

CS 370
Midterm Exam
October 18, 2006

The following exam is open book and open notes. You may feel free to use whatever additional reference material you wish, but **no electronic aids** are allowed. Please note the following instructions. There will be a ten point deduction for failure to comply with them:

- start each problem on a new sheet of paper
- write your social security number, but not your name, on each sheet of paper you turn in
- show your work whenever appropriate. There can be no partial credit unless I see how answers were arrived
- be succinct. You may lose points for facts that, while true, are not relevant to the question at hand

You have until 10:20 to finish the exam.

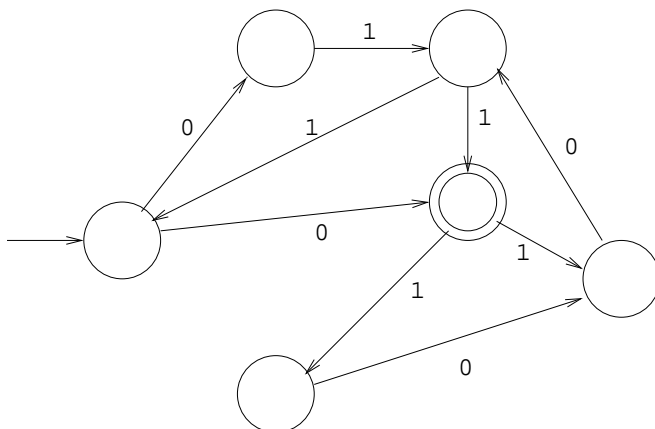
1. (15 points) C^b uses the same comment syntax as C++: A comment starts with `//`, and continues until the end of the line. Write a regular expression that will recognize C^b comments. Translate your regular expression into a finite state machine.
2. (10 points) A constant frustration with C comments is that they can't nest: if you have a block of code you'd like to comment out, like this:

```
/* comment out the following:  
  a = b + c; /* add b to c */  
  b = 2 * a;  
  OK, end the commenting-out */
```

only the first line (`a = b + c;`) gets commented-out. The `*/` at the end of that line ends the comment, so the second line is compiled, and then the closing remark is a bunch of syntax errors.

Comment processing is normally handled by the scanner. Could the C scanner be modified to recognise nested comments (without doing violence to the sense in which we've used the term "scanner")? Either outline how it could be done or say why it couldn't.

3. (30 points) Give a nondeterministic pushdown automaton that will recognise palindromes taken from the alphabet $\{a, b, c\}$
4. (20 points) Which of the following strings is accepted by the nondeterministic finite state machine in the figure?



- (a) 0111001
- (b) 010010

5. (25 points) The following is a description of a PDA.

$$M = (\Sigma, \Gamma, S, T, s_0, A)$$

where

$$\Sigma = \{0, 1\}$$

$$\Gamma = \{X, Y\}$$

$$S = \{s_0\}$$

$$T = \{$$

$$T(s_0, 0, \epsilon) = (s_0, X)$$

$$T(s_0, 0, Y) = (s_0, \epsilon)$$

$$T(s_0, 1, X) = (s_0, \epsilon)$$

$$T(s_0, 1, \epsilon) = (s_0, Y)$$

}

$$A = \{s_0\}$$

Which of the following strings is accepted by this PDA?

(a) 0010111001

(b) 01100