Administrivia

- HW1 out today (really).
  - Due Sunday, October 04.
  - Think! Collaborate! Discuss! (In that order.)
    - And get AWS Spark set up, soon.
- HW0 peer review assignments out today.
- A reading about the next module (Multicore) coming soon.
Last of Spark
(Except for HW1)

• More on Shuffling and Partitions
• Filtering
• Iteration & Accumulators
• Wrap up
Shuffling
Shuffle Considerations

• Shuffle writes out
  \((\text{NumWorkers} \times \text{NumDestPartitions})\) files.

  • Too many destination partitions can be worse than too few.

• Too few workers = poor parallelism
  
  • \# workers \(\geq\) \# nodes/cores

• Too many workers = increased overhead: scheduling & communication.
Example

• UserData: Large, (K, V) with K = user_id
• Events: Small (K, V) with K = user_id
• Cost of calling join()?
Let’s experiment

- Compare different partitioning strategies.
- Default vs. Hash with varying numbers of partitions.
Partition Inheritance

• Ignore what I said before, it’s more complicated than I thought.

• If using a single RDD Transformation -> same partitioning

• If a multi-RDD Transformation ->
  join() -> sum of parents,
  cartesian() -> product of parents,
  something_else() -> best to verify.
Co-partitioning

- If two RDDs have the same partitioning, they are “co-partitioned.”

- Co-partitioned does not mean Co-located, but it does avoid shuffles.

- Co-partitioned and created by the same action does mean co-located (modulo node failures, recomputes, etc.)
Accumulators

• Global-ish variables, shared between driver & workers.
  • Write-only in workers.
    • via accum.add()
  • Read/Write in driver.
What are they good for?

• What if we have unlikely events?
  • example: blank lines in a text file

• We don’t want to create and count an entire RDD for them…

• But we do want to know how many there are.
Iteration

- How do we know if an iteration has completed?
- Or if there's an exceptional case we want to deal with?
- Limitation: in Transformations, might be run more than once per RDD entry. In Actions, only once.
Large RDDs

- Want to count (conditionally) entries in an RDD.
- `filter()` and `reduce()`? - New large RDD.
- Accumulator & `rdd.foreach()`
  - `foreach()` can only operate on Accumulators
HW1 Preview

• 5 problems
  • Partitioning & Load Balancing
  • Anagram: Text processing
  • Breadth-First Search: Graphs and iteration
  • Connected Components: Graphs and iteration
  • Markov Text: Indexing, Searching
Spark Wrap-up

• Things I might write more about later, but unlikely:
  • Broadcast variables
  • Custom Partitioning
  • Caching
  • Spark Libraries: Streaming, MLLib, GraphX, Spark SQL
• What are your questions?