KATHMANDU UNIVERSITY
End Semester Examination
August, 2018

Marks scored:

Level : B.Sc.
Year : III
Course : COMP 316
Semester: I

Exam. Roll No. :
Time : 30 mins.
F.M. : 10

Registration No.:
Date : AUG 20 2018

SECTION "A"
[20 Q.× 0.5=10 marks]

Choose and circle the most appropriate answer:

1. What does Finite State Machine recognize?
   a. only CFG
   b. any grammar
   c. both A and B
   d. only regular grammar

2. What is basic drawbacks of FSM ?
   a. cannot remember arbitrary large amount of information
   b. sometimes fails to recognize grammars that are regular
   c. sometimes recognizes grammars that are not regular
   d. None of these

3. Language of DFA is given as:
   a. $L(D) = \{w \mid \hat{\delta}(q0,w) \cap F \neq F\}$
   b. $L(D) = \{w \mid \hat{\delta}(q0,w) \cap F \neq \emptyset\}$
   c. $L(D) = \{w \mid \hat{\delta}(q0,w) \cup F \neq F\}$
   d. $L(D) = \{w \mid \hat{\delta}(q0,w) \in F\}$

4. Can a DFA simulate NFA?
   a. No
   b. Sometimes
   c. Yes
   d. Depends on NFA

5. The regular expression denote a language comprising all possible strings of even length over the alphabet (0, 1)
   a. (0+1)(1+0)*
   b. 1 + 0(1+0)*
   c. (00+0111+10)*
   d. (1+0)

6. Set of regular languages over a given alphabet set is closed under
   a. Union
   b. Complementation
   c. Intersection
   d. All of above

7. The regular expression to denote a language L which accepts all the strings which begin or end with either 00 or 11 is ?
   a. [(00(0+1)*11] + [11(0+1)*00]
   b. $[(00+11)(0+1)^{+}] + [(0+1)+(00+11)]$
   c. [(00+11)(0+1)*]+[(0+1)*(00+11)]
   d. (00+11)(0+1)*(00+11)

8. The _____ of a set of states, P, of an NFA is defined as the set of states reachable from any state in P following Є-transitions.
   a. Є-closure
   b. Є-pack
   c. Q in the tuple
   d. None of the above

9. A given grammar is called ambiguous if
   a. two or more productions have the same non-terminal on the left hand side
   b. a derivation tree has more than one associated sentence
   c. there is a sentence with more than one derivation tree corresponding to it
   d. brackets are not present in the grammar

10. The productions
E—>E+E
E—>E—E
E—>E*E
E —> E / E
E —> id
a. generate an ambiguous language
b. are left recursive
c. both A and B
d. are unambiguous

11. Which of the following is true for A→Aβ | α
a. A→βA'
A'→αA' | Є
b. A→αA'
A'→βA' | Є
c. A→βA' | αA'
d. A→αβ

12. Consider the grammar :
S —>ABCc | Abc
BA —> AB
Bb —> bb
Ab —>ab
Aa —>aa
Which of the following sentences can be derived by this grammar?
a. abc
b. aab
c. abcc
d. abbb

13. Pumping lemma is generally used to verify that
a. given grammar is not regular
b. given grammar is regular
c. whether two given regular expressions are equivalent or not
d. None of the above

14. The intersection of CFL and regular languages
a. is always context-free
b. is always regular
c. both A and B
d. need not to be regular

15. Following context free grammar
S —>aB | bA
A —>b | aS | bAA
B —> b | bS | aBB
generates strings of terminals that have
a. odd number of b's and a's
b. equal number of a's and b's
c. even number of a's and b's
d. odd number of a's and even number of b's

16. Context free grammar is not closed under
a. Union
b. Product
c. Complementation
d. Kleen Closure

17. Which of the following operations are eligible in PDA?
a. Push
b. Pop
c. Both A and B
d. Insert

18. Given a Grammar G:
S->aA|a|B
B->A|bb

Which of the following will be the simplified grammar?
a. S->aA|aB, A->a, B->bb
b. S->aA|aB, A->a, B->A
c. S->aA|aB, A->B, B->bb
d. None of above

19. Which of the functions are not performed by the turing machine after reading a symbol?
a. writes the symbol
b. moves the tape one cell left/right
c. proceeds with next instruction or halts
d. none of the mentioned

20. Turing Machine can be represented using the following tools:
a. Transition Table
b. Transition Graph
c. Queue and Input tape
d. All of above

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SECTION "B"

[6 Q.×4=24 marks]

Attempt ***ANY SIX*** questions.

1. Formally define DFA. Construct a DFA that accepts all the strings of even length over alphabet $\sum = \{0, 1\}$. Show that the string 0101 is accepted by this DFA using extended transition function. [1+1+2]

2. Convert the following NFA into equivalent DFA using subset construction method. [4]

δ	0	1
➢ p	{q}	{p, q}
q	{r}	φ
r	{s}	{s}
*s	φ	φ

3. Prove that for any NFA, $N=(Q_N,\sum,\delta_N,q_0,F_N)$ accepting a language L, there is a DFA, $D=(Q_D,\sum,\delta_D,q_0',F_D)$ that also accepts L. i.e. L(N)=L(D). [4]

4. Convert the following regular expression into Є-NFA.
   a. $(00 + 10)^*$ b. $(01 + 10)^* + (11 + 10)^*$ [2+2]

5. Show that the language L= $\{a^n b^n \mid n \geq 0\}$ is not a regular language. [4]

6. What is Instantaneous Description (ID)? Explain with suitable example. [1+3]

7. Write short notes
   a. Ambiguous Grammar
   b. Turing Machine [2+2]

SECTION "C"

[2 Q. × 8 = 16 marks]

Attempt ***ANY TWO*** questions.

8. Convert the following Є-NFA to DFA using direct method. [8]

δ	Є	a	b
➔ A	{B, D}	{A}	φ
B	φ	{C}	{E}
C	φ	φ	{B}
D	φ	{E}	{D}
*E	φ	φ	φ

9. Simplify the following CFG.
S-> AACD
A->aAb| Є
C->aC|a
D->aDa|bDb| Є [8]

10. Construct a PDA for language L=$\{a^n b^n c^m | n, m \geq 1\}$. Show that the acceptance of string aaabbbcc by this PDA using ID. [4+4]