

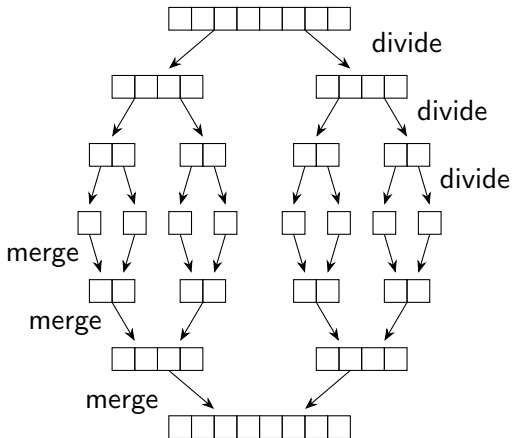
Merge in MIPS

Class 42

Mergesort

- mergesort is a very popular sorting algorithm
- it uses the divide-and-conquer algorithm design pattern, which is a very popular design technique:
 1. **partition** current problem instance into **non-overlapping** smaller problem instances
 2. **solve** smaller instances separately (often recursively)
 3. **combine** small instance solutions into larger instance solution (not always necessary, depending on problem)

Mergesort



Merge

- mergesort requires the **merge** operation
- two input arrays a and b , each already sorted, with m and n elements respectively
- one output array $result$, size $m + n$
- three indices $index_a$, $index_b$, and $index_r$, one for each array, all starting at 0

Merge 0

1	3	4	5	8	9
0	1	2	3	4	5
a					

2	6	7	8
0	1	2	3
b			

0	1	2	3	4	5	6	7	8	9
r									

Merge 1

1	3	4	5	8	9
0	1	2	3	4	5
a					

2	6	7	8
0	1	2	3
b			

1									
0	1	2	3	4	5	6	7	8	9
r									

Merge 2

1	3	4	5	8	9
0	1	2	3	4	5
	a				

2	6	7	8
0	1	2	3
	b		

1	2								
0	1	2	3	4	5	6	7	8	9
		r							

Merge 3

1	3	4	5	8	9
0	1	2	3	4	5
a					

2	6	7	8
0	1	2	3
b			

1	2	3							
0	1	2	3	4	5	6	7	8	9
			r						

Merge 4

1	3	4	5	8	9
0	1	2	3	4	5
			a		

2	6	7	8
0	1	2	3
		b	

1	2	3	4						
0	1	2	3	4	5	6	7	8	9
				r					

Merge 5

1	3	4	5	8	9
0	1	2	3	4	5
				a	

2	6	7	8
0	1	2	3
	b		

1	2	3	4	5					
0	1	2	3	4	5	6	7	8	9
				r					

Merge 6

1	3	4	5	8	9
0	1	2	3	4	5
				a	

2	6	7	8
0	1	2	3
		b	

1	2	3	4	5	6				
0	1	2	3	4	5	6	7	8	9
						r			

Merge 7

1	3	4	5	8	9
0	1	2	3	4	5
				a	

2	6	7	8
0	1	2	3
			b

1	2	3	4	5	6	7			
0	1	2	3	4	5	6	7	8	9
						r			

Merge 8

1	3	4	5	8	9
0	1	2	3	4	5

a

2	6	7	8
0	1	2	3

b

1	2	3	4	5	6	7	8		
0	1	2	3	4	5	6	7	8	9

r

Merge 9

1	3	4	5	8	9
0	1	2	3	4	5

a

2	6	7	8
0	1	2	3

b

1	2	3	4	5	6	7	8	8	
0	1	2	3	4	5	6	7	8	9

r

Merge 10

1	3	4	5	8	9
---	---	---	---	---	---

0 1 2 3 4 5

2	6	7	8
---	---	---	---

0 1 2 3

a

b

1	2	3	4	5	6	7	8	8	9
---	---	---	---	---	---	---	---	---	---

0 1 2 3 4 5 6 7 8 9

r

Merge Implementation

- a brief note on implementation
- in real implementations, there are not three arrays (a, b, and result)
- there is just one array, partitioned into two contiguous ranges
- the “result” is simply the combined range
- it's much easier to understand with three separate arrays, so that's how we will implement it