DFA minimization

CS712
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generating a scanner:

0. user provides regular set
1. regular set $\rightarrow$ NFA
2. NFA $\rightarrow$ DFA

but subset construction can cause a "blowup" in the number of states

3. minimize the DFA

i.e. find an equivalent DFA with the minimal number of states
Minimization algorithm

be aggressive - try using only two states
1. merge all final states
2. merge all non-final states

then repeatedly back off as necessary
- split state when out arcs have different destination in merged DFA

produces DFA with provably smallest number of states required to recognize the regular language
be aggressive

F

N

1, 4, 5, 7, 9

2, 3, 6, 8

needs to be split off

1 4 5 7 9
GNNNNNN
bNENNNN
cEEEEE

2 3 6 8
GEEEEEE
bFFFEF
CNNFE

Keep together split off split off
backoff #1

\[ F_1 \quad F_2 \quad N_1 \quad N_2 \quad N_3 \]

\[
\begin{array}{cccc}
1 & 5 & 7 & 9 \\
9 & N_1 & N_1 & N_3 & N_3 \\
6 & N_2 & N_2 & N_2 & N_2 \\
C & E & E & E & E
\end{array}
\]

\[
\begin{array}{c}
1 & 5 & 7 \\
9 & N_1 & N_1 \\
6 & F_1 & F_2 \\
C & N_1 & N_1
\end{array}
\]

split \ off  \ split \ off  \ split \ off  \ split \ off
back off #2

<table>
<thead>
<tr>
<th>a</th>
<th>b</th>
<th>c</th>
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</thead>
<tbody>
<tr>
<td>2</td>
<td>6</td>
<td>E</td>
</tr>
<tr>
<td>2</td>
<td>6</td>
<td>E</td>
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<td>8</td>
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</tr>
<tr>
<td>8</td>
<td>6</td>
<td>E</td>
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</tbody>
</table>

Done!
minimized DFA