

Mathematics in the Real World: Math 16 / Stats 90
Prof. Jack Poulson
Midterm retake: May 4, 2015

1. Given the dataset

10.5, 11.5, 2, -10, -20, 11, 12, 27, 30,

- (a) (25 pts) Draw and label a box and whisker plot for the dataset.
- (b) (10 pts) Compute the best estimates of the dataset with respect to the two-norm and max-norm.

2. Consider a fair random walk:

- (a) (10 pts) Write down the expected change in squared distance from zero if the walk is currently at position k and takes one more step.
- (b) (10 pts) Write down the expected change in (absolute) distance from zero if the walk is currently at position $k \neq 0$ and takes one more random step, and compute the expected change from taking a step at $k = 0$.
- (c) (10 pts) Describe the behaviour (as precisely as possible) of the Variance and Mean Absolute Deviation of the random walk as the number of steps increases.

3. Consider a random walk where the first step is twice as likely to be forward as backward, but subsequent steps prefer to go in the **same** direction as the preceding step by a factor of two. For example, if the first step was forward, the odds of the next step being forward are $2/3$. But, if the first step was forward and the second step was backward, then the odds of the third step being backward are $2/3$. If the random walk is allowed to continue for **three steps**:

- (a) (5 pts) List the possible final locations.
- (b) (10 pts) Compute the likelihoods of each of these locations.
- (c) (5 pts) Compute the expected location.
- (d) (15 pts) Compute the variance, standard deviation, and Mean Absolute Deviation.