2081:

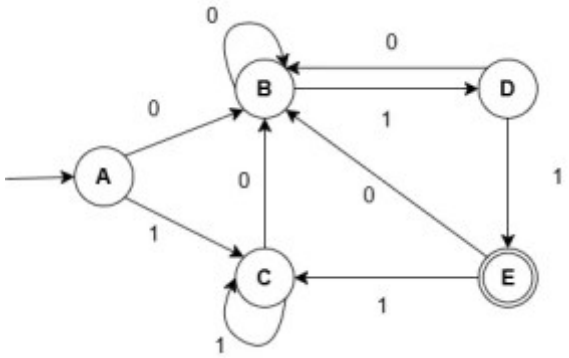
Long Answer Questions: [10 marks each]

1. Mention the transition function of PDA. List the two ways that PDA accepts the string. Convert the following CFG to PDA.

   $S \rightarrow AS \mid \varepsilon$

   $A \rightarrow Ab \mid Bb \mid ab$

2. List any two regular operators. Minimize the following finite state machine using Table Filling algorithm.



3. Define Turing machine as enumerators of strings of a language. Encode the Turing machine TM = ({q0, q1, q2} , {a, b}, {a, b, B}, δ, q2, B, F) with input w = ba and δ is defined as follows:
   δ(q0, b) → (q1, b, R), δ(q1, a) → (q2, a, R), δ(q2, a) → (q1, a, R), δ(q2, b) → (q2, b, L)

Short Answer Questions: [5 marks each]

4. Does machine always refer to hardware? Justify. Define positive closure and Kleene closure.

5. What is undecidable problem? Discuss about Post Correspondence Problem.

6. Define the language of a grammar. For the grammar S → 0S0 | 1 | ε, show the leftmost derivation for the string 00100 with its parse tree.

7. Define ε-closure of a state. Differentiate between Moore and Mealy machine.

8. Represent the following regular grammar to finite automata.

   $S \rightarrow aA \mid aB \mid \varepsilon$

   $A \rightarrow aA \mid aS$

   $B \rightarrow bB \mid \varepsilon$

9. Design the DFA that accepts binary string ending with “00” and show its extended transition function for the string 111000.

10. Convert the following grammar to CNF.

    $S \rightarrow AAB,\ A \rightarrow aA \mid \varepsilon,\ B \rightarrow ab \mid a$

11. For the following Turing Machine, test whether the string “( )))” is accepted or rejected and represent it in transition diagram.

State	X	Action (Write, Move, New State)	Y	Action (Write, Move, New State)	B	Action (Write, Move, New State)
q0	(	X,R,q1		,,q0		,,q4
q1	)	X,L,q2		Y,L,q2		Y,L,q2
q2	X	X,R,q0	Y	Y,R,q3		,R,q4
q3	(	,,q3		,,q3		,R,q4

12. Differentiate between Class P and Class NP problem. Mention the transition function of DFA, NFA, and ε-NFA.

2080-new:

Long Answer Questions: [10 marks each]

1. Describe the extended transition function of NFA. Construct a NFA, using transition table and transition diagram , over {0, 1} that accept the string having substring 01 and ends with 1. Show the acceptance of 0111.

2. Define CFG. Construct a CFG that generates the language of all palindromes over {a,b} that do not contain the substring aa. Show the leftmost derivation and construct the equivalent parse tree for string babbbab.

3. How Turing Machine is used as a computing function? Construct a TM for simulating a function f(x) = 2x for x = {1}. Iterate the TM for input 11 and generate the output 1111.

Short Answer Questions: [5 marks each]

4. Differentiate Kleen closure from positive closure. Compute positive and Kleen closure of {ab}.

5. Design a Mealy machine over {a, b} that generates output 'A' if the input string ends with aa else output 'B' if the string ends with bb.

6. Construct regular expression over {1,2,….9} that represents:
   a. strings of even numbers with length 4 starting with 2 and ending with 8.
   b. strings starting with odd numbers and ending with even numbers.

7. Prove that the language L ={an bn cn | n≥0} is not a context free grammar.

8. Construct a PDA that accepts string over Σ ={a,b} that contains equal number of a's followed by equal number of b's. Show acceptance of aabb and aab.

