CS3300 Quiz 2: Oct 10, 2023. (QP Code: A)

Maximum marks = 30, Time: 45 minutes, Closed Book, Closed Neighbor

Name: ______________________________ Roll: ______________

Read the instructions and questions carefully. You can use the given booklet for rough work and stating any reasonable assumptions you make. But write the answers in the QP itself – marks will be given based on the answers in the QP.

- MCQ and True/False questions: Each incorrect answer will lead to a deduction of 0.5 marks.

Section 1. MCQ, 2 marks each

1. Consider the action sequence shown to process one of the production rules to translate the boolean predicate `B`. Assume the used attributes have the same meaning discussed in the class. Which of the following IS true:

```
B -> B1 || B2       B1.true = B2.true = B.true
                    B1.false = B2.false = B.false
                    B.code = B1.code ||  B2.code
```

   (a) During execution of the generated code, the code for `B1` will always jump to the correct statement.
   (b) During execution of the generated code, the code for `B2` will never be executed.
   (c) During execution of the generated code, the code for `B` will lead to an infinite loop.
   (d) None of the above.

2. Consider a C array `X`, declared as "`int X[10][20]`". Students of CS3300 came out with four different translations for the statement `a = X[i][j]`, as shown below:

```
t1=j*40         t1=i*80         t1=i*40         t1=j*80
t2=i*4          t2=j*4          t2=j*4          t2=i*4
t3 = t1+t2      t3 = t1+t2      t3 = t1+t2      t3 = t1+t2
a=X[t3]         a=X[t3]         a=X[t3]         a=X[t3]
   (A)             (B)             (C)             (D)
```

   Assuming that the size of an integer is 4 bytes and the array is allocated in column-major form, which is the correct three-address IR code.

   (a) A
   (b) B
   (c) C
   (d) D

3. Which of the following is true?

   (a) Every LR(k) grammar can be rewritten as a LR(1) grammar?
   (b) LALR(1) grammar may have conflicts
   (c) For arbitrary values of k_1 and k_2, in general, the expressive power of LR(k_1) is not comparable to that LL(k_2).
   (d) JavaCC uses LR(k) parsing.

Section 2. Fill in the blank, 4 marks each

1. Consider the C code shown in RHS:
The number of nodes and edges in the CFG for its three-address-code are ________ and ________, respectively. [2 + 2 marks].
Hint: Don't forget to include the entry and exit blocks.

```
for (i=1;i<=n;++i){
  for (j=1;j<=n;++j){
    C[i] = 0;
    for (k=1;k<=n;++k){
      C[i] += A[i]*B[i];
    }
  }
}
```

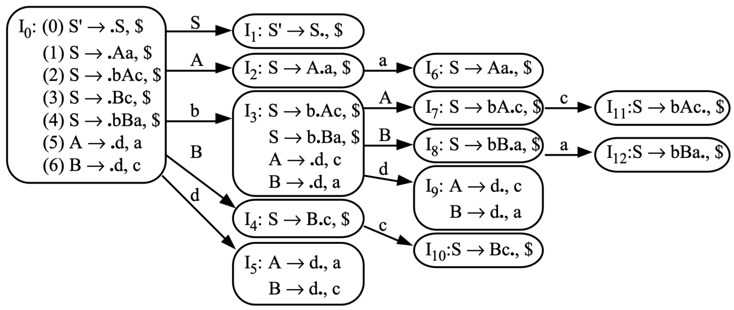
2. Consider the LR(1) item sets shown on the right.

   (a) The number of shift entries in the LR(1) parsing table = ________. [1 mark]

   (b) The number of reduce entries in the LR(1) parsing table = ________ [1 mark]

   (c) The number of rows (excluding the header row) in the LALR(1) table would be ________. [1 mark]

   (d) State True or False: the grammar is LALR(1) ________. [1 mark]



3. Consider the two C codes shown on the right

   (a) The number of jump instructions (count both conditional and unconditional) in the generated code, for the code A and code B are ______ and ________, respectively. [2 marks]

   (b) During execution, the number of executed jump instructions (count both conditional and unconditional), for the code A and code B loop are ____________ and ____________, respectively. State your answer in terms of `n`. [2 marks]

```
i = 0;
while (i < n){
  A[i] = i;
  i++;
}

        (A)
```

```
i = 0;
if (i < n) {
  do {
    A[i] = i;
    i++;
  } while (i < n);
}
        (B)
```

4. Consider the CFG shown on the right.

   (a) The number of production rules in the augmented grammar = _______ [1 mark].

   (b) The number of LR(1) item-sets for this grammar = _______ [3 marks].

$$S \to a\ S\ b$$
$$S \to A$$
$$A \to a\ A$$
$$A \to \epsilon$$

Section 3. True or False Answers, 1 mark each

________ The size of the AST is typically smaller than the syntax tree.

________ In any CFG, the number of join nodes will always match that of the branch nodes.

________ Given an LL(1) grammar, top-down parsers cannot perform on-the-fly evaluation of attributes in S-attributed grammars.

________ A CFG is a rooted undirected graph.

________ An Inherited attribute of a node N is defined only in terms of attributes at the children of N and at N.

________ LR(1) is strictly more expressive than LL(k) (irrespective of the value of k).

________ Given an attribute dependence graph, with no cycles, there is a unique order for evaluating the rules.

________ L-attributed grammars are a superset of S-attributed grammars.