University of Nevada, Las Vegas Computer Science 456/656 Spring 2026

Answers to Assignment 2: Due Monday March 9, 2026

1. True, False, or Open.

   (i) **F** Every language generated by a CF grammar can be parsed with an LALR parser.

   (ii) **O** $\mathcal{P} = \mathcal{NP}$.

   (iii) **T** The *small subset sum problem* is $\mathcal{P}$–TIME. The input of an instance of the small subset sum problem is a list consisting of only positive integers that are no greater than the the length of that list.

2. Work problems 1. through 5. on pages 1 through 3 of lalrhandout2.

   The answers are given in lalrhandout2ans.

3. Using the grammar given in Example 5 on page 3 of lalrhandout2, walk trough the computation of the LALR parser given on that page for the input string $x - (x - x)$.

   Oops! That grammar doesn't involve parentheses!

   The correct grammar to use is that of Example 7. on page 5 of lalrhandout2.

   1. $E \to x_2$
   2. $E \to E -_3 E_4$
   3. $E \to (_5 E_6)_7$

   Here is the computation.

$\$_0$	$x - (x - x)\$$		
$\$_0 x_2$	$-(x - x)\$$		
$\$_0 E_1$	$-(x - x)\$$	1	$r1$
$\$_0 E_1 -_3$	$(x - x)\$$	1	$s3$
$\$_0 E_1 -_3 (_5$	$x - x)\$$	1	$s5$
$\$_0 E_1 -_3 (_5 x_2$	$-x)\$$	1	$s2$
$\$_0 E_1 -_3 (_5 E_6$	$-x)\$$	11	$r1$
$\$_0 E_1 -_3 (_5 E_6 -_3$	$x)\$$	11	$s3$
$\$_0 E_1 -_3 (_5 E_6 -_3 x_2$	$)\$$	11	$s2$
$\$_0 E_1 -_3 (_5 E_6 -_3 E_4$	$)\$$	111	$r1$
$\$_0 E_1 -_3 (_5 E_6$	$)\$$	1112	$r2$
$\$_0 E_1 -_3 (_5 E_6)_7$	$\$$	1112	$s7$
$\$_0 E_1 -_3 E_4$	$\$$	11123	$r3$
$\$_0 E_1$	$\$$	111232	$r2$

   halt

4. Give a $\mathcal{P}$–TIME reduction of 3-SAT to the independent set problem. You are not required to draw a figure, but it might help.

5. Give a $\mathcal{P}$–TIME reduction of the subset sum problem to the partition problem.

   The answers to the last two questions are given in the handouts.