9. Describe how multi-stack TM is different from the semi-infinite tape TM?

10. What is intractability? Define time and space complexity of Turing machine.

11. How conversion of PDA to CFG done ? Illustrate with example.

12. State Arden’s theorem. Convert following DFA into its regular expression using Arden theorem.

	0	1
→ * Q1	Q1	Q2
Q2	Q3	Q2
Q3	Q1	Q2

Model:

Long Answer Questions: [10 marks each]

1. Define the extended transition function of DFA. Draw a DFA accepting language L = {1^n | n = 2, 3, 4…. }. Show acceptance of strings 1110011 and 1110 using extended transition function.

2. What is deterministic pushdown automaton? Configure a pushdown automaton accepting the language, L={w C w^R | w ∈ $(0,1)^*$}. Show instantaneous description of strings 011C110 and 10C10.

3. How does a Turing Machine work? Construct a Turing machine accepting the language L = {$(^n)^n$}. Also show the transition diagram of the machine. Illustrate whether a string (()) is accepted by the Turing machine or not.

Short Answer Questions: [5 marks each]

4. When a grammar is said to be in CNF? Convert the following grammar to CNF:

   S → 1A | 0B | ε

   A → 1AA | 0S | 0

   B → 0BB | 1 | A

   C → CA | CS

5. Define epsilon NFA. Configure equivalent epsilon NFA for the regular expression (ab U a)*.

6. Differentiate Kleene closure from positive closure. For ∑ = {0,1}, compute ∑* and ∑2.

7. Write the regular expression over {0,1} for strings:
   a. Not ending with 0
   b. Of length at least 3 that ends with 00.

8. What is undecidable problem? Define post's correspondence problem with an example.

9. How pumping lemma can be used to prove that any language is not a regular language? Show that language, L = {0n1n | n>0} is not a regular language.

10. Discuss how Turing Machine with multiple tracks differs from a Turing Machine with multiple tapes.

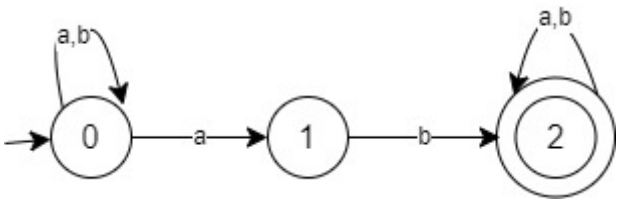
11. How are context free grammars defined? Write a context free grammar over {0,1}, where the strings start and end with the same symbol.

12. What is halting problem? How can you argue that halting problem is undecidable?

2080:

Long Answer Questions: [10 marks each]

1. What is NFA? How is it different from DFA? How is NFA to DFA conversion done? Convert the following NFA into DFA.



2. How does Turing machine accept a string? Design a Turing Machine over the alphabet {0,1,a} that processes the string defined by L = {a01a,a10a,a0101a}. Show both transition diagram and table. Show acceptance of a0101a.

3. Define context free grammar with an example. Explain with example, how context free grammar is converted to Chomsky Normal Form.

Short Answer Questions: [5 marks each]

4. Define string, substring, empty string, and empty language over alphabet {a,b}.

5. Design a DFA that accepts single line and multi-line comments of the C-Language.

6. Write regular expression over {a,b} that represents:
    a. Strings having exactly two a's and at least two b's.
    b. Strings having an even number of a's and each a followed by at least one b.

7. Using pumping lemma, prove that the language L = {aibjck | j=i+k} is not regular.

8. Design a PDA over {x,y} which accepts strings defined by the language L = {xnynxy | n>=0}. Show acceptance of xyxy.

9. Design a Turing machine that computes a function f(n)=0.

10. How abstract, decision and optimization problems are different from each other?

11. How is PDA to CFG conversion done? Consider a PDA that accepts by empty stack,
    P=({p,q},{0,1},{Z},δ,p,z); with δ defined as
    δ(p,0,z)=(p,0z), δ(p,0,0)=(p,00), δ(p,1,0)=(p,ε), δ(p,ε,z)=(q,ε),
    Now construct an equivalent CFG.

12. What is the meaning of the term “Context Free” in context free grammar? Justify with a suitable example. What is the need of a parse tree?

2079:

Long Answer Questions: [10 marks each]

1. Show that, For any NFA N=(Q, ∑, δ, q0, F) accepting language L=∑, There is a DFA D= (Q', ∑', q0′, δ', F') accepting the same language L.

2. State and prove the Pumping Lemma for regular languages. How can you show with example that pumping lemma is used to prove that a given language is not a regular? Explain.

