

## Math 2001: Homework W2

The following assignment will be graded with an emphasis on clarity of exposition. You should write in complete sentences, be as precise as possible, and be mathematically correct (both in content and format). Be sure to include a title, a short introduction to the topic, and to define all the relevant mathematical terms. The assignment should be **typed**, and emailed as a .pdf to me by 2pm on the day it is due.

Explain why the number of shortest walks in an  $m \times n$  grid from one corner to another is

$$\binom{s}{r}$$

where

$$s = \frac{\text{total \# of}}{\text{blocks walked}} \quad \text{and} \quad r = \frac{\text{total \# of blocks}}{\text{in ? direction}}$$

You should include

- (a) An introduction
- (b) Set up the problem
- (c) What do you mean “shortest walk?” I.e. What is  $s$  in terms of  $m$  and  $n$ ?
- (d) A precise statement of your main theorem.
- (e) To prove your theorem, you should carefully describe how to match up shortest walks with subsets, so
  - Given a shortest walk  $p$ , how does this determine some  $r$ -element subset of an  $s$ -element set  $A_p$ ?
  - Given an  $r$ -element subset  $B$  of an  $s$ -element set, how does this give a shortest walk  $q_B$ ?
  - Does this give a way to match up the two?

Examples are helpful, but do not constitute proof.

**Extra credit:** +5 points for writing in L<sup>A</sup>T<sub>E</sub>X. If you do so, you need to submit both the .pdf and the .tex file.