CS442/542

DFA Minimization

DFA Minimization

- Minimize the DFA (D, Σ , δ , d_0, D_A}
- The algorithm builds a new machine from subsets of states of the original machine
- The algorithm first builds two subsets: the set of final states and the set of non-final states
- A subset is split if the subset has a conflict on a symbol
- A subset has a conflict on a symbol, c, when the transitions on c of two (or more) states in the subset do not go to states in the same subset.
- The algorithm halts when no subsets have conflicts (i.e. no more splits need to be done)

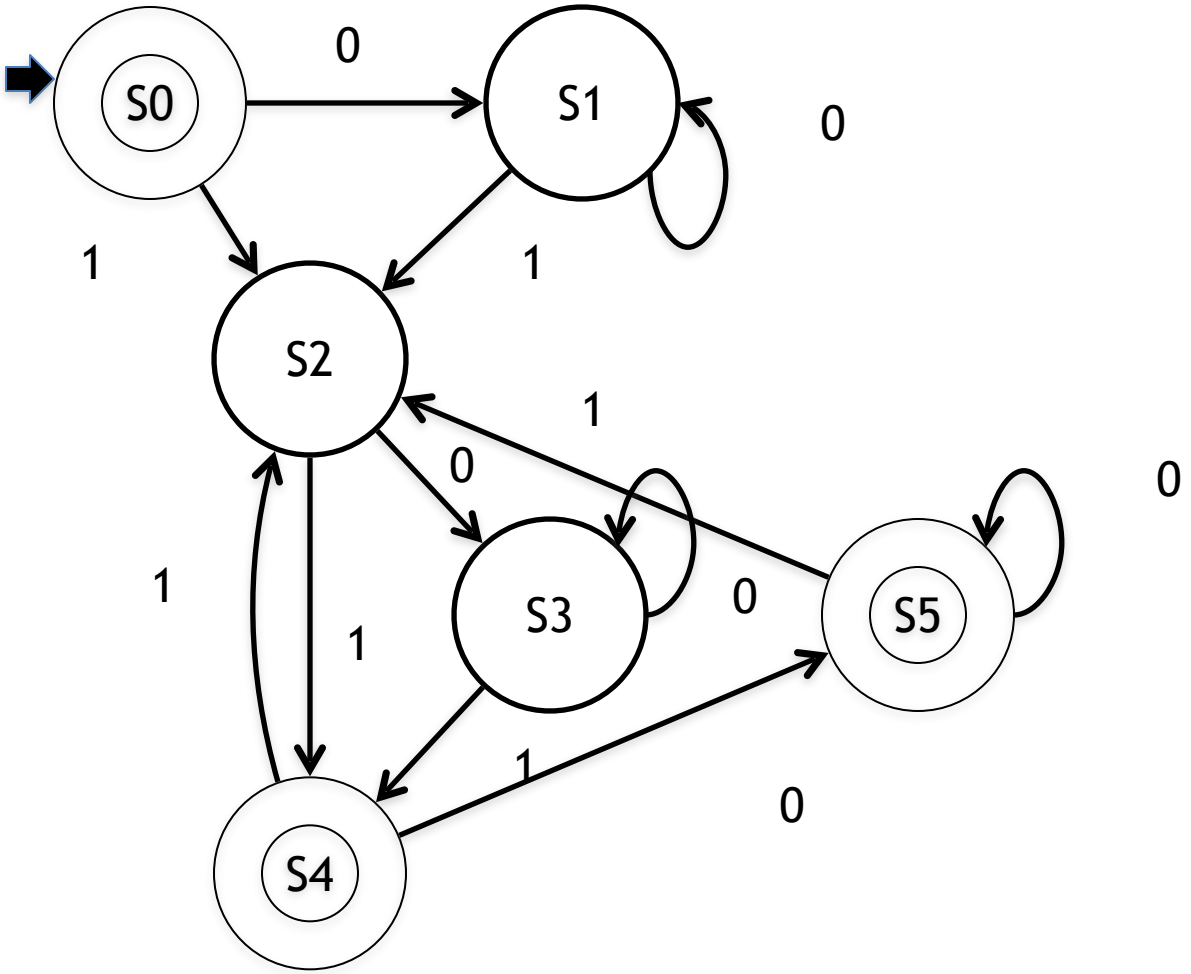
Split (S is a set of states from the original DFA)

```
Split(S) {
    for each c ∈ Σ do
        if c splits S into s1 and s2
            then return {s1, s2};
    end;
    return S;
}
```

DFA Minimization

$T = \{ D_A, (D - D_A) \};$
$P = \varnothing$
while ($P \neq T$) do
    $P \leftarrow T;$
    $T \leftarrow \varnothing;$
    for each $p \in P$ do
        $T = T \cup \text{Split}(p);$
    end;
end;

