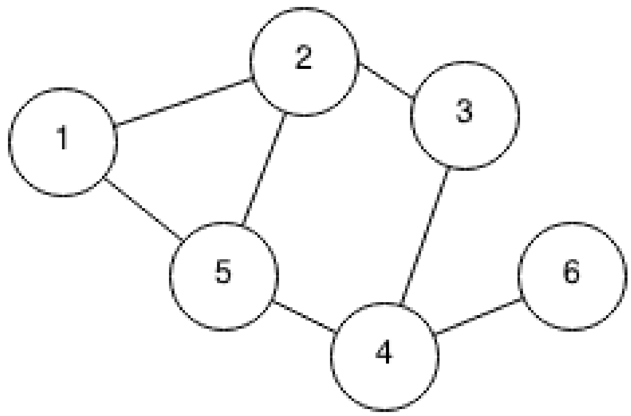
# Oxford Interview Information 2019

# General Information and Advice

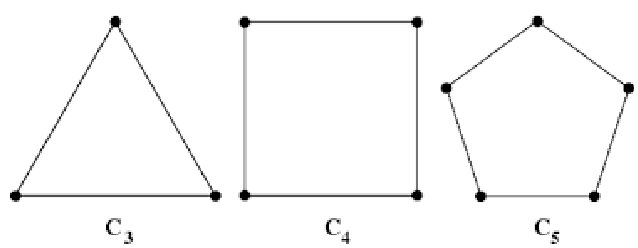
- Firstly, it is important to realise that this is only my experience. There is no guarantee that the process will be the same next year, or indeed at any other colleges.
- Both my interviews were conducted by two people, one tutor and one postgraduate student. The two people were different for each interview. The tutors did most of the talking. The postgraduate students did not talk much and just took notes.
- In my interviews, I wrote on plain paper in pen (provided in the interview). I sat on the same table as the tutor, where they could see me write.
- In my first interview the tutor wrote on the paper as he talked to help illustrate his ideas. I then did my working on the same paper, and used it to help illustrate my answers. In the second interview, the tutor did not use the paper however I was recommended to take notes as he spoke. I used it in the same way to answer.
- No questions about my personal statement were asked. It is likely that the tutor in my first interview did not read my personal statement.
- Interviews lasted approximately 20-25 minutes.
- I wore smart casual to my interviews. I did not feel out of place, most people did not wear suits. However, it would not be wrong to wear a suit if that is what makes you comfortable.
- I felt that the tutors were not so much looking for rigour in my answers. They seemed happy when I explained the key ideas, even if I didn't fully justify everything.
- If you have no clue what to do, a good idea is to do some basic cases, guess a pattern, then prove your guess. This works best when the question seeks an answer in terms of some integer variable.

# Interview 1

- What sport would you compare maths to?
- A graph is a collection of nodes and edges. Below is an example of a graph with 6 nodes and 7 edges.




- A walk on a graph is a sequence of nodes, where any two consecutive nodes are connected to each other via an edge. The length of a walk is the number of nodes in the sequence.
- A path is a walk that does not visit the same node twice.
- Prove that the shortest walk between any two nodes is a path.
- A cycle is a walk that starts and ends on the same node.
- A bipartite graph is a graph where the nodes can be separated into two non-empty groups, such that no two nodes in the same group are directly connected to each other via an edge.
- Which of the following graphs, if any, are bipartite?




- What do you think might be a condition needed for a graph to be bipartite?
- A tree is a graph with no cycles. Are all trees bipartite? It might help to draw an example.
- SPOILERS FOR PREVIOUS PART! We have shown previously that if a graph is bipartite, all cycles must be of even length. Can you prove the converse?

# Interview 2

- I'm going to explain the question. You can take notes if you wish.
- In this question, we shall talk about $n$-squares. An $n$-square is an $n$ dimensional generalization of the square. For example, the 2-square is the standard square, and the 3-square is the cube. We wish to place one vertex of our $n$-square at the origin, and another at the coordinate of all 1s, such that all the coordinates are composed of 0s and 1s only.
- How many vertices does an $n$-square have?
- An increasing 1-walk on an $n$-square is a sequence of vertices starting at the origin and finishing at the vertex of all 1s. Each step moves from one vertex to another along an edge. The walk is called increasing because the number of 1s in the coordinates of any two consecutive vertices in the walk must increase.
- How many increasing 1-walks are there on an $n$-square?
- An increasing 2-walk is like an increasing 1-walk, except two steps are now taken at the same time (and each one is increasing). Therefore any two consecutive vertices in the walk will be exactly 2 edges apart. Note that this is only valid for $n$-squares where $n$ is even - we shall take this into account by considering $2n$-squares only. To be clear, we are only concerned with the sequence of vertices in the walk. For example, there is only one increasing 2-walk on the 2-square.
- How many increasing 2-walks are there on the $2n$-square?
- Let's talk about $n$-squares and increasing 1-walks again. I have a favoured vertex on the $n$-square, which we shall call $F$. How many increasing 1-walks are there on the $n$-square that pass through $F$? Let me tell you that the number of 1s in the coordinate of $F$ is the integer $s$.
- How many increasing 1-walks are there from $(0, 0)$ to $(m, m)$, where $m$ is a positive integer? An increasing 1-walk in this context means each step must either be one unit up or one unit right.