R.V.COLLEGE OF ENGINEERING, BANGALORE – 59.

Autonomous Syllabus, 2010.

**Theory of Computation(10CS44)**

**Model paper 1**

**Exam Marks: 100 Exam Hours: 3 hrs**

**All questions in part A are compulsory. Answer 5 full questions from Part B**

**PART A**

1. Є is string with length =…………………………. (1M)
2. --------------------------------is a finite sequence of symbols chosen from some alphabet. (1M)
3. δ\*(q, Є) = (1M)
4. Σ0 is equal to ---------------- (1M)
5. If L1= {a,ab,ba}, L2={b,aa} the L1L2 = (1M)
6. Pumping lemma for Context free language states that (1M)
7. If is CFL and R is regular language then L ∩R is--------------------(Regular/Context free) (1M)
8. Whether the following grammars is ambiguous or unambiguous (2M)

S🡪S1S2|bS|a S1🡪a, S2🡪b

1. Two Conditions for DPDA (2M)
2. The languages accepted TM is called as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ . (1M)
3. For ∑ ={0,1} ,design a Turing machine that accepts the language denoted by the regular expression 101\* (2M)
4. Transition function ∂ for multi stack TM is (2M)
5. Define GNF (2M)
6. **Match the following** (2M)

a. Empty string i. δ\*

b. Null string ii. Σ\*

c. Alphabet iii. Ф

d. power set iv. Є

v. Σ

**PART B**

1. a) Define DFA and construct a DFA to recognize binary numbers divisible by 5. Show the computation on the string 1111 8 marks

b)Compute the Є -closure for the Є -NFA given below 8 marks

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Є | A | b | c |
| 🡪p | Φ | {p} | {q} | {r} |
| q | {p} | {q} | {r} | Φ |
| \* r | {q} | {r} | Φ | {p} |

**OR**

2. a) Convert the Є -NFA to given below to DFA 8 marks

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | + | - | 0-9 | . | Є |
| 🡪1 | 2 | 2 | Φ | Φ | 2 |
| 2 | Φ | Φ | {2,5} | 3 | Φ |
| 3 | Φ | Φ | 4 | Φ | Φ |
| 4 | Φ | Φ | 4 | Φ | 6 |
| 5 | Φ | Φ | Φ | 4 | Φ |
| 6 | Φ | Φ | Φ | Φ | Φ |

b) Define NFA and design NFA to recognize the following set of strings

i) 0101, 101, 011 (assume Σ ={0,1})

ii) abc, abd (assume Σ ={a,b}) 8 marks

3. a) State and prove Kleens theorem 8 marks

b) Define RE. Write the regular expression for the following languages 8 marks

i) The set of all strings over alphabet {a, b, c} containing atleast one a and atleast

one b.

ii) L={w: |w| mod 3 =0}over the language on {a.b}

iii) The set of strings of 0’s and 1’s with atmost one pair of consecutive 1’s

**OR**

4 a)Define ambiguity. Show that the following grammar is ambiguous 8 marks

S🡪 aSbS

S🡪 bSaS

S🡪 Є

b)Define CFG. Show that the Language L={anbm | n ≠ m is context free by generating

CFG for the language 8 marks

5. a) Define PDA and construct a PDA to accept stings containing equal number

of a’s and b’s 8 marks

b) For the grammar 8 marks

S🡪 aABB | aAA

A🡪 aBB | a

B🡪 bBB | A

C🡪 a

Obtain the corresponding PDA

**OR**

6 a) Construct a PDA to accept the Language L={a nb2n | n ≥1 } 7 marks

b) Define CNF. Transform the grammar with productions 9 marks

S🡪abAB

A🡪bAB| Є

B🡪Baa | A | Є to CNF

7. a) Explain the closure properties of CFL’s with example for each. 10 marks

b) Design a Turing Machine that accepts L={a nbn ; n ≥1} 06 marks

**OR**

8. a) State and prove pumping lemma for CFL 06 marks

b) Design a Turing Machine that accepts 10 marks

i) {wwR | w is any string of 0’s and 1’s}

ii) {w | w is even & Σ ={a,b}

9. a) Define a multitape Turing machine and Non Deterministic Turing Machine 4 marks

b) Let x and y are two positive integers represented using unary notation. 12 marks

Design a Turing Machine that computes the function(x,y € 1+)

f(x, y) = x + y if x ≥ y

f (x, y)=xx if x < y

**OR**

10 a) Discuss how to use computer to simulate a Turing Machine and compare 8 marks

b) Define recursive and recursively enumerable languages. Prove L is recursive

language so is complementation of L 8 marks