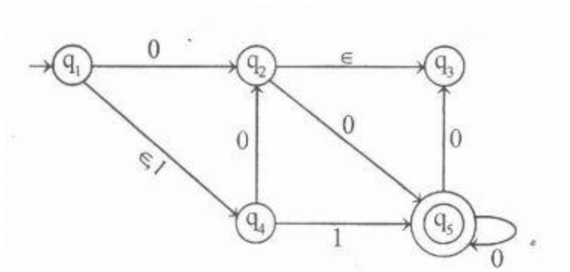
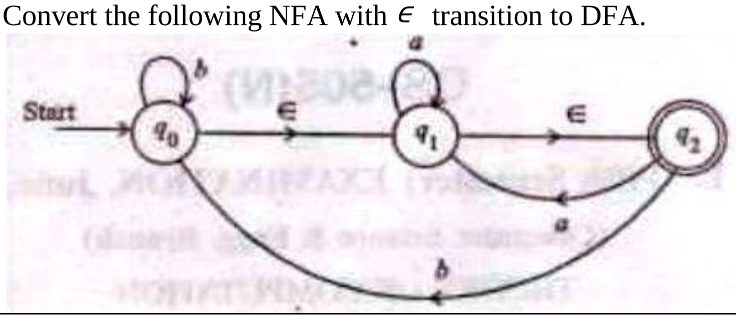
# Department of Computer Science & Engineering
# Numerical Question Bank
# Theory of Computation (CS-505)
## Semester: V

**INTRUCTIONS. 1. All questions with their solution are submitted till 27 October 2014.**

1. Construct the smallest DFA of the given FA which accepts the same language of given FA.




2. Convert the following NFA with $\epsilon$ transition to DFA.




3. State and prove Myhill- Nerode theorem.

4. Convert the following mealy machine into moore machine.

| Present state | Next state | | | |
|---|---|---|---|---|
| | $a = 0$ | | $a = 1$ | |
| | State | Output | State | Output |
| $q_0$ | $q_1$ | $n$ | $q_2$ | $n$ |
| $q_1$ | $q_1$ | $y$ | $q_2$ | $n$ |
| $q_2$ | $q_1$ | $n$ | $q_2$ | $y$ |

5. Design FA to check whether the any chosen binary number is divisible by 3.

6. Construct DFA equivalent to the given NFA, where $\delta$ is as

| | 0 | 1 |
|---|---|---|
| p | {q,s} | {q} |
| q | {r} | {q,r} |
| r | {s} | {p} |
| s | - | {p} |

<table>
<tr><td>7.</td><td>Construct an DFA for the following regular expression<br><br>$10+(0+1)0^*1$</td></tr>
<tr><td>8.</td><td>Show that the language { $0^p$ ,p is prime} is not regular.</td></tr>
<tr><td>9.</td><td>Construct the DFA to the given NFA for which have $\delta$ is as<br>
<table>
<tr><td></td><td>0</td><td>1</td></tr>
<tr><td>p</td><td>{p,q}</td><td>{p}</td></tr>
<tr><td>q</td><td>{r}</td><td>{r}</td></tr>
<tr><td>r</td><td>{s}</td><td>ϕ</td></tr>
<tr><td>*s</td><td>{s}</td><td>{s}</td></tr>
</table></td></tr>
<tr><td>10.</td><td>Design PDA corresponding to CFG<br>$S \to aSa$<br>$S \to bSb$<br>$S \to c$</td></tr>
<tr><td>11.</td><td>Construct NFA with $\epsilon$ moves for the regular expression $(0+1)^*$</td></tr>
<tr><td>12.</td><td>Convert the given regular expression into DFA.<br>$(a+bc)^*ad$</td></tr>
<tr><td>13.</td><td>Simplify the given CFG by using<br>1) elimination of $\epsilon$ transition<br>2) elimination of unit production<br>3) elimination of useless symbols<br>$S \to aA \mid aB$<br>$A \to bAA \mid aS \mid a \mid \epsilon$<br>$B \to aBB \mid bba \mid A$<br>$C \to aBA$</td></tr>
<tr><td>14.</td><td>Write the CFG for the following language:<br>i) $L = \{0^i 1^j 2^k \mid i=j \text{ or } j=k\}$<br>ii) $L = \{0^n 1^n \mid n>=1\}$</td></tr>
<tr><td>15.</td><td>Convert the following grammar into CNF.<br>$S \to baA \mid aB$<br>$A \to abAA \mid aS \mid a$<br>$B \to aBB \mid bSbb$</td></tr>
<tr><td>16.</td><td>Design a PDA for the language<br>$\{L = a^{2n}b^n \mid n>=1\}$</td></tr>
<tr><td>17.</td><td>State and Prove Pumping lemma for CFG, using some example.<br>Or<br>Explain Pumping Lemma for CFL's with the help of example</td></tr>
<tr><td>18.</td><td>Let $G$ be the grammar .<br>$S \to aB \mid bA$<br>$A \to a \mid aS \mid bAA$<br>$B \to b \mid bS \mid aBB$<br>For the string $aaabbabbba$ made</td></tr>
</table>

| | |
|---|---|
| | i) LMD<br>ii) RMD<br>iii) Parse Tree |
| 19. | Obtain the CFG for the PDA given below:<br>$A = (\{q_0, q_1\}, \{0,1\}, \{A, z\}, d, z, \{q_1\})$<br>where $\delta$ is given as:<br>$\delta(q, 0, z) = (q_0, Az)$<br>$\delta(q_0, 1, A) = (q_0, AA)$<br>$\delta(q_0, 0, A) = (q, \epsilon)$ |
| 20. | State and prove closure properties of the recursively enumerable language. |
| 21. | Design Turing Machine for the language $\{L = a^n b^n \mid n>=1\}$ |
| 22. | Construct Turing Machine for the language $\{L = a^m b^m c^m \mid m>=1\}$ |
| 23. | Construct PDA equivalent to following grammar:<br>$S \rightarrow aAA$<br>$A \rightarrow aS \mid bS \mid a$ |
| 24. | Check whether the given grammar is ambiguous or not.<br>$S \rightarrow iC + S$<br>$S \rightarrow iC + ScS$<br>$S \rightarrow a$<br>$S \rightarrow b$ |
| 25. | Construct an DFA accepting the set of all strings over the alphabets {0, 1}, such that number of 0's divisible by 5 and number of 1's divisible by 3. |
| 26. | Construct a PDA that accepts the language<br>$\{ww^R \mid w \text{ in } (0,1)^*$ *and* $w^R$ is for the reverse of the *w*. |
| 27. | Write Short note on the following:<br>1) Hamilton circuit<br>2) Travelling salesman problem<br>3) Partitioning problem<br>4) Untractable problem |