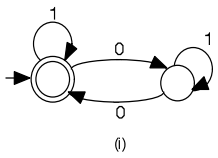
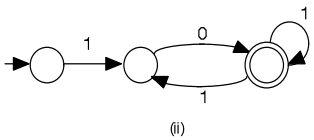
CS3012 Formal Languages

Exercises 2: Finite State Automata

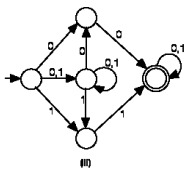
1. Describe in words the languages accepted by each of the following FSAs:





Answer (i):

Answer (ii):



Answer (iii):

2. Give a formal definition for the FSAs which define the following languages
(i.e. specify Q, I, F, T, E):

(i) strings containing *a* or *ab* $\{a, b\}$

Answer:

(ii) strings containing *aba* or *bab* $\{a, b\}$

Answer:

(iii) strings containing exactly one *a* (and any number of *b*s) or exactly one *b* (and any number of *a*s) $\{a, b\}$

Answer:

(iv) strings containing *a*, *ab* or *abc* $\{a, b, c\}$

Answer:

(v) strings containing *a*, *ba* or *cba* $\{a, b, c\}$

Answer:

3. Give a formal definition for a FSA accepting the infinite set of strings representing numbers divisible by 2. (i.e. 0,2,4,6,8,10,12,….)

Answer:

4. Give a formal definition for a FSA accepting the infinite set of strings representing numbers divisible by 3. (this one is tricky, try (on paper) doing a division of 3 into some large number *x*, and see if the process you are using to deal with each new digit of *x* could be automated by a machine.)

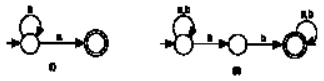
Answer:

5. Give a formal definition for a FSA accepting the set of strings over $\{a, b\}$ which contain an even number of *a*'s and an even number of *b*'s. (this one is tricky, try doing it manually for some random

string of a's and b's. What do you need to remember as you're going through the string? How many states will the FSA need, to remember this?)

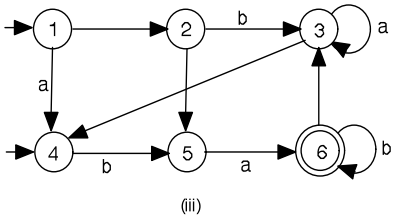
Answer:

6. **[In 2009-2010 and 2010-2011, SKIP this exercise.]**
Give a formal definition for a DFSA for the following, using the "NDFSA -> DFSA" algorithm from lectures (i.e. in your answer show the workings of the table used for removing edge choices, and specify the final Q, I, F, T, E):



Answer (i)

Answer (ii)



(iii)

Answer (iii)

7. (very simple) Give a method of constructing a FSA B from a FSA A, such that:
L(B) = {*w* | there is a path from *p* to *q* labelled *w* in A, for some states *p* and *q*}

Answer: