Compiler Construction
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Quiz 2
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Name: _____

This exam has 2 questions, for a total of 10 points.

1. [5 points] Using the grammar that you used for assignment 2, draw the parse tree and the abstract syntax tree for the following Python program.

```
print - 1 + input()
```

Solution: Here's the parse tree in outline form.

```
module
|-stmt_list
  |-stmt
  | |-"print"
  | |-expr
  |   |-expr
  |   | |-"-"
  |   | |-expr
  |   |   |-INT
  |   |-"+"
  |   |-expr
  |     |-INPUT
  |     |-"("
  |     |-")"
  |-stmt_list
    |-empty
```

Here's the AST

```
Module(None, Stmt([Printnl([Add((UnarySub(Const(1)),
                                 CallFunc(Name('input'), [],
                                          None, None)))], None)]))
```

2. [5 points] Write down or draw the LALR(1) parse table (state transition diagram) for the following grammar. Resolve shift-reduce errors in favor of shifting. In each state, list the items (grammar rules with dots) for that state and the actions (shift, goto, and reduce).

```
(1) start ::= match
(2) match ::= "a" "b"
(3) match ::= "a" match "b"
```

Solution:

```
state 0
    start ::= . match
    match ::= . "a" "b"
    match ::= . "a" match "b"

    on "a" shift to state 1
    on match goto state 2

state 1
    match ::= "a" . "b"
    match ::= "a" . match "b"
    match ::= . "a" "b"
    match ::= . "a" match "b"

    on "a" shift to state 1
    on "b" shift to state 3
    on match goto state 4

state 2, accept
    start ::= match .

state 3
    match ::= "a" "b" .

    on end,"a", or "b" reduce by rule 2

state 4
    match ::= "a" match . "b"

    on "b" shift to state 5

state 5
    match ::= "a" match "b" .

    on end,"a", or "b" reduce by rule 3
```