CURTIN UNIVERSITY

DEPARTMENT OF COMPUTING

Theoretical Foundations of Computer Science

300/500

Interim Test

2nd Semester 2014

NAME: _____

STUDENT NUMBER: _____

Time Allowed: Sixty (60) Minute test preceded by a 5 MINUTE READING PERIOD during which time notes may be made on the back page of the paper. The supervisor will indicate when answering may commence.

AIDS: None

INSTRUCTIONS: This paper consists of five (6) questions with a total of 60 marks.

ATTEMPT ALL QUESTIONS

No electronic devices such as Phones and PDA are allowed. All phones, even in a bag, must be turned off.

INSTRUCTIONS FOR QUESTIONS 1 TO 5:

QUESTIONS 1 to 5 each describe a problem in English, set notation, a language or in terms of strings. It is your task to do the following for each of the five:

Classify the problem into one the appropriate category; Regular, Context-Free or neither. You may instead state the tier (T1, T2 or T3+) if you prefer. **(2 marks)**
In addition:

1. For a problem that is Regular, prove that this is the case by constructing either a DFA, a NFA, or a Regular Expression that accepts the language of the problem. **(6 marks)**
2. For a problem that is Context-Free, do both of the following:
    a. Prove that the problem is not Regular using the pumping lemma. **(7 marks)**
    b. Prove that the problem is Context-Free by constructing either a PDA or CFG that accepts the language of the problem. **(7 marks)**
3. For a problem that is neither, prove that it is not Context-Free using the pumping lemma for Context-Free grammars. **(9 marks)**

If you are unable to do a pumping lemma proof, a small amount of marks may be awarded for a good explanation of why the problem is not Regular or Context Free.

You may choose to prove that something is not Regular (or Context-Free) using a method other than the pumping lemma, if you are sure that this form of proof is convincing. However, use of the pumping lemma is strongly recommended.