CS 480/580 Midterm 1
Spring 2000

The exam has 100 points total, 20 points for each of the five questions. (120 points and 6 questions for 580 students). Closed book, closed notes, closed neighbors.

Name:

1. Here is just a portion of the grammar for our programming language

\[
\begin{align*}
\text{Stmt} & ::= \text{if expr then Stmt} \\
\text{Stmt} & ::= \text{id} = \text{expr} \\
\text{Expr} & ::= \text{id} \mid \text{Expr} + \text{id}
\end{align*}
\]

Draw a parse tree for the input

if \( x + y \) then if \( z \) then \( z = y + x \)

2. Draw the DFA that would be constructed by the LR parsing algorithm for this grammar. Number your states.

3. Show the sequence of shift and reduce steps that would occur when processing the input ``if \( x \) then \( y = z \)''.

4. Imagine that \( a \) is an array with index values 2 to 5 of integers. The elements of \( a \) begin at offset -80 in the activation record. variable \( i \) is an integer at offset -8. Draw the AST that would be created for the expression

\[ 3.2 \ast a[i] \]

5. When building a shift reduce parser, the parser generator reports a shift-reduce conflict when it has seen an expression matching ``^ type'' and it is looking at a left square bracket. Explain what a shift reduce conflict is and why it occurs at this point.

\[
\text{type ::= id} \mid ^\text{type} \mid \text{type [ integer ]}
\]
6. (580 only) Draw the sequence of activation records that would appear on the stack at the point we execute the print statement after the sequence or calls on A, B, C and D. Explain what calculation is used to access the two variables x and y.

function A ()
var x : int
    function B ()
var y : int
        function D ()
begin
        print(y+x);
        end
        function C ()
begin
    D ()
end
    begin
C();
end
begin
B()
end