Total No. of Questions : 8]

SEAT No. : [ ]

P806

[Total No. of Pages : 2

[5870]-1126
T.E. (Computer Engineering)
THEORY OF COMPUTATIONS
(2019 Pattern) (Semester-I) (310242)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Figures to the right side indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Assume suitable data, if necessary.***

Q1) a) Write a grammar G for generating the language **[9]**
i) L={w belongs to {a,b}* | w is an even length palindrome with |w|>0}
ii) Set of odd length strings in {0,1}* with middle symbol '1'

b) Simplify the following grammar **[9]**
S→ 0A0|1B1|BB
A→ C
B→ S|A
C→ S|€

OR

Q2) a) Reduce the following grammar to Greibach Normal form. **[9]**
S→ AA | 0
A→ SS | 1

b) Construct a DFA for the following left linear grammar. **[9]**
S→ B1/A0/C0
B→ B1/1
A→ A1/B1/C0
C→ A0

Q3) a) Construct a context free grammar which accepts N(A), where **[9]**
A = ({q0,q1}, {0,1}, {Z0,Z}, δ, q0, Z0, φ}-where δ is given by
δ (q0, 1, Z0) = {(q0, ZZ0)}
δ (q0, ε, Z0) = {(q0,ε)}
δ (q0, 1, Z) = {(q0, Z Z)}
δ (q0, 0, Z) = {(q1, Z)}
δ (q1, 1, Z) = {(q1, ε)}
δ (q1, 0, Z0) = {(q0, Z0)}

P.T.O.

b) Construct a PDA that accept the language generated by grammar **[8]**

i) $S \rightarrow 0S1|A, A \rightarrow 1A0|S|€$

ii) $S \rightarrow aABB|aAA, A \rightarrow aBB|a, B \rightarrow bAA|A$

OR

Q4) a) What is NPDA? Construct a NPDA for the set of all strings over {a,b} with odd length palindrome. **[9]**

b) Design a push down automaton to recognize the language generated by the following grammar: **[8]**

$S \rightarrow S + S \mid S \square S \mid 4 \mid 2$

Show the acceptance of the input string 2 + 2*4 by this PDA.

Q5) a) What is a Turing Machine? Give the formal definition of TM. **[9]**
Design a TM that replaces every occurrence of abb by baa.

b) What are the different ways for extension of TM? Explain. **[9]**
Design TM for language L = {a^i b^j | i<j}

OR

Q6) a) What is TM? Design TM to check well formedness of Parenthesis. Expand the transition for (())() **[9]**

b) Elaborate the following terms **[9]**

i) Universal Turing Machine (UTM)

ii) Recursively Enumerable Languages

iii) Halting Problem of Turing Machine

Q7) a) Justify "Halting Problem of Turing machine is undecidable". **[9]**

b) Define the Class P and Class NP and Problem with their example in detail. **[8]**

OR

Q8) a) Explain Satisfiability Problem and SAT Problem and comment on NP Completeness of the SAT Problem. **[9]**

b) What do you mean by polynomial time reduction? Explain with suitable example. **[8]**

Total No. of Questions : 8]

SEAT No. : [ ]

PA-1442

[Total No. of Pages : 3

[5926]-58

T.E. (Computer Engg.)
THEORY OF COMPUTATION
(2019 Pattern) (Semester-I) (310242)

Time : 2½ Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***Answer Q1 or Q2, Q3. orQ4, Q5 or Q6, and Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figure to the right indicate full marks.***
4) ***Assume suiable data if necessary.***

Q1) a) Convert the following grammar to Chomsky Normal form (CNF) **[9]**

$S \rightarrow a \mid aA \mid B$

$A \rightarrow aBB \mid \varepsilon$

$B \rightarrow Aa \mid b$

b) Convert the following grammar to GNF. **[9]**

$S \rightarrow XB \mid AA$

$A \rightarrow a \mid SA$

$B \rightarrow b$

$X \rightarrow a$

OR

Q2) a) Show that the following grammar is ambiguous. **[6]**

S-> iCtS

S-> iCtSes

S-> a

C-> b

b) Convert the following grammar to chomsky normal form (CNF) **[6]**

G=({S}, {a, b}, P, S)

P = {$S \rightarrow aSa \mid bSb \mid a \mid b \mid aa \mid bb$}

P.T.O.

c) Consider the following grammar. **[6]**

E-> E + E | E–E | id

Derive the string id-id*id using

i) Leftmost derivation

ii) Rightmost derivation.

