



BRAINWARE UNIVERSITY

Term End Examination 2020 - 21

Programme – Bachelor of Science (Honours) in Computer Science

Course Name – Introduction to Automata Theory

Course Code - BCS503

Semester / Year - Semester V

Time allotted : 85 Minutes

Full Marks : 70

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

Group-A

(Multiple Choice Type Question)

1 x 70=70

1. (Answer any Seventy)

(i) Which of the following is not a part of 5-tuple finite automata?

- | | |
|-------------------|------------------------|
| a) Input alphabet | b) Transition function |
| c) Initial State | d) Output Alphabet |

(ii) If an Infinite language is passed to Machine M, the subsidiary which gives a finite solution to the infinite input tape is _____

- | | |
|-----------------------|------------------|
| a) Compiler | b) Interpreter |
| c) Loader and Linkers | d) None of these |

(iii) For the following change of state in FA, which of the following codes is an incorrect option?

- | | |
|----------------|----------------|
| a) ? (m, 1) =n | b) ? (0, n) =m |
| c) ? (m,0) =? | d) ? (n,1) =? |

(iv) Moore Machine is an application of:

- | | |
|-------------------------------------|--------------------------------|
| a) Finite automata without input | b) Finite automata with output |
| c) Non- Finite automata with output | d) None of these |

(v) In Moore machine, output is produced over the change of:

- | | |
|----------------|-----------|
| a) transitions | b) states |
|----------------|-----------|

c) both transitions & states

d) None of these

(vi) For a Moore Machine, Given Input='101010', thus the output would be of length:

a) $|Input|+1$

b) $|Input|$

c) $|Input|-1|$

d) Cannot be predicted

(vii) The total number of states and transitions required to form a moore machine that will produce residue mod 3.

a) 3 and 6

b) 3 and 5

c) 2 and 4

d) 2 and 5

(viii) The output alphabet can be represented as:

a) ?

b) ?

c) ?

d) None of these

(ix) The O/P of Moore machine can be represented in the following format:

a) $Op(t)=?(Op(t))$

b) $Op(t)=?(Op(t)i(t))$

c) $Op(t): ?$

d) None of these

(x) Which of the following is a correct statement?

a) Moore machine has no accepting states

b) Mealy machine has accepting states

c) We can convert Mealy to Moore but not vice versa

d) All of these

(xi) In mealy machine, the O/P depends upon?

a) State

b) Previous State

c) State and Input

d) Only Input

(xii) Which of the given are correct?

a) Moore machine has 6-tuples

b) Mealy machine has 6-tuples

- c) Both Mealy and Moore has 6-tuples d) None of these

(xiii) The O/P of Mealy machine can be represented in the following format:

- a) $Op(t) = ?(Op(t))$ b) $Op(t) = ?(Op(t)i(t))$
c) $Op(t): ?$ d) None of these

(xiv) The ratio of number of input to the number of output in a mealy machine can be given as:

- a) 1 b) n: n+1
c) n+1: n d) None of these

(xv) Mealy and Moore machine can be categorized as:

- a) Inducers b) Transducers
c) Turing Machines d) Linearly Bounded Automata

(xvi) The major difference between Mealy and Moore machine is about:

- a) Output Variations b) Input Variations
c) Both Output Variations & Input Variations d) None of these

(xvii) Which one among the following is true? A mealy machine

- a) produces a language b) produces a grammar
c) can be converted to NFA d) has less circuit delays

(xviii) A Language for which no DFA exist is a _____

- a) Regular Language b) Non-Regular Language
c) May be Regular d) Cannot be said

(xix) When are 2 finite states equivalent?

- a) Same number of transitions b) Same number of states
c) Same number of states as well as d) Both are final states

transitions

(xx) $\lambda^*(q, ya)$ is equivalent to

- a) $\lambda((q, y), a)$
- b) $\lambda(\lambda^*(q, y), a)$
- c) $\lambda(q, ya)$
- d) independent from λ notation

(xxi) The format: $A \rightarrow aB$ refers to which of the following?

- a) $A \rightarrow B$
- b) $A \rightarrow b$
- c) $B \rightarrow Aa$
- d) None of these

(xxii) A can be $A \rightarrow$ derivable if and only if _____

- a) $A \rightarrow A$ is actually a production
- b) $A \rightarrow B, B \rightarrow A$ exists
- c) Both $A \rightarrow A$ is actually a production & $A \rightarrow B, B \rightarrow A$ exists
- d) None of these

(xxiii) If NFA of 6 states excluding the initial state is converted into DFA, maximum possible number of states for the DFA is ?

