

PRINCE OF SONGKLA UNIVERSITY  
FACULTY OF ENGINEERING  
Department of Computer Engineering

**Midterm Examination:** Semester 1

**Date:** Sunday July 30th, 2006

**Subject Number:** 240-340

**Subject Title:** Compiler Structures

**Lecturer:** Aj. Andrew Davison

**Academic Year:** 2006-2007

**Time:** 9:00 – 11:00 (2 hours)

**Room:** A 400

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**Exam Duration:** 2 hours

**This paper has 2 pages.**

**Authorized Materials:**

- Writing instruments (e.g. pens, pencils).
- Books (e.g. dictionaries) and calculators are **not** permitted.

**Instructions to Students:**

- *Answer questions in English.* Perfect English is **not** required.
- Attempt all questions.
- Write your answers in an answer book.
- Start your answer to each question on a new page
- Clearly number your answers.
- Any unreadable parts will be considered wrong.
- When writing programs, use good layout, and short comments; marks will not be deducted for minor syntax errors.
- The marks for each part of a question are given in brackets (...).

**Question 1**

(20 minutes; 20 marks)

- a) What is a lexical analyzer? Explain with the help of diagrams, but do **not** include any code examples. (5)
- b) Write a lex program which counts the number of words contained in the input file. (10)
- c) Explain how the program in part (b) works, especially how a word is defined, and how lex matches the program's rules against the input. (5)

**Question 2**

(20 minutes; 20 marks)

- a) Explain the four parts of a grammar. Give brief examples, but do **not** include any program code. (10)
- b) Write a grammar for expressions which use the '+' and '\*' operators, brackets, and whose operands are integers. Example expressions include "23+5" and "(5\*2)+67". (10)

**Question 3**

(30 minutes; 30 marks)

- a) What are FIRST sets? Define FIRST() using FIRST\_SEQ(). (8)
- b) What are FOLLOW sets? Define FOLLOW() using FIRST\_SEQ(). (8)
- c) Calculate the FIRST and FOLLOW sets for the expressions grammar that you wrote in Question 2(b). (14)

**Question 4**

(50 minutes; 50 marks)

- a) What is a LL(1) grammar? Give an example, but do **not** include any program code. (10)
- b) What are PREDICT sets? Define PREDICT() using FIRST() and FOLLOW(). Do not define FIRST() and FOLLOW(). (10)
- c) Use PREDICT() to check the expressions grammar that you wrote in Question 2(b). (15)
- d) Explain how a recursive descent parser is generated by translating your expressions grammar into C functions. Include code for main(), but **not** for nextToken(), match(), error(), or scanner(). (15)

--- End of Examination ---