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JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATION- December 2017

B.Tech Vth Semester

COURSE CODE: 10B11CI513 MAX. MARKS: 35

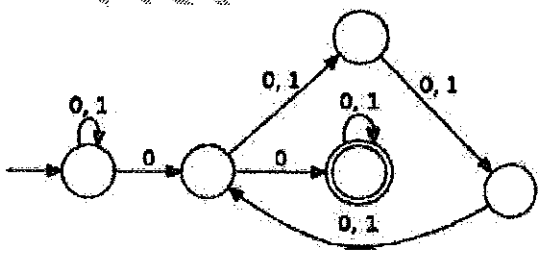
COURSE NAME: Theory of Computation

COURSE CREDITS: 04 MAX. TIME: 2Hrs

Note: *All questions are compulsory. Carrying of mobile phone during examinations will be treated as case of unfair means.*

1. Answer the following questions and justify you answers: **[5x2=10 Marks]**
   i. Can the head of the Turing machine ever stay on the same cell for two subsequent steps of a computation?
   ii. Can the state set of a Turing machine consist of only a single state?
   iii. Which of the games fill under the category of Turing-complete?
   a) Minecraft b) Minesweeper
   c) Pokemon Yellow d) All of the mentioned
   iv. Suppose that L is a context free language and R is regular. Is L – R necessarily be context free?
   v. Which of the following can lack in a Universal computer?
   a) Turing Complete Instruction set b) Infinite memory
   c) Infinite time d) None of the mentioned

2. Consider the following Automata: **[3 Marks]**



Design a regular expression for the language accepted by this Finite Automata.

3. Convert the following Push Down Automata PDA **M =({p, q}, {(,)}, {(, Z_0}, δ, p,{q})** to CFG:
where δ is given by the following transition rules, and 'e' represents the empty string:

$\delta((p, (, Z_0), (q, (Z_0))$

$\delta((q, (, (), (q, (())$

$\delta((q,), (), (q, e))$

$\delta((p, e, Z_0), (r, e))$

$\delta((q, e, Z_0), (r, e))$ **[5 Marks]**

4. Design a Turing machine M recognizing the language L = $\{0^n 1^{2n} \mid n>=0\}$. Consider the input string w = 00111. Write the whole sequence of configurations that M will enter when run on w. Does M accept w? **[5 Marks]**

5. Consider the language L = $\{ww^R\}$. **[5 Marks]**
   (a) Describe a one tape Turing machine to accept L.
   (b) Describe a two tape Turing machine to accept L.
   (c) How much more efficient is the two tape machine?

6. a. Design a Turing Machine that semi decides the language L where L= all strings over {a, b} that contains the substring aaa.
   b. Design a Turing machine that which decides whether a string of 0s and 1s, considered as a binary number, is odd or divisible by 8. **[2+5=7 Marks]**