

## PMCC and Hypothesis Testing

### Starter

1. **(Review of a previous lesson)** Find the PMCC for  $\sum x_i = 367$ ,  $\sum y_i = 270$ ,  $\sum x_i^2 = 23845$ ,  $\sum y_i^2 = 12976$ ,  $\sum x_i y_i = 17135$  and  $n = 6$ .  
Comment on your findings.

$$\text{Working: } S_{xy} = \sum x_i y_i - \frac{\sum x_i \sum y_i}{n} = 17135 - \frac{367 \times 270}{6} = 620$$

$$S_{xx} = \sum x_i^2 - \frac{(\sum x_i)^2}{n} = 23845 - \frac{367^2}{6} \approx 1396.83$$

$$S_{yy} = \sum y_i^2 - \frac{(\sum y_i)^2}{n} = 12976 - \frac{270^2}{6} = 826$$

$$r = \frac{S_{xy}}{\sqrt{S_{xx} S_{yy}}} = \frac{620}{\sqrt{1396.83 \times 826}} = 0.577 \text{ (3 d.p.)}$$

There appears to be weak positive correlation between  $x$  and  $y$ .

**E.g. 1** The PMCC value for 12 sets of data points is found to be  $-0.593$ . Carry out the following hypotheses tests and comment on your findings.

- (a) A 2-tailed test at a 5% significance level.  
(b) A 1-tailed test at a 1% significance level.

- Working:**
- (a) No information is given so carry out a two-tailed test.  
 $H_0 : \rho = 0$  **the quantities are not correlated**  
 $H_1 : \rho \neq 0$  **the quantities are correlated**  
 Critical value is 0.5760 **significance level is 2.5% either side**  
 Since  $|r| = |-0.593| > 0.5760$  there is evidence to reject  $H_0$   
 i.e. there is evidence to suggest there is a correlation between the variables
- (b)  $H_0 : \rho = 0$  **the quantities are not correlated**  
 $H_1 : \rho > 0$   
 Critical value is 0.6581  
 Since  $|r| = |-0.593| < 0.6581$  there is no evidence to reject  $H_0$   
 i.e. there is evidence to suggest there is not a correlation between the variables

**E.g. 2** The ages  $A$  (years) and heights  $H$  (cm) of 11 members of a football team were recorded and following statistics were found:

$$\sum A = 168, \sum H = 1275, \sum AH = 20704, \sum A^2 = 2585, \sum H^2 = 320019.$$

- (a) Calculate the product moment correlation coefficient.  
(b) Test at the 5% level the assertion that age and height are positively correlated.

**Working:** (a)  $S_{AH} = 1231.27, S_{AA} = 19.189, S_{HH} = 172234.9, r = 0.677$

(b)  $H_0 : \rho = 0$  *the quantities are not correlated*  
 $H_1 : \rho > 0$  *the quantities are correlated*

Critical value is 0.5214

Since  $r = 0.677 > 0.5214$  there is evidence to reject  $H_0$

i.e. there is evidence to suggest there is a correlation between age and height

[Video: PMCC and hypothesis testing](#)

[Correlation EQ](#)

[Solutions to Starter and E.g.s](#)

### Exercise

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