1st Internal Suggestions

1. Define finite automata. Why it is called finite?

Ans. Finite automata (Singular: automaton) are the machine format of regular expression, which is
the language format of type 3 grammar. A finite automata is defined as $M = \{Q, \Sigma, \delta, q0, F\}$.

Where Q: Finite non-empty set of states.

Σ : Finite non-empty set of input symbols.

δ : Transitional function.

$q0$: Beginning state.

F : Finite non-empty set of final states.

Finite automata are a type of finite state machines. It has finite number of states. Finite automata can be
thought of a finite state machine without output.

2. Construction of DFA, NFA, Moore and Mealy Machine.(As discussed in class)

3. Problem on Minimization of DFA (Myhill-Nerode Theorem)

4. NFA to DFA conversion

5. Moore to Mealy , Mealy to Moore Conversion.(Practice problems from the class)

6. Arden's Theorem:

Statement: Let P and Q be two Regular Expression s over Σ. If P does not contain Λ, then for the equation R = Q + RP has a unique (one and only one) solution R = QP*.

Proof:

If R = QP* is a solution of the equation R = Q + RP then by putting the value of R in the RHS in the equation we get –

R = Q + RP

$R = Q + QP^*P$

$R = Q (\Lambda + P^*P)$ [By taking Q as common from both terms]

$R = QP^*$ [By identity rule we know, $\Lambda + R^*R = R^*$]

So, from here it is proved that $R = QP^*$ is a solution of the equation $R = Q + RP$.

**Now we have to prove that $R = QP^*$ is the one and only one solution of the equation $R = Q + RP$.

As $R = Q + RP$, so put the value of R again and again in the RHS of the equation.

$R = Q + RP$

$= Q + (Q + RP)P$

$= Q + QP + RPP$

$= Q(\Lambda + P) + RPP$

$= Q(\Lambda + P) + (Q + RP)PP$

$= Q(\Lambda + P) + QPP + RPPP$

$= Q(\Lambda + P + PP) + RPPP$

After several steps we shall get

$R = Q(\Lambda + P + PP + PPP + \ldots + Pn) + RPn + 1.$

$R = Q(\Lambda + P + PP + PPP + \ldots + Pn)$ [By neglecting RPn+1]**

$R = QP^*$ [As we know, $\Lambda + P + PP + PPP + \ldots + Pn = P^*$]

That means $R = QP^*$ is the unique solution of the equation $R = Q + RP$.

**(This part only contains explanation. You can exclude this.

Now let a string w belongs to R. If w is a Λ string then in which part the Λ will belong?

This string will belong to either in $Q(\Lambda + P + P2 + P3 + \text{----} Pn)$ part or in $RPn + 1$ part.

However, according to point number (ii) P does not contain Λ, so the string w does not belong to $RPn + 1$.

So, it will obviously belong to $Q(\Lambda + P + P2 + P3 + ---- Pn)$ which is nothing but QP^*. [$(\Lambda + P + P2 + P3 + ---- Pn)$ is any combination of P including Λ].)