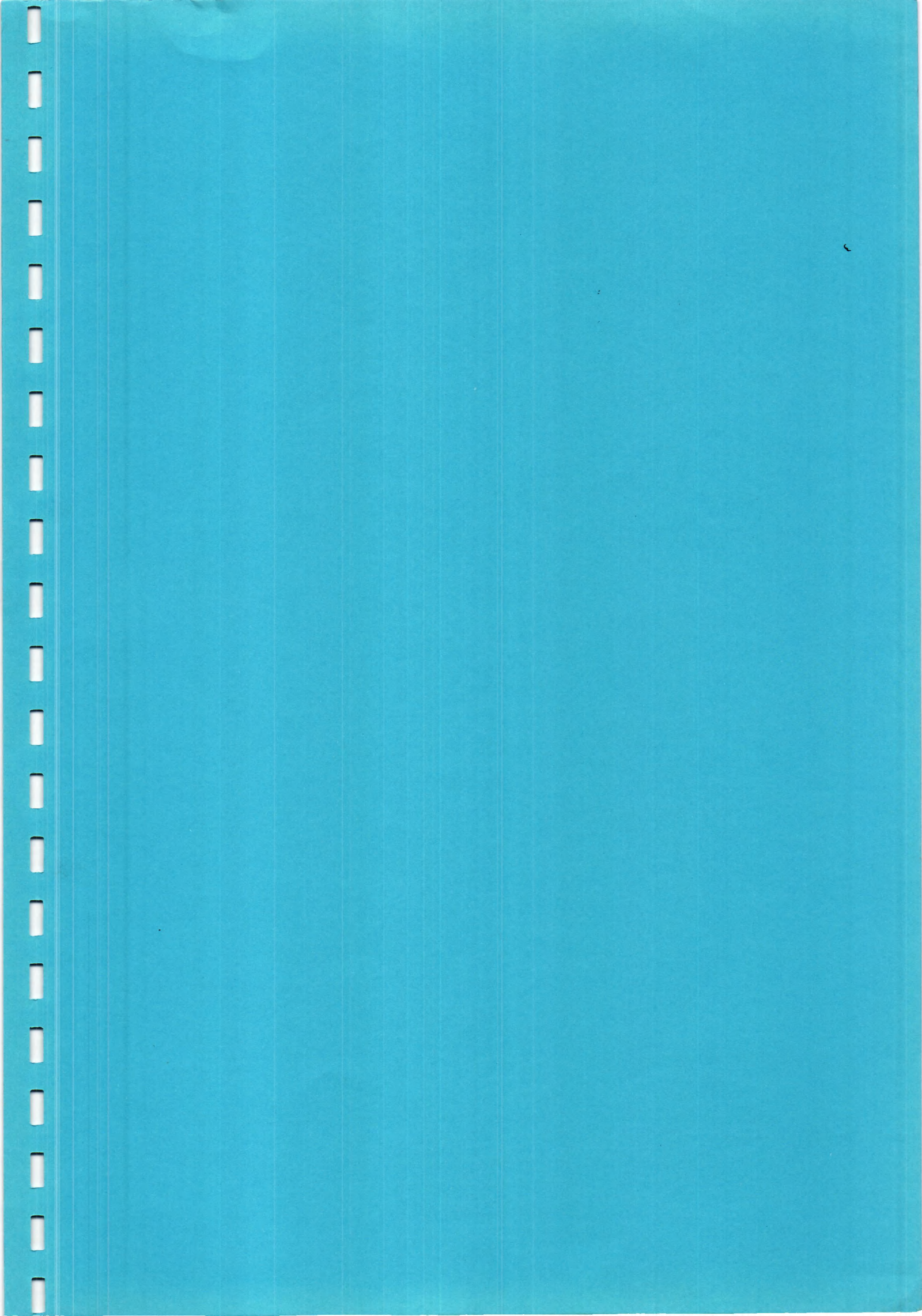


KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Level : B. Sc.
Year : III

Marks scored:

Course : COMP 316
Semester : I



Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Level : B. Sc.

