15-440
Distributed Systems
Recitation 11

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جامعة كارنيجي ميلون في قطر
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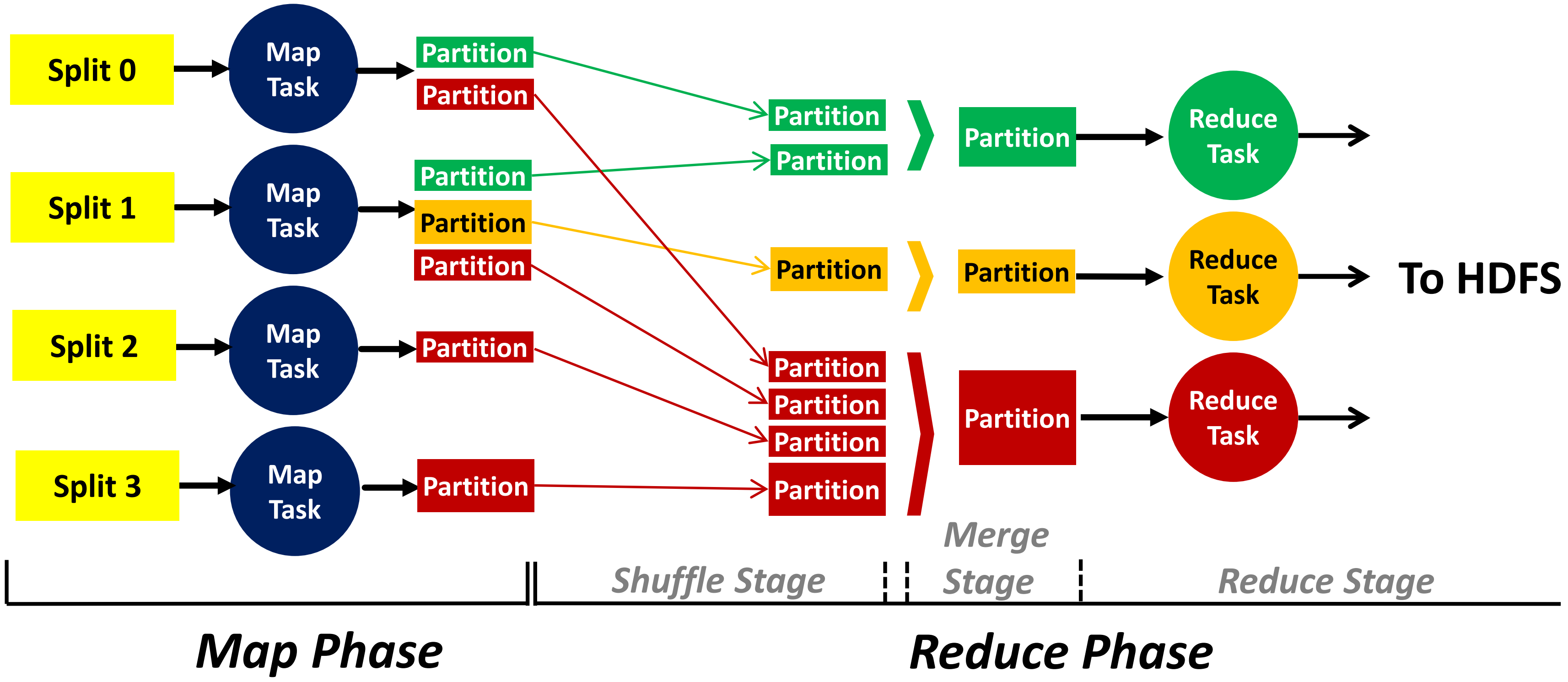
Project 4

Apply MapReduce to cluster analysis, using the **K-Means** algorithm

MapReduce: A Systems View



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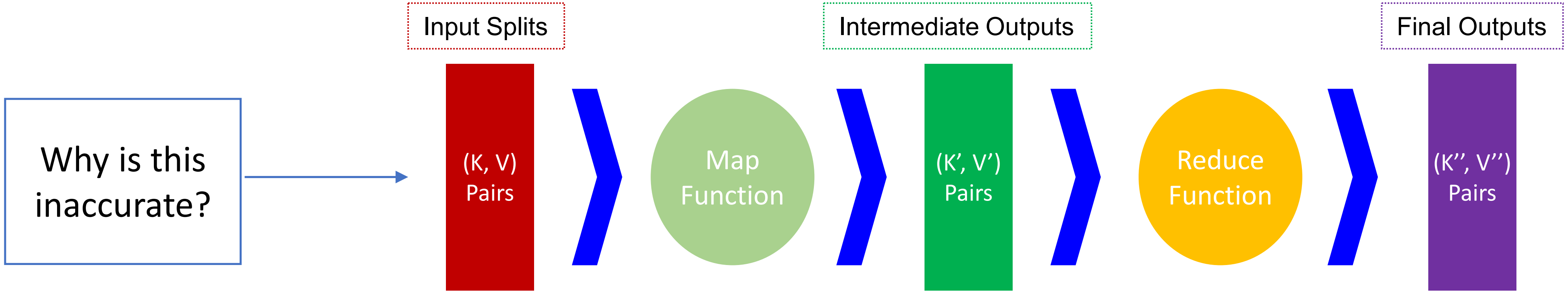
Data Structure: Keys and Values

- **In a MapReduce program, the programmer has to specify two functions: the Map function and the Reduce function that implement the *Mapper* and the *Reducer*, respectively**

- **In MapReduce, data elements are always structured as key-value (i.e., (K, V)) pairs**