- a) 64
- b) 32
- c) 128
- d) 127

(xxiv) Given Language $L = \{x \mid \{a, b\}^* | x \text{ contains } aba \text{ as its substring}\}$ Find the difference of transitions made in constructing a DFA and an equivalent NFA?

- a) 2
- b) 3
- c) 4
- d) Cannot be determined.

(xxv) The construction time for DFA from an equivalent NFA (m number of node) is:

- a) $O(m^2)$
- b) $O(2^m)$
- c) $O(m)$
- d) $O(\log m)$

(xxvi) Which of the following option is correct?

- a) NFA is slower to process and its representation uses more memory than DFA
- b) DFA is faster to process and its representation uses less memory than NFA
- c) NFA is slower to process and its representation uses less memory than DFA
- d) DFA is slower to process and its representation uses less memory than NFA

(xxvii) If L_1 and L_2 are context free languages, which of the following is context free?

- a) L_1^*
- b) $L_2 \cup L_1$
- c) $L_1.L_2$
- d) All of these

(xxviii) A grammar with more than one parse tree is called:

- a) Unambiguous
- b) Ambiguous
- c) Regular
- d) None of these

(xxix) _____ is the acyclic graphical representation of a grammar.

- a) Binary tree
- b) Oct tree
- c) Parse tree
- d) None of these

(xxx) Grammar is checked by which component of compiler

- a) Scanner
- b) Parser
- c) Semantic Analyzer
- d) None of these

(xxxii) Finite automata requires minimum _____ number of stacks.

- a) 1
- b) 0
- c) 2
- d) None of these

(xxxiii) What is wrong in the given definition? Def: $(\{q_0, q_1, q_2\}, \{0,1\}, ?, q_3, \{q_3\})$

- a) The definition does not satisfy 5 Tuple definition of NFA
- b) There are no transition definitions
- c) Initial and Final states do not belong to
- d) Initial and final states can't be same

the Graph

(xxxiii) Which of the following is not a notion of Context free grammars?

- a) Recursive Inference
- b) Derivations
- c) Sentential forms
- d) All of these

(xxxiv) The language accepted by Push down Automaton:

- a) Recursive Language
- b) Context free language
- c) Linearly Bounded language
- d) All of these

(xxxv) Which of the following statements are correct for a concept called inherent ambiguity in CFL?

- a) Every CFG for L is ambiguous
- b) Every CFG for L is unambiguous
- c) Every CFG is also regular
- d) None of these

(xxxvi) The entity which generate Language is termed as:

- a) Automata
- b) Tokens
- c) Grammar
- d) Data

(xxxvii) Transition function maps.

- a) $Q * Q \rightarrow ?$
- b) $Q * Q \rightarrow ?$
- c) $Q * ? \rightarrow Q$
- d) $Q * ? \rightarrow Q$

(xxxviii) Number of states require to accept string ends with 10.

- a) 3
- b) 2
- c) 1
- d) can't be represented.

(xxxix) Extended transition function is

- a) $Q * ?^* \rightarrow Q$
- b) $Q * ? \rightarrow Q$
- c) $Q * * ?^* \rightarrow ?$
- d) $Q * ? \rightarrow ?$

(xl) String X is accepted by finite automata if

- a) $\delta^*(q, x) \in A$
- b) $\delta(q, x) \in A$
- c) $\delta^*(Q_0, x) \in A$
- d) $\delta(Q_0, x) \in A$

(xli) For the expression $E^*(E)$ where * and brackets are the operation, number of nodes in the respective parse tree are

- a) 6
- b) 7
- c) 5
- d) 2

(xlii) The number of leaves in a parse tree with expression $E^*(E)$ where * and () are operators

- a) 5
- b) 2
- c) 4
- d) 3

(xliii) Which of the theorem defines the existence of Parikh's theorem?

