SASTRA UNIVERSITY

(A University under section 3 of the UGC Act, 1956)

B.Tech. Degree Examinations **May 2012**

Fifth Semester

Course Code: **BCSDCS 504**

Course: **THEORY OF COMPUTATION**

Question Paper No. : **B0828** Duration: **3** hours

Max. Marks: **100**

PART – A

Answer all the questions **20 x 2 = 40 Marks**

1. Explain the concepts of Grammar and Language with an example.

2. Let $L = \{0^n1^n \mid n \geq 0\}$. Describe the language L^2 in words.

3. Sketch a Machine that accepts all binary strings ending with 1.

4. Define a Finite automaton.

5. Draw the diagram of the automaton with start S and accepting state T.

	0	1
S	S	T
T	S	T

6. Describe the language accepted by the automaton in question no. 5.

7. Describe the language accepted by the automaton given below, where S is both the start and the accepting states.

	0	1
S	S	T
T	S	T

8. Define a regular language with an example.

9. True or False: Regular languages are closed under union.

10. Give a formal definition of a Non-deterministic finite automaton.

11. Define a context-free language with an example.

12. What are variables? What are terminals?

13. What is Chomsky's Normal Form?

14. In the language generated by S $\rightarrow$aSb|bSa|€, derive the string abababab.

15. Give a simple application of the pumping Lemma for CFG.

16. Define a Turing Machine.

17. Give an example of a Recursive Function.

18. Define space and time complexity.

19. Define NP and give an example.

20. Give two examples of NP-complete problems.

PART – B

Answer all the questions **4 x 15 = 60 Marks**

21. State the Pumping Lemma for regular language and sketch the proof.

(OR)

22. Use Pumping Lemma to prove that $\{0^n1^n | n \geq 0\}$ is not a regular language.

23. Briefly explain how you would convert a NDFA to a DFA.

(OR)

24. Prove that regular languages are closed under union.

25. Describe a PDA that accepts $\{0^n1^n | n \geq 0\}$.

(OR)

26. Show that the language $L = \{a^nb^nc^n | n \geq 0\}$ is not context free.

27. Describe Turing machine that generates the language consisting of all strings 0^N where N is a power of 2.

(OR)

28. Describe the Turing machine that generates the language consisting of all binary strings with equal number of 1's and 0's.

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B.Tech. Degree Examinations

May 2013

Fifth Semester

Course Code: **BCSDCS 504**

Course: **THEORY OF COMPUTATION**

Question Paper No. : **B0668**

Duration: **3 hours**

Max. Marks: **100**

PART – A

Answer all the questions **20 x 2 = 40 Marks**

1. Write a grammar for the language $L = \{a^n b^m / n, m \geq 1\}$.

2. Using pumping lemma, show that $L = \{a^{n^2} / n \geq 1\}$ is not regular.

3. Define deterministic finite state automaton.

4. Draw a finite state diagram for the following regular expression. (a + ab*)* ab.

5. Find L(r) where r = (aa)* (bb)*b.

6. Define Chomsky Normal form.

7. Convert the following CFG into CNF.
   S → a s b A B ; S → a b b

8. Convert the following grammar into Greibach Normal form.
   S → a s a a b ; S → a A B a b

9. Draw a derivation tree for the following grammar for the word a b b b b.

$S \rightarrow aAB$; $A \rightarrow bBb$; $B \rightarrow A / \lambda$.

10. Define left most and right most derivations.

11. Define pumping lemma for context free grammar.

12. What is push down automaton?

13. Give an example of a context free grammar but not a regular grammar.

14. Write down the context free grammar for the language

$L = \{ww^R / w \in \{a, b\}^*$

15. If L is a context free language then show that $\bar{L}$ is also context free language.

16. Define Turing machine.

17. What is Turing thesis?

18. State the uses of tape in Turing machine.

19. Comment on the following statement:
"Turing machines are Transducers".

20. What is computable language?

PART – B

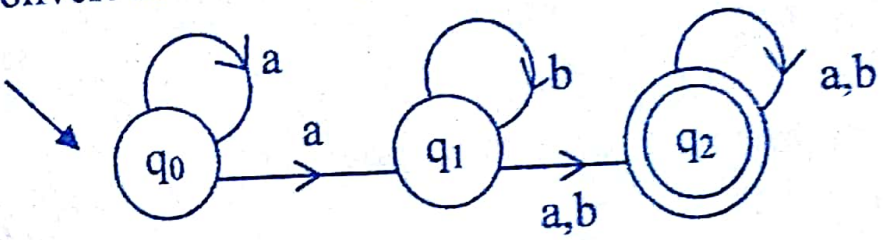
Answer all the questions **4 x 15 = 60 Marks**

