Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

VII SEMESTER B.TECH. (INFORMATION TECHNOLOGY/COMPUTER AND COMMMUNICATION ENGINEERING)

END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: PROGRAM ELECTIVE V - NATURAL COMPUTING [ICT 4011]

REVISED CREDIT SYSTEM
(29/11/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data, if any, may be suitably assumed.

1A. Design a DFA that accepts the language consisting of the set of those strings over {a, b, c} in which the number of a's plus the number of b's plus twice the number of c's is divisible by six. **5**

1B. What are the three reasons for using DNA computing to solve computational problems? Explain. **3**

1C. What are the various stopping conditions for a genetic algorithm? **2**

2A. Explain with an example, the Leonard Adleman's steps to solve an instance of Hamiltonian path problem using DNA **5**

2B. Let M be the PDA defined by

$Q = \{q0, q1, q2\}$ $\Sigma = \{a, b\}$ $\Gamma = \{A\}$ $F = \{q1, q2\}$

$\delta(q0, a, \lambda) = \{[q0, A]\}$
$\delta(q0, \lambda, \lambda) = \{[q1, \lambda]\}$
$\delta(q0, b, A) = \{[q2, \lambda]\}$
$\delta(q1, \lambda, A) = \{[q1, \lambda]\}$
$\delta(q2, b, A) = \{[q2, \lambda]\}$
$\delta(q2, \lambda, A) = \{[q2, \lambda]\}$

i Describe the language accepted by M.
ii Give the state diagram of M. **3**

2C. Explain the sequence of four operations that are performed on a test tube in DNA sticker model. **2**

3A. Suppose you're running a travel agency, and you need to move three people namely Sona, Svetlana and Adija from Patna to Paris. And suppose that you have booked 2 jets for this purpose, and you want to figure out who gets into which jet ,given the following information:

- Sona and Svetlana are friends
- Sona and Adija are enemies
- Svetlana and Adija are enemies

Show how Quantum Computing increases the efficiency when compared to regular non-quantum computing if you want to achieve the following goals:

- Maximize the number of friend pairs that share the same jet
- Minimize the number of enemy pairs that share the same jet

5

3B. List and explain any 6 operations that can be performed on DNA **3**

3C. Design a DFA that recognizes the following language: L = {w | w starts with 0 and has odd length, or starts with 1 and has even length}. DFA may not contain more than three states. **2**

4A. Explain the following with respect to membrane computing

i) Main ingredients of a P system
ii) Three main types of P systems
iii) Rules according to which an object evolves in P systems **5**

4B. What are the DiVincenzo's criteria that any universal quantum computer must allow? Explain. **3**

4C. Obtain a grammar to generate following languages

i. $L= \{a^n b^{2n} : n \geq 0\}$
ii. $L= \{a^n b^{n+2} : n \geq 0\}$ **2**

5A. Obtain a PDA to accept the language $L(M)= \{w \mid w \in (a+b)^*\}$ and $n_a(w) = n_b(w)$ by a final state. Also show the sequence of moves made by the above obtained PDA for the string abbbaa. **5**

5B. Explain with an example the DNA Splicing model. **3**

5C. With examples, explain the crossover and mutation operators using binary and permutation encodings. **2**