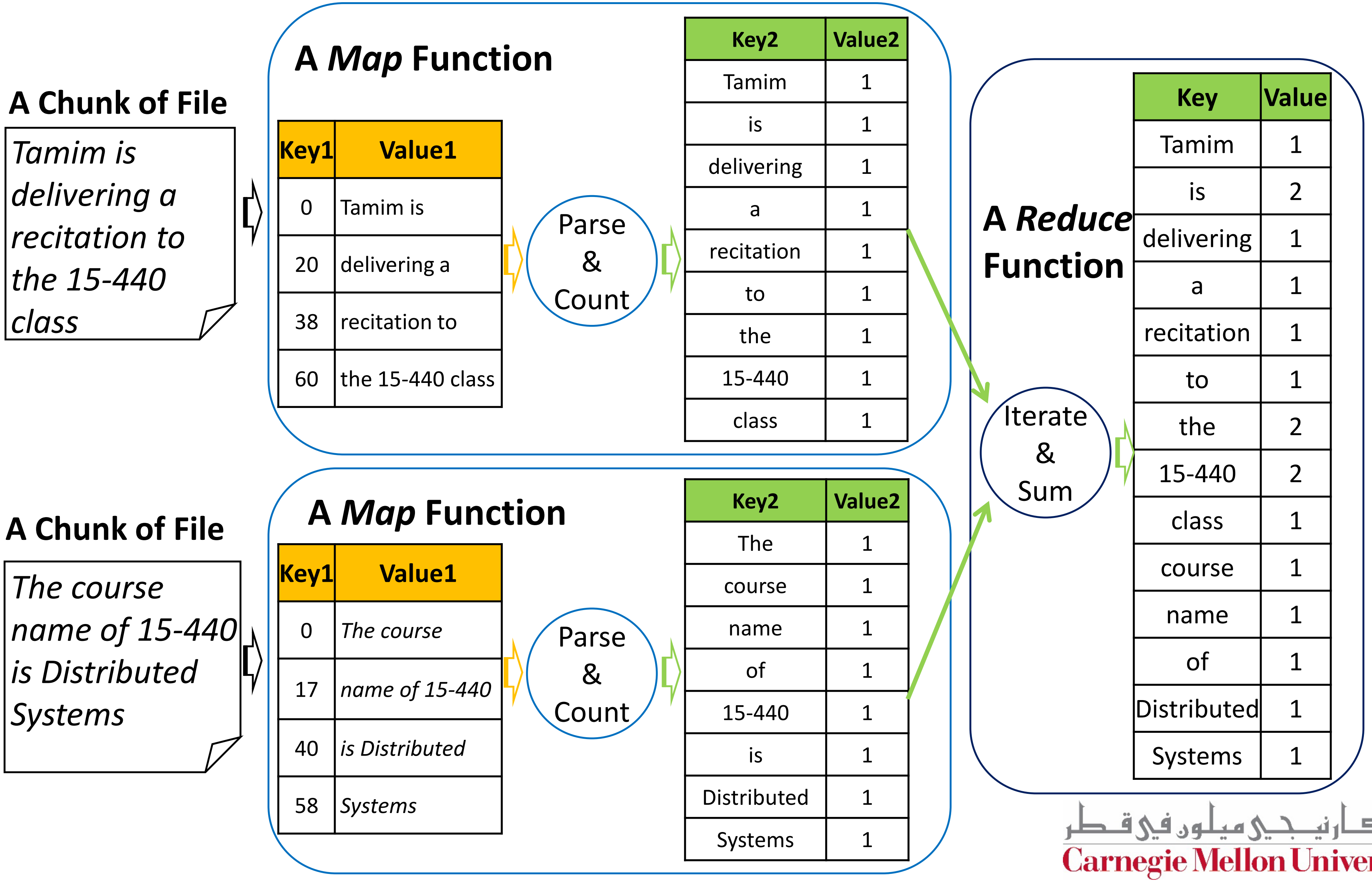
- **Therefore, the Map and Reduce functions *receive* and *emit* (K, V) pairs**



More accurately:
•**map:** (K1, V1) → list(K2, V2)
•**reduce:** (K2, list(V2)) → list(K3, V3)

MapReduce: An Application View

How are the keys and values determined?



A Chunk of File

Tamim is delivering a recitation to the 15-440 class

A *Map* Function

Key1	Value1
0	Tamim is
20	delivering a
38	recitation to
60	the 15-440 class

Key2	Value2
Tamim	1
is	1
delivering	1
a	1
recitation	1
to	1
the	1
15-440	1
class	1

A Chunk of File

The course name of 15-440 is Distributed Systems

A *Map* Function

Key1	Value1
0	*The course*
17	*name of 15-440*
40	*is Distributed*
58	*Systems*

Key2	Value2
The	1
course	1
name	1
of	1
15-440	1
is	1
Distributed	1
Systems	1

A *Reduce* Function

Key	Value
Tamim	1
is	2
delivering	1
a	1
recitation	1
to	1
the	2
15-440	2
class	1
course	1
name	1
of	1
Distributed	1
Systems	1

WordCount.java (Helpers)

- **Scanner Object:**

- A Scanner breaks its input into tokens using a delimiter pattern, which matches whitespace by default.

- hasNext(): checks if the Scanner has another token in its input.

- next(): gets the next token

- **MR Text object:**

- .set(token): sets a token to a Hadoop Text object

- **OutputCollector<Text, IntWritable> object:**

- .collect(x, y) sets a text x and Int y (k,v) paris output to the reduce function

What about Multiple Iterations?