21. (a) Construct a DFA for the language
$L = \{w / w$ contains an even number of a's and b's$\}$ (8)

(b) Using pumping lemma, show that the language $L = \{a^n b^n / n \geq 1\}$ is not regular. (7)

(OR)

22. Convert the following NFA into DFA



Also minimize the DFA.

23. (a) Construct a grammar for the language $L = \{a^n b^n c^n / n \geq 1\}$. (9)

(b) Convert the following CFG into CNF. (6)

$S \rightarrow A\ a\ B\ a\ b$

$B \rightarrow A\ a\ a\ B$

$A \rightarrow a\ B\ B$

(OR)

24. (a) Show that every $\in$-free context free language can be generated by context free grammar in Greibach Normal form. (9)

(b) Convert the following CFG into GNF:

$S \rightarrow a\ s\ b\ c$; $S \rightarrow b\ A$; $S \rightarrow C$, $A \rightarrow b\ A$, $A \rightarrow a$.

Where $S, A \in N$ and $a, b, c \in T$. (6)

25. (a) Using pumping lemma, show that $L = \{a^n b^n c^n / n \geq 1\}$ is not a CFL. (8)

(b) Construct a push down automaton for the language
$L = \{a^n b^n c^m / n, m \geq 1\}$ (7)

(OR)

26. (a) Construct a push down automaton for the language
$L = \{a^n b^{3n} / n \geq 1\}$. (8)

(b) Using pumping lemma, show that the language
$L = \{a^{n!} / n \geq 0\}$ is not CFL. (7)

27. Construct a Turing machine to compute the following function.

$$f(x,y) = \begin{cases} x - y & if\ x > y \\ 0 & if\ x \leq y \end{cases}$$

Where x & y are positive integers.

(OR)

28. (a) Write short notes on:
(i) Turing machines with semi-infinite tape. (3)
(ii) Off-line turing machine (3)

(b) Construct a turing machine for the language $L = \{a^n b^n / n \geq 1\}$ (9)

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B.Tech. Degree Examinations **November 2013**

Fifth Semester

Course Code: **BCSDCS 504**

Course: **THEORY OF COMPUTATION**

Question Paper No. : **B0591** Duration: **3** hours

Max. Marks: **100**

PART – A

Answer all the questions **20 x 2 = 40 Marks**

1. Define finite state automaton.
2. What is regular expression?
3. Draw a finite state diagram for the following regular expression $(aa^* + b)^*$
4. State pumping lemma for regular language.
5. Define regular grammar.
6. What is ambiguity grammar?
7. Draw a two different derivation trees for the word a+b*c from the following grammar:
   $E \rightarrow I;\ E \rightarrow E + E;\ E \rightarrow E * E;\ E \rightarrow (E);\ I \rightarrow a \mid b \mid c$
8. Define Greibach Normal form.

9. Convert the grammar with productions
$S \rightarrow ABa$; $A \rightarrow aab$; $B \rightarrow Ac$
to Chomsky normal form.

10. Convert the grammar $S \rightarrow abSb \mid aa$ into Greibach Normal form.

11. Define push down automaton.

12. Define pushing lemma for context free grammar.

13. Construct a grammar for the language $L = \{a^n b^n / n \geq 1\}$.

14. Show that the family of context free language is closed under union.

15. Comment on the following statement:
$\delta(q_0, a, z_0) = \{(q_1, z_0 z_1), (q_2, z_2)\}$

16. Define Turing machine.

17. When we call a turing machine as "Standard Turing machine"?

18. What is Turing – computable?

19. Define off-line Turing machine.

20. Write a short note on multitape turing machine.

PART – B

Answer all the questions **4 x 15 = 60 Marks**

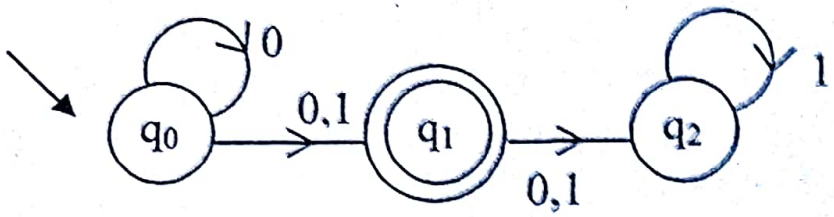
21. (a) Construct a finite state automaton for the language
$L = \{a^m b^n / m, n \geq 1\}$. (8)

