

EMTH211 Tutorial 11 Problems

Attempt the following problems before the tutorial and show your work to your tutor.

Problem 1

Suppose that we have 50 measurements of a variable \mathbf{x} and 82 measurements of a variable \mathbf{y} . If the norm of $\|\tilde{\mathbf{x}}\|$ is 14 and the norm of $\|\tilde{\mathbf{y}}\|$ is 18, which variable has the greater variance?

Problem 2

Suppose that we have 170 measurements of a variable \mathbf{x} and 145 measurements of a variable \mathbf{y} . If $\tilde{\mathbf{x}}$ and $\tilde{\mathbf{y}}$ have the same norm of 26, which variable has greater standard deviation?

Problem 3

The number of birds observed at a feeder is observed to be smaller on cold days. Is the correlation between number of birds and temperature ($^{\circ}\text{C}$) positive, negative, or zero? Would the correlation change if we measured temperature in $^{\circ}\text{F}$?

Problem 4

If more shipwrecks happen near the shore than further away, is the correlation between distance to the shore and number of shipwrecks positive, negative or zero?

Problem 5

If $2.5\text{cm} = 1\text{inch}$, how will the standard deviation of some measurements in cm change if we rewrite them in inches? How will the variance of the measurements change?

Problem 6

A person's body mass index (BMI) is defined by

$$\text{BMI} = \frac{\text{mass in } kg}{(\text{height in } m)^2}$$

If we measure the mass and BMI of a number of people who are all $1.8m$ tall, what will be the correlation between mass and BMI?

Problem 7

If we take a group of people who all weigh $100kg$ and measure their BMI and height, will the correlation between height and BMI be positive, negative or zero?

In-tutorial problems

Problem 8

If we measure the mass in pounds instead of kg, how will the correlation change?

Problem 9

If \mathbf{x} is a vector, what is the correlation between \mathbf{x} and $-\mathbf{x}$?

Problem 10 (Matlab)

Consider the pressure and temperature measurements for a boiler in Table 1. These data consist of $n = 6$ measurements each of two variables: \mathbf{x} = temperature and \mathbf{y} = pressure.

- (i) Compute mean, variance, and standard deviation for \mathbf{x} and \mathbf{y} .
- (ii) Compute covariance and correlation of \mathbf{x} and \mathbf{y} .
- (iii) Produce a scatter plot of \mathbf{y} against \mathbf{x} , and of $\tilde{\mathbf{y}}$ against $\tilde{\mathbf{x}}$.

Temp ($^{\circ}\text{C}$)	Pressure (kPa)
0	91
10	95
20	100
30	101
40	107
50	112