Problem 1

To create an automata for the language

\[ L_1 = \{ w \in \Sigma^* \mid w \text{ contains an odd number of } a\text{s and does not contain three consecutive } b\text{s} \}, \]

you need to keep track of two pieces of information: how many \( b\)s has it seen and has it seen an even or odd number of \( a\)s. In Figure 1(a), the three states \( q0, q2, \) and \( q4 \) keep track of the number of consecutive \( b\)s seen when an even number of \( a\)s have been seen. Similarly for states \( q1, q3, \) and \( q5 \) for an odd number of \( a\)s. Once 3 consecutive \( b\)s have been read, it moves to state \( q6 \) and never leaves.
Problem 2

To create an automata for the language

\[ L_2 = \{ w \in \Sigma^* | \text{w contains an odd number of } a\text{s or does not contain three consecutive } b\text{s} \}, \]

it is easiest to create two NFAs, one for an odd number of \( a \)s and one for not three consecutive \( b \)s and then join them via an \( \varepsilon \) transition from the start state as seen in Figure 1(b).

Problem 3

The regular expression for the URLs needs to ignore leading and trailing text by prepending and appending the regular expression for \( \Sigma^* \), namely\(^1\)

\[(a+b+c+d+e+f+g+h+i+j+k+l+m+n+o+p+q+r+s+t+u+v+w+x+y+z+0+1+2+3+4+5+6+7+8+9+/+:+.)*. \]

For the quarter, we need fall of 2000; fall, winter, spring, and summer of 2001–2007; and winter of 2008. The regular expression is \((fa00+((fa+wi+sp+su)0(1+2+3+4+5+6+7))+wi08)\). The course number must be in the range 1–199. There are several ways to do this, one is

\[((1+2+3+4+5+6+7+8+9)+(1+!)(1+2+3+4+5+6+7+8+9)(0+1+2+3+4+5+6+7+8+9)+10(0+1+2+3+4+5+6+7+8+9)).\]

Lastly, for the homework, we need \((hw+homework)(1+2+3+4+5+6+7+8+9)(0+1+2+3+4+5+6+7+8+9)*.(ps+pdf).\)

Putting this all together and ignoring the linebreaks which are just for formatting here, we have

\[(a+b+c+d+e+f+g+h+i+j+k+l+m+n+o+p+q+r+s+t+u+v+w+x+y+z+0+1+2+3+4+5+6+7+8+9+/+:+.)*. \]

http://www.cse.ucsd.edu/(fa00+((fa+wi+sp+su)0(1+2+3+4+5+6+7))+wi08)/

cse((1+2+3+4+5+6+7+8+9)+(1+!)(1+2+3+4+5+6+7+8+9)(0+1+2+3+4+5+6+7+8+9)+10(0+1+2+3+4+5+6+7+8+9))/

(hw+homework)(1+2+3+4+5+6+7+8+9)(0+1+2+3+4+5+6+7+8+9)*.(ps+pdf)

\[(a+b+c+d+e+f+g+h+i+j+k+l+m+n+o+p+q+r+s+t+u+v+w+x+y+z+0+1+2+3+4+5+6+7+8+9+/+:+.)*. \]

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\(^1\)Proper usage of English dictates that I end my sentences with a period. The trailing period this and subsequent regular expressions are just that and not to be confused with . which is used as part of the regular expression itself.