3. Given the following expression grammar for simple arithmetic expression with operator + and *.
   E→ E+T | T
   T → T+F | F
   F → (E) | a
   Remove the left recursion from this grammar then simplify and convert to CNF.

Short Answer Questions: [5 marks each]

4. Explain the ε-closure of states on an ε-NFA with suitable examples.

5. Convert the following regular expression into equivalent Finite Automata
   a. (0+1)*10(1+0)
   b. 1*0(0+1)*1

6. Define the term: Parse Tree, left-most and right-most derivation, sentential form and ambiguity with example.

7. Give the formal definition of Push Down Automata. How CFG can be converted into equivalent PDA. Explain with an example.

8. Define regular grammar. Also explain the method of converting right linear grammar into equivalent finite automata.

9. Construct a Turing machine that accepts the language, L = { $a^n b^n$ | n≥0}.
10. Define Turing machine and its roles.

11. Explain about the complexity classes p, NP and NP-Complete.

12. Write short notes (Any two) :
    a. Big Oh, Big Omega and Big Theta
    b. Tractable and Intractable Problems
    c. Chomsky Hierarchy

2078:

Long Answer Questions: [10 marks each]

1. Give the formal definition of DFA and NFA. How NFA can be converted into equivalent DFA? Explain with suitable example.

2. Find the minimum state DFA for the given DFA below:

States	Input	
	0	1
A	B	F
B	E	C
C	B	D
*D	E	F
E	B	C
F	B	A

3. Construct a Turing Machine that accepts the language of odd length strings over alphabet {a, b}. Give the complete encoding for this TM as well as its input string w = abb in binary alphabet that is recognized by Universal Turing Machine.

Short Answer Questions: [5 marks each]

4. Define the term alphabet, prefix and suffix of string, concatenation and Kleen closure with example.

5. Give the regular expressions for the following language over alphabet {a, b}.
    a. Set of all strings with substring bab or abb.
    b. Set of all strings whose 3^{rd} symbol is ‘a’ and 5^{th} symbol is ‘b’.

6. Show that L = { a^n | n is a prime number } is not a regular language.

7. Explain about the Chomsky's Hierarchy about the language and programs.

8. Define a Push Down Automata. Construct a PDA that accepts L = {$a^n b^n$ | n > 0}.

9. Construct the following grammar into Chomsky Normal Form.

   $S \rightarrow abSb \mid a \mid aAb$

   $A \rightarrow bS \mid aAAb \mid \varepsilon$

10. Define Turing Machine and explain its different variations.

11. What do you mean by computational Complexity? Explain the time and space complexity of a Turing machine.

12. Explain the term Intractability. Is SAT problem intractable? Justify.

2076:

Long Answer Questions: [10 marks each]

1. Define the NFA with ε-transition and ε-closure of a state. Show that for every regular expression r, representing a language L, there is ε-NFA accepting the same language. Also convert regular expression (a+b)*ab* into equivalent Finite Automata.

2. How can you define the language accepted by a PDA? Explain how a PDA accepting language by empty stack is converted into an equivalent PDA accepting by final state and vice-versa.

3. Define a Turing machine. Construct a TM that accept L = {wcw^R | w∈(0, 1) and c is ε or 0 or 1. Show that string 0110 is accepted by this TM with sequence of Instantaneous Description (ID).

Short Answer Questions: [5 marks each]

4. Give the formal definition of DFA. Construct a DFA accepting all strings of {0, 1} with even number of 0's and even number of 1's.

5. Define Chomsky Normal Form and Greibach Normal Form in reference to CFG. Give a suitable example of each.

6. Give the regular expressions for following language over alphabet {0, 1}.
   a. Set of all strings with 2^{nd} symbol from right is 1.
   b. Set of all strings starting with 00 or 11 and ending with 10 or 01.

7. Show that language L={0^m1^m | m>=1} is not a regular language.

8. Describe the Turing machines with multiple tape, multiple track and storage in state.

9. Construct a NFA accepting language of {0, 1} with each string ending with 01 and convert it into equivalent DFA.

10. Construct a PDA accepting language over {0, 1} representing strings with equal no of 0s and1s. Show by sequence of IDs that 0101 is accepted by this PDA.

11. Define complexity of a Turing machine. Explain about big Oh, big Omega and big Theta notation used for complexity measurement.

12. What do you mean by tractable and Intractable problems? Explain with reference to TM.