Faculty of Information Technology
Monash University

FIT2014 Theory of Computation
SAMPLE MID-SEMESTER TEST

2nd Semester 2016

Working Space

Question 1 **(5 marks)**

A language L is called **hereditary** if it has the following property:

> For every nonempty string x in L, there is a character in x which can be deleted from x to give another string in L.

Prove by contradiction that every nonempty hereditary language contains the empty string.

Question 2 **(8 marks)**

In this question, we write T for True and F for False.

Let P_n be the proposition $x_1 \wedge x_2 \wedge \cdots \wedge x_n$. Note that P_1 consists just of x_1, and P_n is equivalent to $P_{n-1} \wedge x_n$.

Prove by induction on n that, if $x_1 = \mathrm{F}$, then P_n is False.

Question 3 **(3 marks)**

Write down a regular expression for the language of all binary representations of positive integers.

Your alphabet for this question is {0,1}. Leading zeros are not allowed. Do not use any signs or decimal points.

ANSWER:

Question 4 **(3 marks)**

Construct a Finite Automaton (FA) to recognise the language of strings consisting of an odd number of 0s followed by an even number of 1s.

(Note: zero is considered to be an even number.)

Question 5 **(7 marks)**

Construct a Nondeterministic Finite Automaton (NFA) to recognise the language represented by the regular expression

$$(\mathtt{aa} \cup \mathtt{b})^*\mathtt{ab}^*.$$

Question 6 **(4 marks)**

Consider the five-state Finite Automaton represented by the following table.

	state	a	b
Start	1	2	3
	2	1	5
	3	1	4
Final	4	2	5
Final	5	3	5

Convert this into an equivalent FA with the minimum possible number of states.

Write your answer in the following table. You may not need all the rows available.

state	a	b

Working Space

END OF TEST