Quiz 2

EECS665 - Compiler Construction
2019, Fall

Name: _____   Student ID: _____

Do Not Open Until Instructed!

Before the Quiz starts:

- Read all of the instructions on this page
- Write your name and student ID on this page
- Retrieve your page of notes and writing materials
- Put all other materials away and silence your devices

After the Quiz starts:

- Write your student ID (**not** your name) on all subsequent pages
- If you feel a question is wrong or impossible, notify course staff.
- Announcements / corrections will appear on the projector
- Turn in all your related paper when finished, including:
  - your notes page
  - the provided quiz itself
  - provided reference pages
  - provided scratch paper
- You may leave when done (no new material will be presented).
- Work quickly, move on if you are stuck.

Feel free to draw **something spooky** for October in the box below to pass the time

Total Questions: 5
Time Limit: 35 minutes
Total Pages:

- 6 pages total

Score: _____ / 50 pts

QUESTION 1 (10 POINTS)

Consider the following grammar:
X ::= X a Y
X ::= b
Y ::= ε
Y ::= Y Z
Z ::= c
Z ::= ε
Complete the following:

FIRST(X) _____

FIRST(Y) _____

FIRST(Z) _____

FIRST(X a Y) _____

FIRST(Y Z) _____

QUESTION 2 (10 POINTS)

Consider the following grammar fragment:

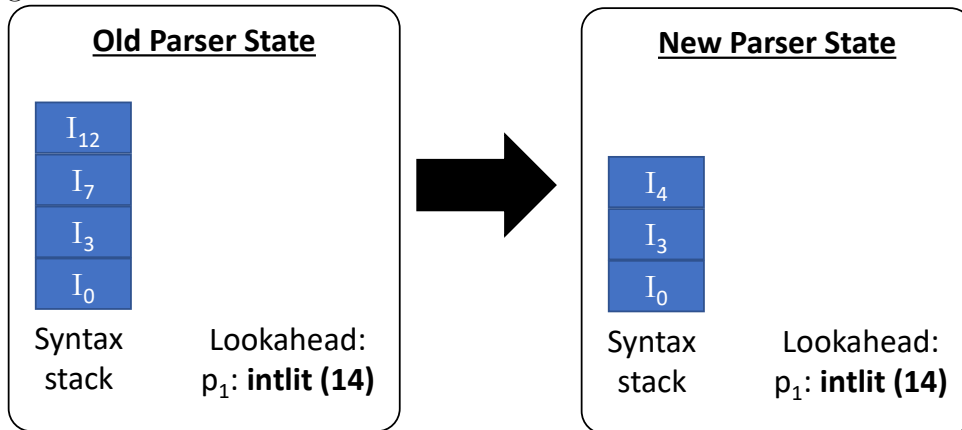|			
①	X	::=	**cross intlit intlit**
②	X	::=	*Y*
③	Y	::=	*Z W*
④	Y	::=	ε

(note that the actual questions are on the next page)

QUESTION 2, PART I

Assume that the following action has been taken by an LR Parser built from the above grammar:

Old Parser State

| I_{12} |
| I_7 |
| I_3 |
| I_0 |

Syntax stack   Lookahead: p_1: **intlit (14)**

New Parser State

| I_4 |
| I_3 |
| I_0 |

Syntax stack   Lookahead: p_1: **intlit (14)**

What cell or cells must exist in the LR Parsing table to have updated the parser state in this way? (Give the row, column, and entry at that cell)

QUESTION 2, PART II

Assume that the following action has been taken by an LR Parser built from the above grammar:

Old Parser State

| I_{11} |
| I_0 |

Syntax stack   Lookahead: p_1: **intlit (14)**

New Parser State

| I_2 |
| I_{11} |
| I_0 |

Syntax stack   Lookahead: p_2: **char ('a')**
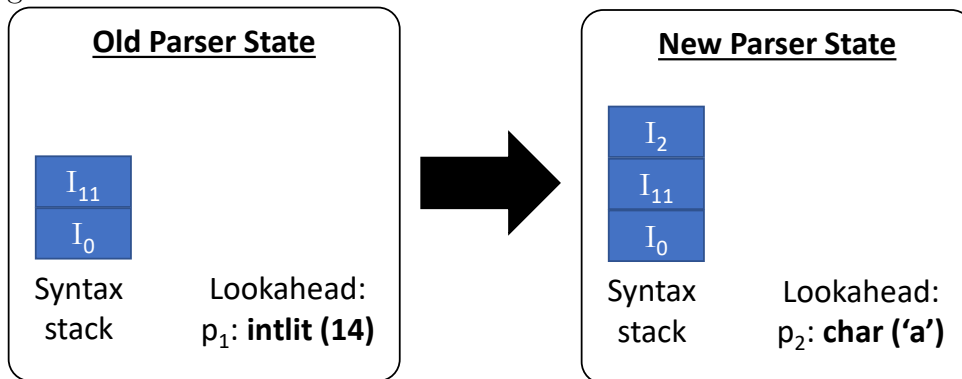
What cell or cells must exist in the LR Parsing table to have updated the parser state in this way? (Give the row, column, and entry at that cell)

QUESTION 3 (10 POINTS)

Consider the following program:

```
int x;
int y;
void foo(){
  x = 5;
  print x;
  print y;
}
int main(){
  x = 1;
  y = 2;
  if (rand()){
    int x;
    y = 3;
    x = 4;
    foo();
  }
  print x;
  print y;

  return 0;
}
```

Let rand() be a function that returns a random boolean value.

Under a static scoping scheme, what is printed when rand() returns true? _____

Under a static scoping scheme, what is printed when rand() returns false? _____

Under a dynamic scoping scheme, what is printed when rand() returns true? _____

Under a dynamic scoping scheme, what is printed when rand() returns false? _____

QUESTION 4 (10 POINTS)

Student ID: _____

Assume there is a grammar where the following sets have been calculated:

FIRST(X) = { a, b, ε}
FIRST(Y) = { c }
FIRST(Z) = { b, d, ε}

Consider this grammar *fragment* (i.e., other rules of the grammar may exist but are not shown)

X ::= Z a
Y ::= c Y Z
Z ::= b X

Also assume that none of these symbols is the start symbol.

Based on the grammar fragment and the given FIRST sets, what values are contributed to the FOLLOW sets:

FOLLOW(X) _____

FOLLOW(Y) _____

FOLLOW(Z) _____

If there is other information you would need to complete the above sets, indicate it below:

Question 5 (10 Points)

Do ONE of the following problems in the space below the boxes:

Option 1:

Show a grammar that is not LL(1), and write out the selector table that proves the grammar is not LL(1). Your grammar may not be ambiguous.

Option 2:

Show the completed CYK parsing table for the following string on the following grammar:

Input String: **a b b a**

Grammar:

$S \longrightarrow A\ B$
$A \longrightarrow A\ D$
$A \longrightarrow \mathbf{a}$
$B \longrightarrow D\ C$
$C \longrightarrow E\ F$
$D \longrightarrow \mathbf{b}$
$E \longrightarrow \mathbf{b}$
$F \longrightarrow \mathbf{a}$