

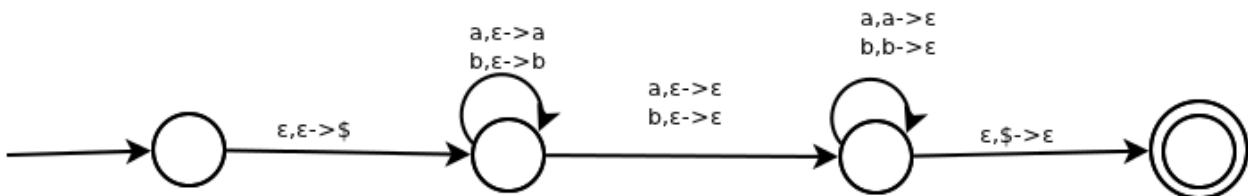
COM 2003
Marked Problems Sheet 2

This problems sheet is to test your understanding of concepts relating to pushdown automata, context free languages and Turing Machines. The sheet will be marked to give you feedback on your understanding, but does not count towards your final mark for the semester. Rather it is an opportunity to practice the kind of problems you will face in the January exam.

Deadline: December 16th 2013

Hand-in: via Regent Court Reception, at an office hour, or at one of the lectures up to and including December 16th's.

1. Design pushdown automata for the following languages:
 - a. $\{a^i b^j c^k \mid j = i + k\}$
 - b. The language of all strings over the alphabet $\{0,1\}$ that are not palindromes.
2. Design context-free grammars for the following languages:
 - a. The language of all palindromes over the alphabet $\{a,b,c\}$
 - b. $\{a^i b^j c^k \mid i > j \text{ or } i > k\}$
3. Give a context-free grammar that generates the language recognised by the following pushdown automaton:



[2 marks]

4. Is the language $\{a^i b^j c^k \mid k > j > i\}$ context-free? Prove your answer.

[3 marks]

5. Is the set of all subsets of the natural numbers countable or uncountable? Prove your answer.

[3 marks]