## Data Science Toolbox Question Sheet

## 11.1 Parallel Infrastructure

## Daniel Lawson

## Block 11

- 1. Show that a streaming algorithm for the standard deviation  $\hat{s}_n^2 = d_n^2/(n-1)$  where  $d_n^2 = d_{n-1}^2 + (x_n \overline{x}_n)(x_n \overline{x}_{n-1})$  follows from the definition of the standard deviation,  $\hat{s}_n^2 = \sum_{i=1}^n (x_i \overline{x}_n)^2/(n-1)$ .
- 2. In big data, people often talk about Volume, Velocity, Variety, and Veracity. Define each and explain the circumstances under which they might be a problem.
- 3. Describe the HDFS file system at a high level, being sure to give the role of the namenode and datanodes. How does it tolerate faults?
- 4. Describe the Map/Sort/Reduce framework and explain the importance of each of these steps, as well as the role of the keys in each.
- 5. Explain how parallelism in the map stage is achieved and describe any limitations.
- 6. Give two circumstances in which the reduce step is inefficient. How can each be prevented?
- 7. Explain what an **immutable** data object is, and why it is used in spark.
- 8. Explain what a transformation is, and how it can lead to efficient parallel computation in spark.