DFA for (0*10*10*)*



DFA Minimization

- Round 1

	S0, S4, S5	S1, S2, S3
0	S1, S5, S5	S1, S3, S3

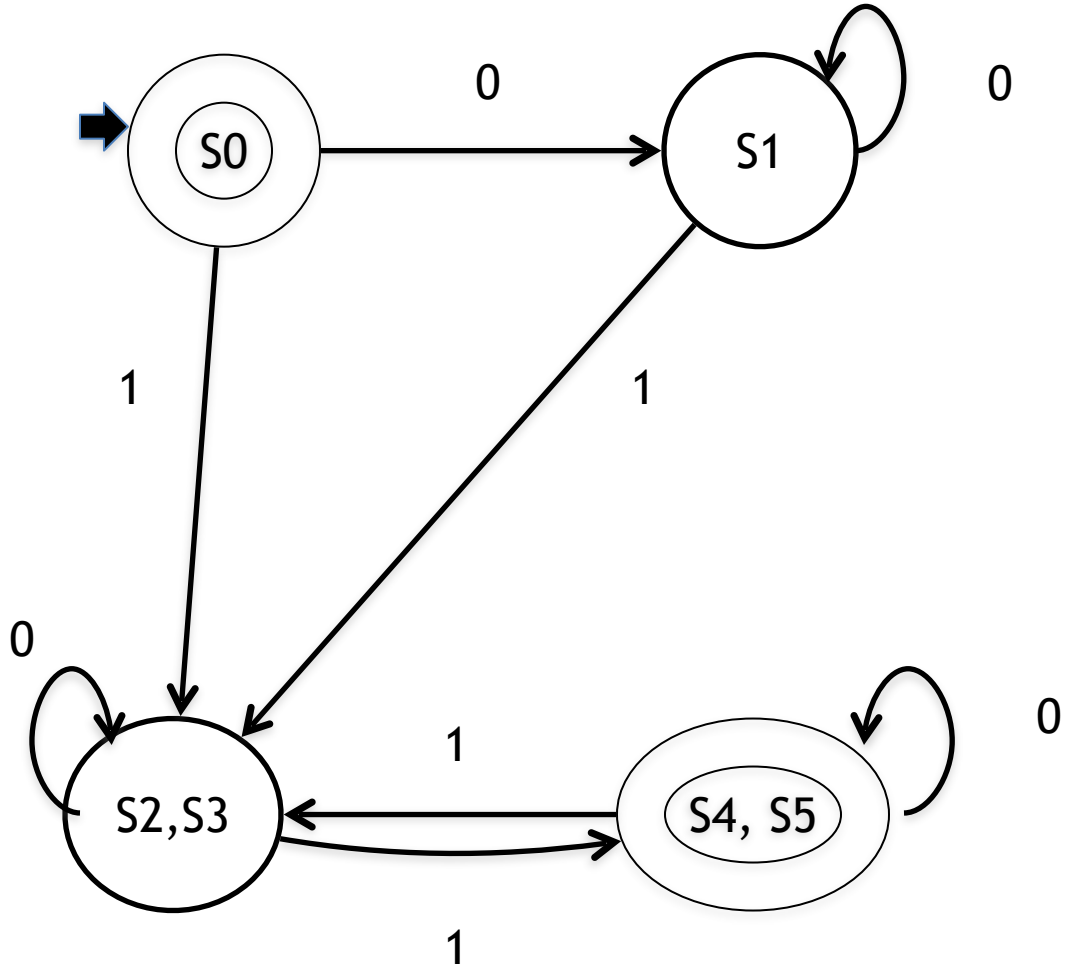
- Round 2

	S0	S4, S5	S1, S2, S3
1	S2	S2, S2	S2, S4, S4

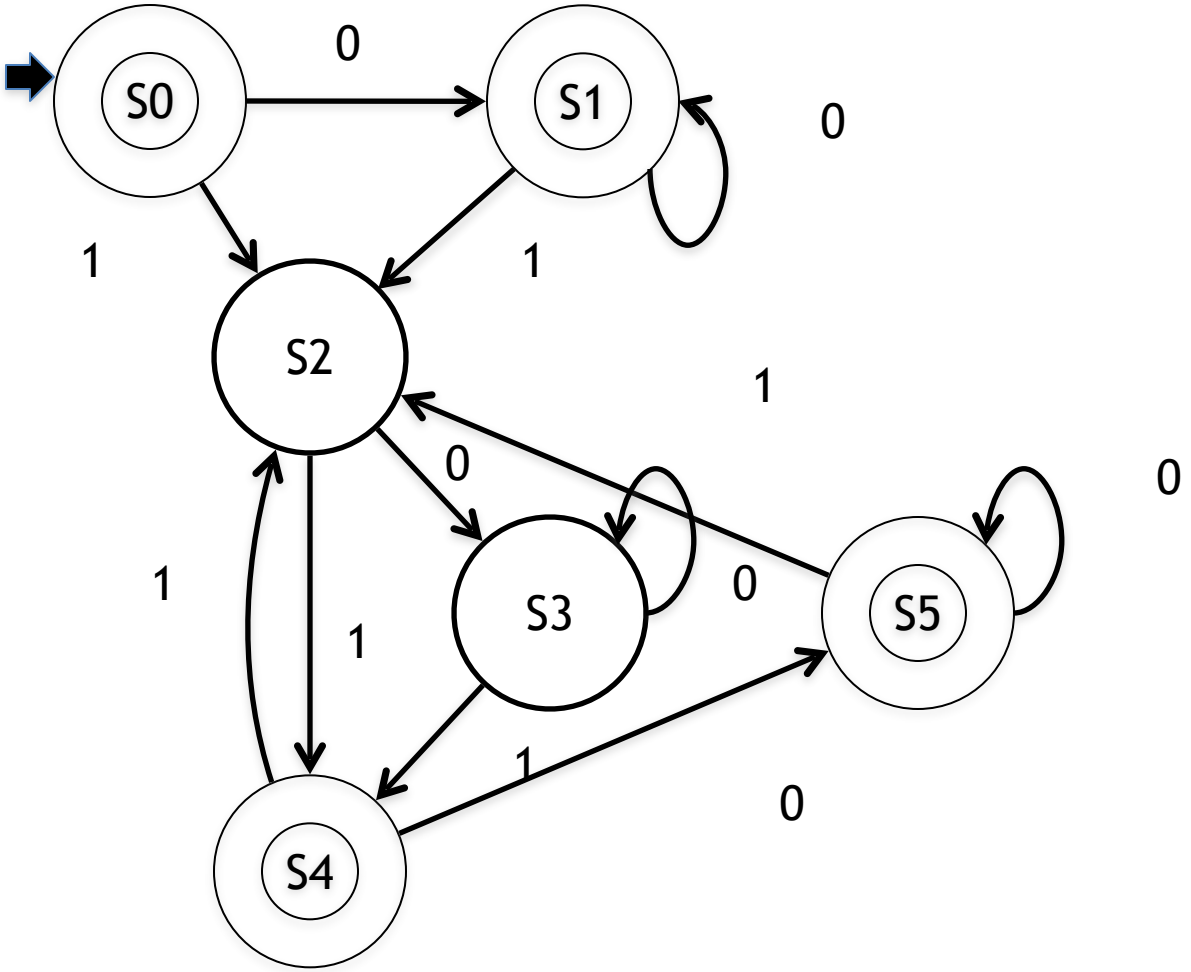
- Round 3

	S0	S4, S5	S1	S2, S3
0	S1	S5, S5	S1	S3, S3
1	S2	S2, S2	S2	S4, S4

