Dhaka International University

Department of Computer Science & Engineering

Question Bank

Batch No.:51(1st shift) Semester: 9th

Course Code: CSE-315 **Course Title: Theory of Computing**

<table>
<tr><td>Q.No.</td><td>Questions</td></tr>
<tr><td>1.</td><td>1. List out any four the applications of Automata Theory</td></tr>
<tr><td>2.</td><td>2. Define the following i)Alphabet ii)string iii)Language iv)∑* v)problem
Give examples for each.</td></tr>
<tr><td>3.</td><td>3. Define Deterministic Finite State Machine (DFSM) .
List out the characteristics of DFSM</td></tr>
<tr><td>3.</td><td>3. Define Deterministic Finite Automata. Design DFA for the following Languages
i)set of all strings of 0’s and 1’s containing substring 01
ii)L ={ w │ string w begins with 01 and is of even length}
iii)set of all strings of a’s and b’s that end with abb
iii) set of all strings of a’s and b’s that do not end with abb</td></tr>
<tr><td>4</td><td>4. Define Non Deterministic Finite Automata. Design NFA for the following Languages
i)set of all strings that end with substring 01
ii)set of all strings that contain 1 as a second symbol from last
iii)set of all strings that contain character ‘a’ as fourth symbol from last
iv)L ={w in {a,b}* │there exist substrings x and y in {a,b}* such that (w= x abbaa y or w= x baba y) Note: here w is a string consisting of substrings x & y</td></tr>
<tr><td>5</td><td>5. Write any five differences between NFA and DFA</td></tr>
<tr><td>6</td><td>6. Convert the following NFA to DFA
<table>
<tr><td>Ò(delta)</td><td>0</td><td>1</td></tr>
<tr><td>→q0</td><td>{q0,q1}</td><td>{q0}</td></tr>
<tr><td>q1</td><td>ϕ</td><td>{q2}</td></tr>
<tr><td>⋆q2</td><td>ϕ</td><td>ϕ</td></tr>
</table></td></tr>
<tr><td>7.</td><td>7. Define epsilon NFA. Design €-NFA for the following Languages
i)set of all strings containing an optional a followed by aa followed by any number of b’s
ii)L={w in {a,b}* │w = aba or │w│ is even } note: │w│ indicates length of string w</td></tr>
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<tr><td>8</td><td>8. Define €-closure of a state. Convert the following €-NDFSM into equivalent DFSM
<table>
<tr><td>Ò</td><td>€</td><td>a</td><td>b</td><td>c</td></tr>
<tr><td>→p</td><td>{q,r}</td><td>ϕ</td><td>{q}</td><td>{r}</td></tr>
<tr><td>q</td><td>ϕ</td><td>{p}</td><td>{r}</td><td>{p,q}</td></tr>
<tr><td>⋆r</td><td>ϕ</td><td>ϕ</td><td>ϕ</td><td>{p}</td></tr>
</table></td></tr>
<tr><td>9</td><td>9. Define Regular Expression as per basis and induction steps (Refer Page number 50 of notes)</td></tr>
<tr><td>10</td><td>10.Design Regular expressions for the following Languages
i)set of all strings of a’s and b’s that end with either a or bb
ii) L = $\{a^n b^m : (m+n) \text{ is even} \}$
iii) L =$\{ a^n b^m : n>=4, m<=3 \}$
iv)set of all strings of a’s and b’s whose fourth symbol from right end is b</td></tr>
<tr><td>11</td><td>11.Prove that every Language defined by Regular expression is also defined by is also defined by Finite Automata</td></tr>
<tr><td>12</td><td>12.Convert the following Regular expressions to €-NFA(epsilon NFA)
i)(a+b)*ab ii)((01) + 1) iii)011(0+1)*</td></tr>
<tr><td>13</td><td>13.State and prove pumping theorem for Regular Languages</td></tr>
<tr><td>14</td><td>14.Show that the L= $\{ a^n b^n \mid n>=1 \}$ is not Regular Language</td></tr>
<tr><td>15</td><td>List out closure properties of Regular Languages</td></tr>
<tr><td>16</td><td>Define i)equivalent and ii)distinguishable pair of states
Consider the following DFA
<table>
<tr><td>Ò</td><td>a</td><td>b</td></tr>
<tr><td>→q_1</td><td>q_2</td><td>q_3</td></tr>
<tr><td>q_2</td><td>q_3</td><td>q_5</td></tr>
<tr><td>*q_3</td><td>q_4</td><td>q_3</td></tr>
<tr><td>q_4</td><td>q_3</td><td>q_5</td></tr>
<tr><td>⋆q_5</td><td>q_2</td><td>q_5</td></tr>
</table>
i)Draw a table of Equivalent(in distinguishable) and distinguishable pair of states
ii)Construct minimum state DFA</td></tr>
<tr><td>17</td><td>Define Regular Grammar. Construct Regular Grammar for the following languages
i)L = {w € {a,b}* : |w| is even }
ii) L = {w € {a,b,c}* : there is a symbol a £(sigma) not appearing in string w }
iii)L= {w € {a,b}* : string w contains odd number of a’s and w ends with b }</td></tr>
<tr><td>18</td><td>Construct i) Leftmost Derivation(LMD) ii)RightMost Derivation(RMD) iii)parse tree for the string aaabab using the grammar: S→AbB A→aA |€ B →aB|bB|€</td></tr>
<tr><td>19</td><td>Explain the working of Push Down Automata (PDA)with a diagram</td></tr>
</table>

20	Design PDA for the following languages i)L= {$a^n b^n$ n>=1 }) L= {w : $n_a(w) = n_b(w)$ } over £ ={a,b}
21	Convert the following Grammars(CFGs) to PDA that accept by empty stack i)S→aSb |bSa|SS|€ ii)S→0S1|A A→1A0|S|€
22	Define i)Deterministic PDA ii)Non-Deterministic PDA
23	State and prove pumping theorem for Context Free Languages
24	Show that L= { $a^n b^n c^n$ | n>=1 } is not Context Free Language