

5 Data Science (djw1005)

In order to judge whether early prehistoric humans had some form of religious belief, archaeologists have proposed studying the alignment of graves in a burial site. The thinking is that if the graves all point in the same direction then the society must have had some form of supernatural belief which led them to align the graves in this way. However, we wouldn't expect perfect alignment: the skeletal remains might be at an angle to the original grave; or there might be a mix of aligned and non-aligned graves from different waves of occupants.

You have been asked by an archaeologist friend to conduct a hypothesis test of whether a collection of graves shows alignment. The dataset is a list $[x_1, \dots, x_n]$ of angles, $0 \leq x_i < 360$ where 0 denotes North, 90 denotes East, and so on.

- (a) What is meant by a “null hypothesis”? What null hypothesis do you propose? [5 marks]
- (b) What is meant by a “test statistic”? What test statistic do you propose? Explain how your test statistic deals with the fact that 359.999 and 0 are very similar angles. [7 marks]
- (c) What is meant by a “one-sided” or “two-sided” test? Which will you use? Explain your reasoning. [5 marks]
- (d) Define “ p -value”. Explain how to compute the p -value for your test. [3 marks]