DFA Minimization



DFA for 0*(10*10*)*

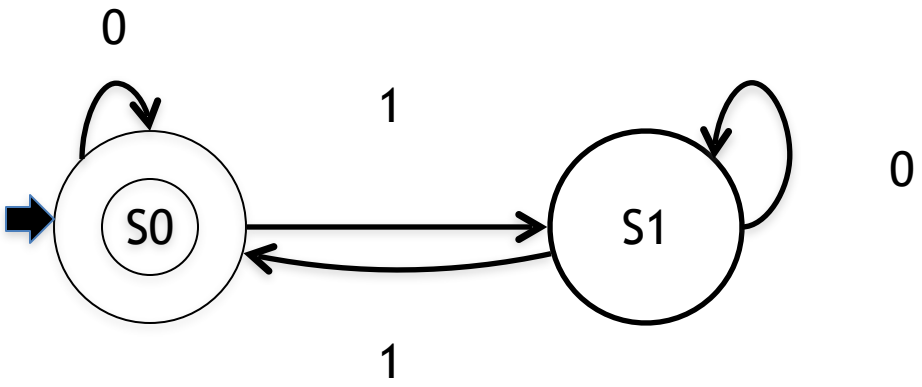


DFA Minimization

- Round 1

	S0, S1, S4, S5	S2, S3
0	S1, S1, S5, S5	S3, S3
1	S2, S2, S2, S2	S4, S4

DFA Minimization



DFA Minimization

- Potential Problems
  - The transition function is not total
  - Dead states