Foundation of Computer Science (CS60001)
Solution-06

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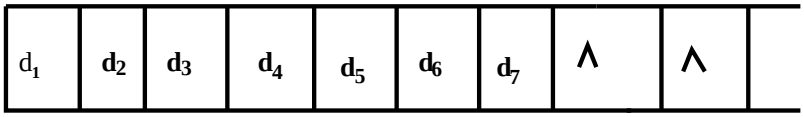
1. Prove that finite machine with 2 push down store is same powerful as turing machine

Solution: ($\Rightarrow$) If the tape head is currently scanned the symbol d_4 then corresponding finite machine with 2 push down store will be $y_1 = d_4\ d_3\ d_2\ d_1$ and $y_2 = d_5\ d_6\ d_7$. If tape head moves to right and d_4 will be replaced by β i.e (d_4, β, R) then the scenario will be as given bellow:



$y_1 = d_5\ \beta\ d_3\ d_2\ d_1$ and $y_2 = d_6\ d_7$. If tape head moves left and d_4 will be replaced by β i.e (d_4, β, L) then the scenario will be as given bellow:
$y_1 = d_3\ d_2\ d_1$ and $y_2 = \beta\ d_5\ d_6\ d_7$. There are two special cases
Case 1 : If currently scanned symbol is d_7 and moves to right then $y_1 = \wedge\ \beta\ d_6\ d_5\ d_4\ d_3\ d_2\ d_1$ and $y_2 = \wedge$
Case 2 : If currently scanned symbol is d_1 tape heads tries to move left then It goes to *Reject* Halt.
($\Leftarrow$) $y_1 \Leftarrow$ odd cell of Turing machine
$y_2 \Leftarrow$ even cell of Turing machine
If $\sigma = \sigma_1\ \sigma_2\ \sigma_3$, $y_1 = d_1\ d_2\ d_3\ d_4$ and $y_2 = e_1\ e_2$, the corresponding turing machine will be given bellow:
$\wedge\ \wedge\ \wedge\ \sigma_1\ \sigma_2\ \sigma_3\ \sharp\ d_1\ e_1\ d_2\ e_2\ d_3\ \wedge\ d_4\ \wedge$.
Now, the operation on y_1 and y_2 of the finite machine are simulated by applying the corresponding operation on the even and odd cells of the tape to the right of $\sharp$.