

Probability 1, Autumn 2015, Assessed HW sheet 1

Deadline: To be handed in by 10am on Friday the 6th November.

Hand in: You should hand your work along with a completed cover sheet in to the marked cabinet on the ground floor of the School of mathematics. Please staple each sheet of your work together with the cover page at the front. Cover sheets are available on the ground floor of the School of Mathematics.

Assessment: This homework will count for 5% of your total mark for Probability 1. To obtain full marks you will need to explain clearly how you obtained your answer, using appropriate notation.

Collaboration: The work you hand in should be your own work. You are welcome to discuss the problems with each other but the solutions you hand in should be written solely by you.

Solutions will be available on Blackboard on the 14th Nov.

HW A1.1 (7 marks) Number plates issued in Bristol this Autumn are of the following format:

$W \star 65 \ast \ast \ast$

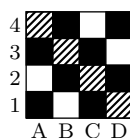
where

- \star is any one of the 12 letters M, N, O, P, R, S, T, U, V, W, X, Y, and
- $\ast \ast \ast$ is any three-letter 'word' made out of 24 letters (because I and Q cannot be used here) of the English alphabet *except* 36 three-letter words which would actually be offensive.

How many possible number plates can be issued under these rules?

HW A1.2 Four rooks are randomly placed on a 4×4 chessboard.

- (a) (4 marks) What is the probability that no rook can attack another (that is, no column and no row contains more than one of them)?
- (b) (6 marks) Now, suppose that no rook can attack another. Under this condition, what is the probability that the diagonal of the chessboard (squares A4, B3, C2, D1):



has no rooks at all? *HINT: Consider the reduced sample space that no rook can attack each other, and let A_i be the event that row i has its rook on the diagonal, $i = 1, 2, 3, 4$. Are these events disjoint?*

HW A1.3 On a fair die, the face $\square \cdot$ is opposite to the face $\square \cdot \cdot \cdot$, the face $\square \cdot$ is opposite to the face $\square \cdot \cdot$, and the face $\square \cdot \cdot$ is opposite to $\square \cdot \cdot \cdot$. We roll such a fair die on a table made of glass. Alice notices X , the number shown on the top of the die, while Bob is under the glass table, looking for Y , the number shown on the bottom of the die.

- (a) (2 marks) Determine the probability mass function of X , and the probability mass function of Y .
- (b) (3 marks) Determine the probability mass function of the sum $X + Y$.
- (c) (3 marks) Determine the probability mass function of the difference $X - Y$.