Year : III

Exam Roll No. :

Time: 30 mins.

Course : COMP 316

Semester : I

F. M. : 10

Registration No.:

Date APR 16 2017

SECTION "A"

[20 Q × 0.5 = 10 marks]

Encircle the alphabet that represent correct answer.

1. Consider the production of a grammar as:

$S \rightarrow AA$

$A \rightarrow aa$

$A \rightarrow bb$

Describe the language specified by the production grammar

- a. $L = \{aaaa, aabb, bbaa, bbbb\}$ b. $L = \{abab, abaa, aaab, baaa\}$
c. $L = \{aaab, baba, bbaa, bbbb\}$ d. $L = \{aaaa, abab, bbaa, aaab\}$

2. Let $L_1 = \{a^i b^j \mid i > j\}$ and $L_2 = \{a^i b^j \mid i < j\}$. What is the union of L_1 and L_2 ?

- a. $\{a^i b^j \mid i > j \geq 1\}$ b. $\{a^i b^j \mid i, j \geq 1\}$
c. $\{a^i b^j \mid i > j \geq 1\}$ d. $\{a^i b^j \mid i, j \geq 1, i \neq j\}$

3. Which of the following statement is wrong?

- a. Recursive languages are closed under union
b. Recursive languages are closed under complementation
c. If a language and its complement are both regular, then the language must be recursive
d. A language is accepted by FA if and only if it is recursive

4. The regular expression denoting a language comprising all possible strings of even length over the alphabet $(0,1)$ is

- a. $1 + 0(1 + 0)^*$ b. $(0 + 1)(1 + 0)^*$ c. $(1 +)$ d. $(00 + 0111 + 10)^*$

5. A finite state machine can be considered as of having finite tape length without rewinding capability and unidirectional tape movement.

- a. Turing machine b. Pushdown automata
c. Context free languages d. Regular languages

6. Any given transition graph has an equivalent to _____

- a. Regular expression b. DFA
c. NFA d. All of them

7. The intersection of CFL and regular language _____

- a. is always regular b. is always context free
c. both (a) and (b) d. need not be regular

8. Which of the following regular expressions identity's is true?

- a. $(r^*)^* = r^*$ b. $(r+S)^* = r^* + S^*$ c. $r^*S^* = r^* + S^*$ d. All of the above

9. Palindromes can't be recognized by any Finite State Machines because
- A FSM can't remember arbitrarily large amount of information
 - A FSM can't fix the mid-point
 - A FSM can't find whether the second half of the string matches the first half
 - All of the above
10. Can a DFA simulate NFA?
- No
 - Yes
 - Sometimes
 - Depends on NFA
11. Consider the regular expression $(0+1)^n$. The minimum state finite automation that recognize the language represented by this regular expression contains
- n states
 - $n + 1$ states
 - $n + 2$ states
 - None of these
12. Finite state machine can recognize _____
- Any grammar
 - Only context grammar
 - Any unambiguous grammar
 - Only regular grammar
13. Pumping lemma is generally used for proving
- A given grammar is regular
 - A given grammar is not regular
 - Whether two given regular expressions are equivalent or not
 - None of these
14. Any string of terminals that can be generated by the following CFG is
- $$S \rightarrow XY$$
- $$X \rightarrow ax \mid bx \mid a$$
- $$Y \rightarrow Ya \mid Yb \mid a$$
- has at least one 'b'
 - should end in a 'a'
 - has no consecutive a's or b's
 - has at least two a's
15. The following CFG $S \rightarrow aS \mid bS \mid a \mid b$ is equivalent to the regular expression
- $(a+b)$
 - $(a+b)^*$
 - $(a+b)(a+b)$
 - All of the above
16. The intersection of CFL and a regular language
- need not be regular
 - need not be context free
 - is always regular
 - none of the above
17. The logic of pumping lemma is a good example of
- The pigeon-hole principle
 - The divide and conquer technique
 - Recursion
 - Iteration
18. CFG is not closed under
- Union
 - Kleene star
 - Complementation
 - Product
19. What are recursive languages?
- Closed under intersection
 - Recursively enumerable
 - Closed under complementation
 - All of the above
20. Which of the following pairs of regular expressions are equivalent?
- $1(01)^*$ and $(10)^*$
 - $y(yy)^*$ and $(yy)^*y$
 - y^+ and y^*y^+
 - All of the above

