $g$  (kn) in Camborne for the first 15 days in July 1987, from the large data set.

<b><math>w</math></b>	6	13	12	6	15	17	10	12	6	3	3	4	7	5	8
<b><math>g</math></b>	16	29	25	14	38	40	21	24	16	10	n/a	11	15	17	20

- (a) Draw a scatter graph for this data (omitting the (3, n/a) value). (2)
- (b) Describe the correlation between  $w$  and  $g$ . (1)
- (c) Comment on whether there is likely to be a causal relationship between daily mean wind speed and maximum gust. (1)
- (d) The equation of the regression line for  $g$  on  $w$  is given by  $g = 2.85 + 2.07w$ . Draw this regression line onto your scatter graph. (2)
- (e) For one day  $w = 3$  and there is no corresponding value for maximum gust. Use the equation of the regression line to find  $g$ . (1)
- (e) Why is not suitable to use the regression line to find the maximum expected gust for a daily mean windspeed of 25kn? (1)

**Total 25**