CURTIN UNIVERSITY

DEPARTMENT OF COMPUTING

**Theoretical Foundations of Computer Science**

**Interim Test**

**2nd Semester 2015**

**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 seven (7) 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 6:

QUESTIONS 1 to 6 each describe a problem in English, set notation 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. **(5 marks)**
2. For a problem that is Context-Free, do both of the following:
   1. Prove that the problem is not Regular using the pumping lemma. **(6 marks)**
   2. Prove that the problem is Context-Free by constructing either a PDA or CFG that accepts the language of the problem. **(6 marks)**
3. For a problem that is neither, explain why it is not Context-Free or Regular. **(2 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.

You may choose to prove that something is not Regular 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.