LCMPE222 Midterm Examination
Spring 2017

The examination lasts 2 hours.

The marks for each question and each part of each question are shown in ( ) paranthesis. Total marks 100.

Do not write anything on the question paper except your name and student number.

Use only black or dark blue ballpoint or fountain pen. Do not use pencil at all at any time.

Make sure that your handwriting is legible. Illegible handwriting may render your answers unmarkable and your answers could therefore be awarded a mark of zero.

Cross out errors with a single line only. Crossed out material will not be marked.

Answer all questions

Marks will be given for partial answers, so show all your workings and give your reasoning. Write all your workings on your answer paper, not on the question paper.

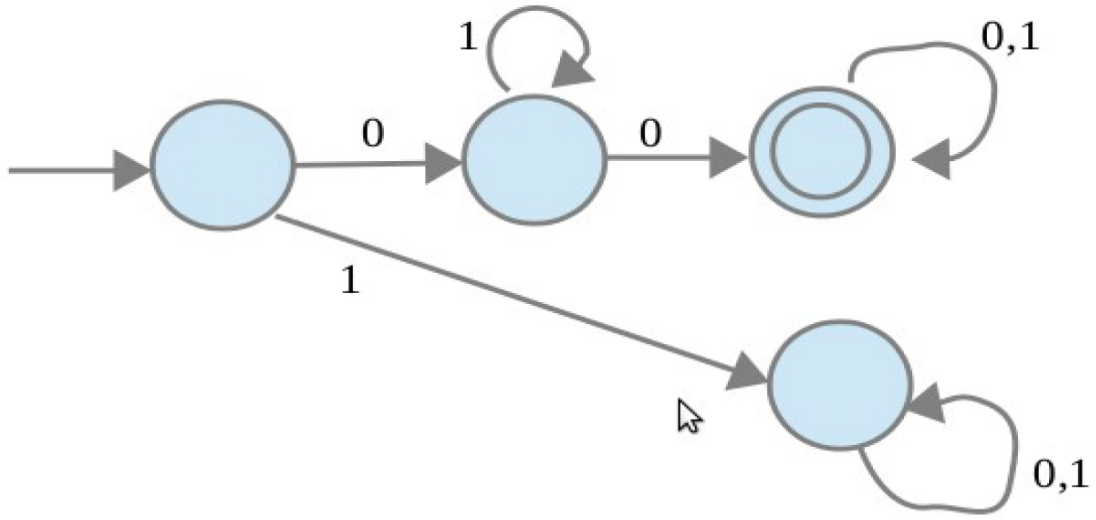
Good luck,

Name :
ID :

(30 pts)
1. Show that the set of regular languages is ***closed under*** the set difference operation —. (Remember that if A,B are two sets A — B is a set that has all members of A that are not members of B). Thus, you should show that if A, B are two regular languages, then so is A — B.

(*Hint*: The set of regular languages is closed under the set union operation U.
Write M_{A-B} as a five-tuple, in terms of M_A and M_B)

(35 pts)
2. Consider the following finite-state automaton M:
(I) Describe the language that M recognizes verbally.
(II) Write a regular expression that describes the language M recognizes.



(35 pts)
3. Consider the following regular expression:

`(aUb)a*b*`

(I) Design an NFA that recognizes the language described by this regular expression.
(II) Write a regular grammar that describes this language.