- a) Parikh's theorem
- b) Jacobi theorem
- c) AF+BG theorem
- d) None of these

(xliv) The transition a Push down automaton makes is additionally dependent upon the:

- a) stack
- b) input tape
- c) terminals
- d) None of these

(xlv) A PDA machine configuration (p, w, y) can be correctly represented as:

- a) (current state, unprocessed input, stack content)
- b) (unprocessed input, stack content, current state)
- c) (current state, stack content, unprocessed input)
- d) None of these

(xlvi) $|^*$ is the _____ closure of $|$

- a) symmetric and reflexive
- b) transitive and reflexive

c) symmetric and transitive

d) None of these

(xlvii) With reference of a DPDA, which among the following do we perform from the start state with an empty stack?

a) process the whole string

b) end in final state

c) end with an empty stack

d) All of these

(xlviii) A DPDA is a PDA in which:

a) No state p has two outgoing transitions

b) More than one state can have two or more outgoing transitions

c) At least one state has more than one transitions

d) None of these

(xlix) If the PDA does not stop on an accepting state and the stack is not empty, the string is

a) rejected

b) goes into loop forever

c) both rejected & goes into loop forever

d) None of these

(l) Which of the following is a simulator for non deterministic automata?

a) JFLAP

b) Gedit

c) FAUTO

d) None of these

(li) Finite-state acceptors for the nested words can be:

a) nested word automata

b) push down automata

c) ndfa

d) None of these

(lii) The instantaneous PDA has the following elements

a) State

b) Unconsumed input

c) Stack content

d) All of these

(liii) The moves in the PDA is technically termed as:

- a) Turnstile
- b) Shifter
- c) Router
- d) None of these

(liv) Which of the following correctly recognize the symbol '|-' in context to PDA?

- a) Moves
- b) transition function
- c) or/not symbol
- d) None of these

(lv) Which of the problems are unsolvable?

- a) Halting problem
- b) Boolean Satisfiability problem
- c) Both Halting problem & Boolean Satisfiability problem
- d) None of these

(lvi) The language accepted by a turing machine is called _____

- a) Recursive Enumerable
- b) Recursive
- c) Both Recursive Enumerable & Recursive
- d) None of these

(lvii) RASP stands for

- a) Random access storage program
- b) Random access stored program
- c) Randomly accessed stored program
- d) Random access storage programming

(lviii) Which of the following is not true about RASP?

- a) Binary search can be performed more quickly using RASP than a turing machine
- b) Stores its program in memory external to its state machines instructions
- c) Has infinite number of distinguishable, unbounded registers
- d) . Binary search can be performed less quickly using RASP than a turing machine

(lix) Which of the following assertion is false?

- a) If L is a language accepted by PDA1 by final state, there exist a PDA2 that accepts L by empty stack i.e.
- b) If L is a CFL then there exists a push down automata P accepting CF; by empty stack i.e. $L=M(P)$

$$L=L(\text{PDA1})=L(\text{PDA2})$$

c) Let L is a language accepted by PDA1 then there exist a CFG X such that $L(X)=M(P)$ d) All of these

(lx) A push down automata can be represented using:

- a) Transition graph b) Transition table
- c) ID d) All of these

(lxi) A push down automata is said to be _____ if it has atmost one transition around all configurations.

- a) Finite b) Non regular
- c) Non-deterministic d) Deterministic

(lxii) Which of the following can accept even palindrome over $\{a,b\}$

- a) Push down Automata b) Turing machine
- c) N DFA d) All of these

(lxiii) Which of the functions can a turing machine not perform?

- a) Copying a string b) Deleting a symbol
- c) Accepting a pal d) Inserting a symbol

(lxiv) If $T1$ and $T2$ are two turing machines. The composite can be represented using the expression:

- a) $T1T2$ b) $T1 \cup T2$
- c) $T1 \times T2$ d) None of these

(lxv) In automata theory, _____ is said to be Computationally Universal if can be used to simulate any single taped Turing Machine.

- a) Computer's instruction set b) A programming language
- c) Cellular Automaton d) All of these

(lxvi) Give a classic example of the concept of turing complete.

- a) lambda calculus
- b) C++
- c) Lisp
- d) All of these

(lxvii) Let two machines be P and Q. The state in which P can simulate Q and Q can simulate P is called

- a) Turing Equivalence
- b) State Equivalence
- c) Universal Turing Machine
- d) None of these

(lxviii) Which among are not the results of computational theory?

- a) In general, it is impossible to predict that what a Turing-complete program will do over an arbitrarily long time.
- b) It is impossible to determine for every input, whether the program will eventually stop or continue forever.
- c) It is not possible to determine whether a program will return true or false.
- d) None of these

(lxix) Which of the games fall under the category of Turing-complete?

- a) Minecraft
- b) Minesweeper
- c) Dwarf Fortress
- d) All of these

(lxx) Can a single tape turing machine be simulated using deterministic 2-stack turing machine?

- a) Yes
- b) No
- c) Cannot be said
- d) None of these