(b) Show that the language L = {a^n / n is prime} is not regular. (7)

(OR)

22. (a) Show that the language L is accepted by NFA then it is also accepted by DFA. (5)

(b) Convert the following NFA into DFA



(10)

23. (a) Construct a context free grammar for the language
L = {wcw^R / w∈{a, b}*} (8)

(b) Convert the following grammar into CNF.
S → a S A B a b | a A A B | a a b b (7)

(OR)

24. (a) Construct a context free grammar for the language
L = {$a^n b^n$ / n ≥ 1} (5)

(b) Show that any context free grammar G = (N, T, S, P) with ε∉ L(G) has an equivalent grammar $\overline{G} = (\overline{N}, \overline{T}, S, \overline{P})$ in CNF. (10)

25. (a) Construct a pushdown automaton for the language
L = {w c w^R / w ∈{a, b}* (10)

(b) Using pumping lemma, show that the language
$L = \{a^{n^2} b^n / n \geq 1\}$ is not CFL. (5)

(OR)

26. (a) Construct a push down automaton for the language
$L = \{a^n b^n / n \geq 1\}$ (10)

(b) Using pumping lemma, show that the language
$L = \{a^n b^m / n$ and m are both prime$\}$ is not CFL. (5)

27. (a) Write short notes on:
(i) Storage in Turing machine. (3)
(ii) Two way infinite tape (3)

(b) Given two positive integers x and y, design a turing machine that computes x + y. (9)

(OR)

28. (a) Design a turing machine that accepts the language
$L = \{a^n b^n / n \geq 1\}$ (10)

(b) Write short notes on "Turing's Thesis". (5)

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SASTRA UNIVERSITY

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B.Tech. Degree Examinations

November 2017

End Semester

Course Code: **BCSCCS 502R03 / BITCIT 502R02 / BICCIC 502R03**

Course: **THEORY OF COMPUTATION**

Question Paper No. : **B0556**

Duration: **3 hours**

Max. Marks: **100**

PART – A

Answer all the questions **10 x 2 = 20 Marks**

1. Describe Set.
2. What is JFLAP?
3. Define Pigeonhole principle.
4. Describe Push down automata.
5. What is the need for context free languages?
6. Write the format of Greibach normal form.
7. Write a note on Turing machines.
8. What is Linear bounded automata?
9. Write the format of context-sensitive grammar.
10. Define post system.

PART – B

Answer all the questions **4 x 15 = 60 Marks**

11. (a) Show that $\sqrt{2}$ is irrational. (5)

(b) Give DFA for the language $L=\{ab^5wb^2 : w\in\{a,b\}^*\}$. (10)

(OR)

12. (a) Find the regular expression for the language

$L=\{w\in\{a,b\}^* : n_a(w) \text{ is even and } n_b(w) \text{ is odd}\}$. (9)

(b) Construct left and right linear grammar for the language

$L=\{a^nb^m : n>=2, m>=3\}$. (6)

13. (a) Explain about CYK algorithm with an example. (7)

(b) Remove all unit, useless and λ productions from the grammar. S→aA/aBB, A→aaA/λ, B→bB/bbC, C→B. What language does this grammar generate? (8)

(OR)

14. (a) Construct npda for language $L=\{a^nb^n : n>=0\}$. (8)

(b) Is the language $L=\{a^nb^n : n>=1\}$ U {a} deterministic? Prove it. (7)

15. Design a Turing machine that computes x + y two positive integers in unary notation.

(OR)

16. State and prove Pumping Lemma for context free languages and linear languages.

17. (a) Elaborate the Complexity classes P and NP. (7)
(b) Explain in detail about Post system. (8)

(OR)

18. Prove that there exists a recursively enumerable language whose complement is not recursively enumerable.

PART – C

Answer the following **1 x 20 = 20 Marks**

19. (a) State and prove pumping lemma for regular languages. (10)
(b) Design a Turing machine that copies strings of 1's. (10)

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