

國立交通大學試題紙

一零一學年度第一次
博士班資格考

科目：編譯器設計 A

日期：102 年 1 月 31 日 第 1 頁 共 2 頁

請“✓”明 ✓不可看書 可看書

* 請將答案依題號順序寫入答案卷

答題時字跡需工整，否則不予計分。Write your answers legibly; otherwise you will get zero score.

1. For each feature below, describe which phases need to be modified: scanning, parsing, semantic analysis, code generation, and justify why other phases do not need to be modified.
 - (1) (2 points) Add a CASE (or switch) statement, when the if-then and if-then-else statements already exist.
 - (2) (2 points) Change the symbol for exponentiation from “^” to “**”, keeping the same semantics.
 - (3) (2 points) Add runtime checking of array references out of bounds before every access to an array.
 - (4) (2 points) Change the semantics of an IF statement to short circuit the evaluation of the predicate when possible to save on runtime expression evaluation.
2. Consider the following lex-like specification. The alphabet is the set {a,b,c}. Parentheses are used to show the association of operations and are not part of the input alphabet.

| | |
|--------|------------------|
| abc | {return token1;} |
| (b c)* | {return token2;} |
| a* | {return token3;} |
| (abc)* | {return token4;} |
| aab* | {return token5;} |
| (b c)c | {return token6;} |

- (1) (6 points) Show how the following string would be partitioned (by adding vertical lines) into tokens by grouping the characters into lexemes. Label each lexeme with the integer of the correct token class. Assume lex semantics for this question.
baaabccacccabbbaaabcccbccaaacccabcbabc
- (2) (4 points) Can any of these rules be removed without changing the scanner's behavior on any string? If no, why not? If so, which rules can be removed and why?

◎請用深黑色鋼筆或原子筆出題

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3. (9 points) For each circumstance below, what grammar transformation(s) will you apply to improve your recursive descent parser, assuming no bugs in your implementation?

- (1) When your recursive descent parser performs too much backtracking, what grammar transformation(s) will you apply?
- (2) When the grammar causes non-termination of your recursive descent parser, what grammar transformation(s) will you apply?
- (3) When your recursive descent parser always terminates but fails to accept a string that is in the language of the grammar that the parser intends to encode, what grammar transformation(s) will you apply?

4. Consider the following grammar with terminals `;` and `nil`.

$$S \rightarrow E;S \mid E$$

$$E \rightarrow \text{nil}$$

- (1) (6 points) Build the LR(0) automaton for the grammar.
- (2) (5 points) Construct the SLR(1) parsing table for this grammar.
- (3) (6 points) Give the steps of an SLR(1) parser as it parses the input

`nil; nil; nil`

by showing the stack, the corresponding symbol on the stack, the input, and the action applied at each step.

| Stack (top is right) | Symbol | Input | Action |
|----------------------|--------|-------|--------|
| | | | |

5. (6 points) Consider the following grammar with terminals `a`, `b`, `c`, `d`, and `e`. Show that either the grammar is, or is not, LR(1). Is the grammar LALR(1)? Justify your answer.

$$S \rightarrow T a \mid b W c e \mid W c e \mid b T c$$

$$T \rightarrow d$$

$$W \rightarrow d$$

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命題老師簽名：

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Qualification Exam for Compilers

January 2013, close book

1. a. (10 points) Please explain two ways to generate code for a `switch` statement. Please also discuss the tradeoff. In a compiler, how will the compiler choose the implementation for a particular `switch` statement in the program?

1. b. (10 points) Find an optimization method that generates better code for a `switch` statement. You may use an example to explain your method.

2. (10 points) Please describe two practical optimization techniques for computing addresses of array elements.

3. (10 points) Please design a data structure to support dynamic dispatch efficiently in an object-oriented language, such as Java or C++. You need to consider single inheritance and overloading.

4. (10 points) Assume all the variables and types are properly declared in the following example. The following assignment statement contains many subexpressions. Please describe which subexpressions generate l-values and which subexpressions generate r-values. Please describe a translation scheme for generating appropriate values.

`a.b[f.g[j+k]].f[m] := m.d[n[p+w]].q[r.s[p+w]] ;`

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