Q3) a) Find the transition rules of PDA for accepting a language

L={w∈{a,b}* |w is of the a^nb^n with n≥1} through both empty stack and final state and demonstrates the stack operation for the string aaabbb. **[9]**

b) Design a PDA for accepting a language $\{a^nb^{2n} \mid n>=1\}$ **[9]**

Simulate this PDA for the input string "aaabbbbbb".

OR

Q4) a) Design a PDA for accepting a language $\{0^n1^m0^n \mid m, n>=1\}$.

Simulate this PDA for the input string "0011100". **[9]**

b) Construct a PDA for $L=\{0^n1^m2^m3^n \mid m,n\geq 0\}$ **[6]**

c) Compare FA and PDA. **[3]**

Q5) a) Write a short note on Halting problem of Turing machine. **[4]**

b) Design a Turing Machine for the following language by Considering transition table and diagram. **[9]**

i) TM That erases all non blank symbols on the tape where the sequence of non blank symbols does not contain any blank symbol B in between.

ii) TM that find 2's complement of a binary machine.

c) Design a Turing Machine that reads a string representing a binary number and erases all leading 0's in the string. However, if the string comprises of only 0's it keeps one 0. **[5]**

OR

Q6) a) Write short notes on: **[4]**

i) Reducibility

ii) Multi-tape Turing Machine

b) Construct a Turing Machine for R=aba*b **[6]**

c) Design a TM that multiplies two unary numbers over Σ={1}. Write simulation for the string 11*111. **[8]**

Q7) a) Justify " Halting problem of Turing machine is undecidable" **[8]**

b) Define and compare class P and class NP problem with suitable diagram **[8]**

OR

Q8) a) Explain in brief the term "recursively enumerable". **[6]**

b) Explain examples of problems in NP. **[6]**

c) Differentiate between P Class and NP class. **[4]**

Total No. of Questions : 8]

SEAT No. :

P269

[Total No. of Pages : 2

[6003]-347
T.E. (Computer Engineering)
THEORY OF COMPUTATION
(2019 Pattern) (Semester-I) (310242)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Give a Context Free Grammar for the following language. **[9]**

i) L1=$\{a^i b^j c^k \mid i = j + k\}$ such that $i, j, k > 0$

ii) L2=$\{a^i b^j c^k \mid j = i + k\}$ such that $i, j, k > 0$

b) Reduce the following grammar to Greibach Normal form. **[9]**

S→SS, S→0S1 01

OR

Q2) a) Show that the following grammar is ambiguous. **[6]**

S-> iCtS

S-> iCtSeS

S-> a

C-> b

b) Convert the following grammar to Chomsky Normal Form (CNF). **[6]**

G=({S}, {a,b}, P,S)

P={S → aSa | bSb | a | b | aa | bb}

c) Consider the following grammar. **[6]**

E -> E + E | E – E | id

Derive the string id-id*id using

i) Leftmost derivation

ii) Rightmost derivation

Q3) a) Find the transition rules of PDA for accepting a language L={w □{a,b}*|w is of the $a^n b^n$ with n ≥1}through both empty stack and final state and demonstrates the stack operation for the string aaabbb. **[9]**

P.T.O.

b) Design a push down automation to recognize the language generated by the following
grammar :
S→S + S | S □ S | 4 |2
Show the acceptance of the input string 2+2*4 by this PDA. **[8]**

OR

Q4) a) What is NPDA? Construct a NPDA for the set of all strings over {a,b} with odd length palindrome. **[9]**

b) Design a push down automation to recognize the language generated by the following. **[8]**
S→S + S | S □ S | 4 |2
Show the acceptance of the input string 2+2*4 by this PDA.

