

All students should begin reading chapter 6 up to and including §6.2 in preparation **for this assignment** and the next lecture.

Distribute the following questions across the members of your group. You will share your solutions (and most importantly the *method* of your solutions) during the next lecture period. Divide up the questions so that **each** question has at least two solutions from different group members.

For questions 1 and 2, you can find the shift reduce table on the following page of this assignment. For questions 3–5, the authors shift reduce tables are in the book. The authors use squared states for **shift-X** operations, and unadorned production rule numbers for **reduce-n** operations.

Depending on where we are in lecture, we may not yet have seen shift-reduce tables where whole rows are **not** consumed with “Reduce-Y” actions. Don’t let the shift-reduce tables in this LGA throw you, they are just more specific under which conditions reductions should be performed. The reading covers this also, and we’ll discuss it in lecture; if not already, then soon.

All these questions are essentially the same, which means **understanding this process** is important for the course. You will be writing an LR compiler, so you want to become familiar with the algorithm sooner than later. I encourage students to mimic lecture slides and actually draw the subtrees that slide to and fro the stack and input deque; “in the back of your head,” while you work these problems out, many of you will be contemplating how to represent these data structures in your preferred coding language, *and that’s a good thing*.

1. Page 224, question 2a
2. Page 224, question 2b
3. Page 224, question 3a
4. Page 224, question 3b
5. Page 224, question 3c
6. Consider the following grammar along with its shift-reduce parsing table shown below.
 - (a) Show the steps taken by the LR parsing algorithm (the “knitting” algorithm) for the input:

op op op cl cl

- (b) What famous language is this? Albeit with different, perhaps obfuscated, grammar symbols?

#	Rules
1	$S \rightarrow D \$$
2	$D \rightarrow op D$
3	$D \rightarrow Z$
4	$Z \rightarrow op Z cl$
5	$Z \rightarrow \lambda$

	<i>cl</i>	<i>op</i>	\$	<i>D</i>	<i>Z</i>
0	r-5	sh-1	r-5	sh-2	sh-3
1	r-5	sh-1	r-5	sh-4	sh-5
2			sh-6		
3			r-3		
4			r-2		
5	sh-7		r-3		
6	Reduce 1				
7	r-4		r-4		

sh-X: shift input to stack, go to state X; r-Y “reduce” the top of the stack with production rule Y.

Table entries: sh- X : shift input to stack, go to state X ; r- Y “reduce” the top of the stack with production rule Y .

For question 1:

	<i>num</i>	<i>plus</i>	\$	<i>E</i>
0	sh-1	sh-2		sh-3
1	r-3	r-3	r-3	
2	sh-1	sh-2		sh-4
3			sh-5	
4	sh-1	sh-2		sh-6
5	Reduce 1			
6	r-2	r-2	r-2	

For question 2:

	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>q</i>	\$	<i>S</i>	<i>A</i>	<i>C</i>	<i>B</i>	<i>Q</i>
0	sh-1	sh-2	r-8	r-8	r-8	r-8	sh-3	sh-4		sh-5	
1		sh-2	r-8	r-8	r-8	r-8				sh-6	
2		sh-2	r-8	r-8	r-8	r-8				sh-7	
3						sh-8					
4			sh-9	r-4		r-4			sh-10		
5			r-10		sh-11	r-10					sh-12
6			sh-9	r-4		r-4			sh-13		
7			r-7	r-7	r-7	r-7					
8	Reduce 1										
9				r-3		r-3					
10						r-2					
11			r-9			r-9					
12			r-6			r-6					
13				sh-14							
14			r-5			r-5					