

**ADMISSIONS EXERCISE**  
**MSc in Computer Science**  
**For entry in 2018**

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- *The questions are based on algorithm design and analysis, logic and formal reasoning, probability, and linear algebra.*
- *There is a total of five questions for you to complete. You should attempt all questions and show working.*
- *Stating the answers without showing how they were obtained will not attract credit.*

Table 1: **Statement of authenticity**

|   |       |
|---|-------|
| I certify that the work I am submitting here is entirely my own and unaided work. |       |
| Print Name  | _____ |
| Signed  | _____ |
| Date  | _____ |

Please sign and return the above statement together with the solutions. Your application will not be considered without it.

## Question 1

Briefly discuss which field of mathematics has interested you most throughout your studies. Please detail how this field can be applied to Computer Science?

## Question 2

What is  $f(x) - f(x + 2)$  if  $f(x + 1) = x(x + 2)$ ?

## Question 3

In your own words, explain what is meant by dynamic programming. Give an example of a problem for which this would be a useful approach, and describe briefly how dynamic programming would solve this problem. You should aim to write 1/2-1 page.

## Question 4

Suppose a social network contains a number of people, each of whom has one of two “opinions” (e.g. a preference for Mac versus PC). Each person is connected with a set of “friends”, some of the other people in the network. You can choose any person in the network and let them see the opinions of their friends, and if most of the friends have the same opinion, then the chosen person will change their opinion to the one shared by the majority of their friends. If there’s an equal split, you can choose their opinion. Assuming the network is connected, can we always find a sequence of people so as to ensure that they all end up with the same opinion?

## Question 5

Two ants walk on a line in a random fashion. They begin 10cm apart. At each time step, each ant has a probability of  $1/2$  to move 1cm to the left, and probability  $1/2$  to move 1cm to the right. What is the probability that after 7 time steps, the ants have met one another (i.e., passed through the same point)?