LTCC Exam – Mathematical Biology

Open the random walker code that we studied in class by going to:

https://github.com/philip-pearce/randomwalkers

1. Plot the mean-squared distance vs. time for the random walkers in the discrete code.
2. Edit the discrete code so that the random walkers are able to stay in the same place at each time step, with equal likelihood as moving right or moving left (i.e. 3 outcomes at each step, with probability 1/3 each). Plot the MSD vs. time.
3. Derive the diffusion equation in this case (see lecture notes) and compare a continuum simulation with the new diffusion coefficient to the discrete simulation.
4. Edit the discrete code so that the random walkers are more likely to move right than left (e.g. 2/3 probability of moving right, 1/3 probability of moving left). Derive the continuum equation in this case – which term explains the new dynamics?

Please send the answers in PDF format to office@ltcc.ac.uk by 19 April if you are taking 1 or 2 LTCC exams or by 23 April if you are sitting 3 or more exams.