Q5) a) Design a Turing Machine for the following language by considering transition table and diagram. **[9]**
i) TM that erases all non blank symbols on the tape where the sequence of non blank symbols does not contain any blank symbol B in between.
ii) TM that find 2's complement of a binary machine.

b) What is TM? Design TM to check well formedness of parenthesis. Expand the transition for (())() **[9]**

OR

Q6) a) How turing machine can be use to compute the functions? Design turing machine for multiplication of two numbers. **[9]**

b) Elaborate the following terms. **[9]**
i) Universal Turing Machine (UTM)
ii) Recursively Enumerable Languages
iii) Halting problem of Turing Machine

Q7) a) Define and Compare Class P and Class NP Problem with suitable diagram. **[9]**

b) What do you mean by polynomial time reduction? Explain with suitable example. **[8]**

OR

Q8) a) Explain Satisfiability Problem and SAT Problem and comment on NP Completeness of the SAT Problem. **[9]**

b) What makes a problem NP-Complete? How do we prove a problem is NP-complete? Are all decision problems NP-complete? **[8]**

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Total No. of Questions : 8]

SEAT No. :

P-7858

[Total No. of Pages : 3

[6180]-46A

T.E. (Computer Engineering)

THEORY OF COMPUTATION

(2019 Pattern) (Semester - I) (310242)

Time : 2½ Hours] *[Max. Marks : 70*

Instructions to the candidates :

1) ***Answer Q1 or Q2, Q3 or Q4, Q5 or Q6, Q7 or Q8.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Assume suitable data, if necessary.***

Q1) a) Check whether the string *10010* is a member of the language generated by following grammar by using Cocke-Younger-Kasami Algorithm- **[9]**

$S \rightarrow AB|BC$

$A \rightarrow BA|0$

$B \rightarrow CC|1$

$C \rightarrow AB|0$

b) Obtain grammar to generate the following language : **[8]**

$L = \{w : n_a(w) \bmod 2=0 \text{ where } w \in \{a, b\}^*\}$

i.e. Language of a and b in which number of number of a's in the string is either zero or in multiple of 2 only.

OR

Q2) a) **[9]**

$S \rightarrow aB|bA$

$A \rightarrow a|aS|bAA$

$B \rightarrow b|bS|aBB$

Derive using Leftmost Derivation and Rightmost Derivation:

i) bbaaba ii) aaabbb.

Draw parse tree for the same.

P.T.O.

b) Find context Free Grammar generating each of these languages. **[8]**

i) $L1=\{a^i b^j c^k$ such that i = j+k where I, j, k > = 1$\}$

ii) $L2=\{a^i b^j c^k$ such that j = i+k where I, j, k > = 1$\}$

Q3) a) Construct a PDA equivalent to following CFG **[10]**

i)

$X \rightarrow 0$

$X \rightarrow 0X$

$X \rightarrow 1XX$

$X \rightarrow XX1$

$X \rightarrow X1X$

ii) $S \rightarrow BD|BC$

$D \rightarrow SC$

$C \rightarrow AA$

$B \rightarrow 0$

$A \rightarrow 1$

b) Design a PDA for a language $L=\{a^n b^{2n} | n >= 1\}$ **[8]**

OR

Q4) a) Construct a PDA accepting the language $L=\{a^n b^m a^n \mid n,m>=0\}$ by null store. **[6]**

b) Design a PDA for a language $L=\{XcX^r | X€\{a,b\}^*$ and string X^r is the reverse of string X$\}$. **[6]**

c) Obtain a PDA to accept the language -

$L=\{w|w€\sum^*, \sum=\{a,b\}$ and $n_a(w) = n_b(w)\}$ by final state **[6]**

Q5) a) Design a Turing machine for well formed parenthesis. **[6]**

b) Design a TM that accepts all strings over {1,0} with even number of 0's and even number of 1's. **[8]**

c) Construct TM that recognizes language over alphabet 0,1 such that string ends in 10. **[4]**

OR

Q6) a) Construct a TM to accept the language over {0,1} containing the substring 001. **[6]**

b) Design a TM to multiply a unary number by 2. **[8]**

c) Design Turing Machine for l's Complement. **[4]**

Q7) a) What is post correspondence problem? Explain PCP with following instance of the set of the strings A and B. **[8]**

	A	B
1.	1	111
2.	10111	10
3.	10	0

b) State and explain with suitable example **[9]**

i) Decidable Problem

ii) Undecidable Problem

iii) Church-Turing Thesis.

OR

Q8) a) What is reducibility in Computability Theory ? Explain in detail, the polynomial - time reduction approach for proving that a problem is NP-Complete. **[8]**

b) Explain with suitable example and diagrams **[9]**

i) Halting problem of TM

ii) Multitape TM

iii) Universal TM

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