KATHMANDU UNIVERSITY
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APR 16 2017

Level : B. Sc.
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Time : 2 hrs. 30 mins.

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Semester : I
F. M. : 40

SECTION "B"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Answer the following: [1+1+1+1=4]
- a. What is Deterministic Finite Automata?
 - b. Design a DFA for the Language $L = \{(01)^i 1^{2j} \mid i \geq 1, j \geq 1\}$ for $\Sigma = \{0,1\}$
 - c. Design a DFA over $\Sigma = \{0,1\}$ which accepts the set of string either start with 01 or end with 01
 - d. Design a DFA for the Language $L = \{w : \text{every run of a's has length two or three}\}$ over $\Sigma = \{a,b\}$

2. State and prove Arden's theorem. Find the regular expression corresponding to the given transition function. [2+2=4]

δ	0	1
→ q1	q1	q2
q2	q3	q2
q3	q1	q4
*q4	q1	q2

3. Prove that language $L = \{0^n \mid n \text{ is a perfect square}\}$ is not regular. [4]
4. Convert the given grammar into CNF [4]
- $S \rightarrow S1 \mid S2$
 $S1 \rightarrow AB$
 $A \rightarrow 0A1 \mid \epsilon$
 $B \rightarrow 2B \mid \epsilon$
 $S2 \rightarrow CD$
 $C \rightarrow 0C \mid \epsilon$
 $D \rightarrow 1D2 \mid \epsilon$
5. Design a PDA for the following language and trace with a string $w = aabbbb$ [4]
- $L = \{a^n b^{2n} \mid n > 0\}$
6. Minimize the given DFA [4]

δ	0	1
→q0	q1	q3
q1	q0	q3
q2	q1	q4
*q3	q5	q5
q4	q3	q3
*q5	q5	q5

7. Write Short notes on (*ANY TWO*):

[2+2=4]

- a. ϵ -closure of a state
- b. Regular expression and its properties
- c. Left recursive grammar and its elimination
- d. Greibach Normal Form

SECTION "C"

[2 Q \times 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Consider the following transition function of a PDA and construct its equivalent CFG [8]

- i. $((q_0, a, Z_0) \rightarrow (q_0, aZ_0)$
- ii. $((q_0, b, Z_0) \rightarrow (q_0, bZ_0)$
- iii. $((q_0, a, a) \rightarrow (q_0, aa)$
- iv. $((q_0, b, b) \rightarrow (q_0, bb)$
- v. $((q_0, a, b) \rightarrow (q_0, ab)$
- vi. $((q_0, b, a) \rightarrow (q_0, ba)$
- vii. $((q_0, c, Z_0) \rightarrow (q_1, Z_0)$
- viii. $((q_0, c, a) \rightarrow (q_1, a)$
- ix. $((q_0, c, b) \rightarrow (q_1, b)$
- x. $((q_1, a, a) \rightarrow (q_1, \epsilon)$
- xi. $((q_1, b, b) \rightarrow (q_1, \epsilon)$
- xii. $((q_1, c, c) \rightarrow (q_1, \epsilon)$

9. State and prove pumping lemma for Context Free Language

[8]

10. Design a Turing Machine for the following language

[8]

$L = \{w \mid w \text{ has equal number of a's, b's and c's and } w \in \{a,b,c\}^*\}$