Trent University

Computing and Information Systems 3050H

Fall 20XX

Sample Exam

Instructor: Dr. R. T. Hurley

Time: 2 hours

Open Course Notes

There are 9 questions for a total of 50 marks.

1) [5 marks] Give a recursive definition for the language $a^n b^{2n}$ where n = 1, 2, 3, ... over the alphabet Σ={a, b}.

2) [12 marks] Consider the following languages over the alphabet ={a ,b},

(i) The language of all words that begin and end an *a*

(ii) The language where every *a* in a word is immediately followed by at least one *b*.

(a) Express each as a Regular Expression

(b) Draw an FA for each language

(c) For Language (i), draw a TG using at most 3 states

(d) For Language (ii), construct a CFG.

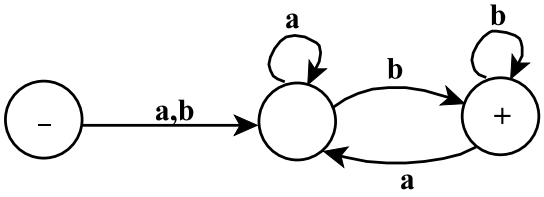
3) [5 marks] Using one of the algorithms discussed in class, construct a finite automata over the alphabet Σ = {a,b} that accepts the language that is based on the intersection of the language of words that end in *a* and the language of words that end in *b*. Draw finite automata for the original languages first.

4) [4 marks] Draw a 3-state Mealy machine that counts the number of occurrences of the string *baa*.

5) [4 marks] Create a CFG for the following regular language over the alphabet Σ = {a, b}

L = **(a+ab)(aa)***

6) [6 marks] Convert the following FA into a CFG and PDA.



7) [3 marks] Prove whether or not the language generated by the following CFG is empty.

S → AB

A → BC

C → DA

B → CD

D → a

A → b

8) [5 marks] Draw a Turing Machine that will accept the regular language over the alphabet Σ={a,b} where all words contain the substring *aaa*.

9) [6 marks] Build a TM over the alphabet Σ={a, b} that accepts the language DoubleA where each word is to have twice as many *a*'s as *b*'s. You might find it easier if you use the Insert# routine.