

Alice, Bob, Charlie and Diane are playing together when one of them breaks a precious vase. They all know who broke the vase. When questioned they make the following statements:

Alice: It was Bob.  
Bob: It was Diane.  
Charlie: It was not me.  
Diane: What Bob says is wrong.

Each statement is either true or false.

- (i) Explain why at least one of the four must be lying.
- (ii) Explain why at least one of them must be telling the truth.
- (iii) Let us suppose that exactly one of the four is lying, so the other three are telling the truth. Who is lying? Who did break the vase? Explain your answer.
- (iv) Let us now suppose that exactly one of the four is telling the truth, so the other three are lying. Who is telling the truth? Who did break the vase? Explain your answer.
- (v) Let us now suppose that two of the statements are true and two are false. List the people who might now have broken the vase. Justify your answers.
- (vi) Hence show that if we don't know how many of the four statements are true, then any one of the four could have broken the vase.