Faculty of Computers and Information Technology
Course Name: Automata Models
Course Code: CAS 205
Instructor: Dr. AzzaTaha

Year: 2018-2019 (Fall Semester)
Mid-Term Exam. (5-11-2018)
Time Allowed: 1.5 hrs.
Marks: 20

Model Answer

Question 1: Choose the correct answer: **(10 Marks)**

1. If A = {1, 2, 3, 4, 5} and B = {5, 6, 7} then |A − B| equals:
   a. 5 b. 4 c. 3 d. 7
2. If B = {{1}, {3, 4, 5}}, then |B| equals:
   a. 4 b. 2 c. 3 d. 1
3. If A = {3, 4, 6, 7} and B = {5, 7}, which of the following is in A x B:
   a. 7 b. (7, 7) c. (5, 6) d. {7, 7}
4. If A = {1, 2, 3, 4} and B = {1, 2, 3}, which of the following is correct?
   a. A is a subset of B.
   c. B is a proper subset of A.
   b. A and B are disjoint.
   d. A − B = ϕ
5. Consider the function f, f: {a, b, c} → {1, 2, 3}, such that f(a) = 1, f(b) = 3 and f(c) = 3 then the *domain* of f is:
   a. {3} b. {1, 2, 3} c. {a, b, c} d. {1, 3}
6. Consider the function h, h: Z →{0, 1} defined by h(x) = $\begin{cases} 0 & \text{if } x \text{ is even} \\ 1 & \text{otherwise} \end{cases}$, then:
   a. h is one to one
   c. h is bijective
   b. h is onto
   d. h is invertible
7. If ∑ = {a, b, c}, w is a string over ∑ and |www| = 18, what is the length of w?
   a. 18 b. 12 c. 6 d. 3
8. If L = {aba, ba}, which of the following strings is NOT in L^+?
   a. λ b. baba c. baaba d. ba
9. If L = { λ, 011, 00}, which of the following strings is NOT in L^+?
   a. λ b. 11 c. 01100 d. 00011
10. If L = {aa, ab}, which of the following strings is NOT in L^*?
    a. aba b. aaaa c. aaab d. abaa
11. If L = {a, aa, aaa, …} and M = { λ, b, bb, bbb, …}, which of the following strings is NOT in L.M:
    a. aaa b. λ c. abb d. aab
12. If $L_1 = \{a^n b^n : n > 0\}$ and $L_2 = \{c^m : m > 0\}$, which of the following strings NOT in $L_1 . L_2$?
    a. λ b. ccc c. ab d. All of the previous
13. Find L in L.{a , b} = {a, baa, b, bab}
    a. L = {a, ba}
    c. L = {ba, λ}
    b. L = {b, ba}
    d. L = { ab, ba}
14. Select *a correct* grammar generating the language {b, abc, aabcc, …}
    a. S → aAc, A → b A | λ
    c. S → λ |b | aSc
    b. S → b| aSc
    d. S → aAc | λ, A → bA

15. Select a *correct* grammar generating the language {ac, abc, abbc, abbbc, …}

a. S → aAc, A → b A | λ
c. S → ac S | a | λ
b. S → aAc, A → b A
d. S → aAc | λ , A → b A

16. Select a correct grammar to define the language {0, 01, 011, 0111, …}

a. S → 0A, A → 1 | 1A
c. S → 0A, A → λ | 1A
b. S → 0 | 1S
d. S → 1 | 0S

17. Which of the following grammar is regular?

a. G = <{S}, {a, b}, { S→ λ | abS}, S>
b. F = <{S}, {a, b}, {S→ λ | b | aSa}, S >
c. H = <{S, A, B}, {a, b}, {S→AB, A → aA |a, B → bB | b}, S>
d. I = <{S, A}, {a, +}, {S → S+A | A, A → a}, S>

18. Let G = < {D,S} , {0,1,2,…,9} , P , S>, where P is:

S → D1 | D3 | D5 | D7 | D9   D → λ | D0 | D1 | D2 | D3 | D4 | D5 | D7 | D8| D9

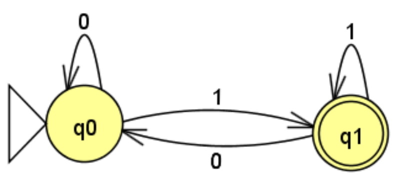
Then the string 2018 ∈ L(G)

a. True   b. False

19. If a given function f is bijective, then it is invertible.

a. True   b. False

20. Select the language defined by the following automaton:



a. $\{1w : w \in \{0,1\}^*\}$
c. $\{1w : w \in \{1\}^*\}$
b. $\{w1 : w \in \{0,1\}^*\}$
d. $\{w1 : w \in \{0\}^*\}$

Question 2: **(10 Marks)**

1) Construct a grammar to describe the language $\{10^n1 : n \geq 1\}$, and then show by either a derivation or a parse tree that the string 10001 can be derived from the constructed grammar.

Answer:

S → 1A1, A → 0 | 0 A (2 Marks)

Derivation: S ⇒ 1A 1 ⇒ 10A 1 ⇒ 100A1 ⇒ 10001 (2 Marks)

Parse Tree: S

1 A 1

0 A

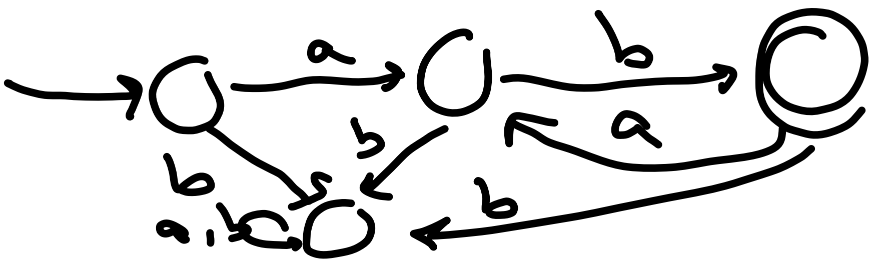
0 A

0

2) Show that the language {ab, abab, ababab, ... } is regular. (2 Marks)

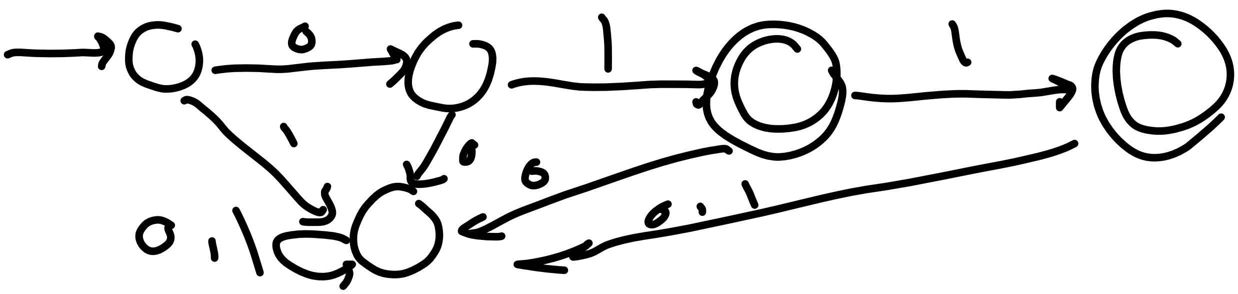
Answer: only one of the following representations is enough (regular grammar or finite machine)

1. This language can be represented by the regular grammar: S → ab | abS
2. This language can be represented by the machine:



3) Design a finite state machine to describe each of the following languages: (4 Marks)

a. L = $\{01, 011\}$



b. M = $\{aaw: w \in \{a, b\}^*\}$