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

E E L U
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Year: 2017-2018 (Fall Semester)
Mid-Term Exam. (30-10-2017)
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. 1 c. 7 d. 0
2. If A = {a, b, c} then the power set of A has
   a. 6 elements b. 9 elements c. 8 elements d. 3 elements
3. If A = {a, b, c} and *B* = {a, b, c, d}, which of the following is correct?
   a. A is a proper subset of B. c. B is a subset of A.
   b. A and B are disjoint. d. B – A = ϕ
4. If a given function f is bijective, then f is invertible.
   a. True b. False
5. Let g: N → N, defined by g(x) = 2x, then the function g has inverse.
   a. True b. False
6. If L = $\{a, bb\}$, then $aabb \in L^*$
   a. True b. False
7. Consider the function h, h: {a, b, c} → {1, 2, 3}, such that h(a) = 1, h(b) =3 and h(c) = 3 then the *range of h* is:
   a. {3} b. {1, 2, 3} c. {a, b, c} d. {1, 3}
8. If Σ = {a, b, c}, u = aaa and v = bbc, then |uv| equals:
   a. 6 b. 7 c. 8 d. 9
9. If L = {11, 10}, which of the following strings is NOT in L^*?
   a. 010 b. 1111 c. 1110 d. 1011
10. If L = {λ, 010, 10}, which of the following strings is NOT in L^+?
    a. λ b. 1010 c. 00 d. 010
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. baa c. abb d. aab
12. Find L in: {λ, a, ab}. L = {b, ab, ba, aba, abb, abba}
    a. L = {b, ba} c. L = {ab, ba }
    b. L = {b, ab} d. L = {λ, b, ba}
13. Select a *correct* grammar to describe the language {00, 01}.
    a. S → 00 | 01 c. S → 0S | 1S
    b. S → λ | 00 | 01 d. S → λ | 0S | 1S
14. Select a *correct* grammar generating the language {aa, aba, abba, abbba, …}
    a. S →aAa | λ, A → bA | λ
    b. S →aAa, A →bA
    c. S →aAa, A → bA | λ
    d. S →aAa | λ, A→ bA

15. Let G = ({A,S} , {a, b } , P , S) , where P consists of S → 1A1, A → 0A | λ, then G is a regular grammar.

a. True b. False

16. 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

Which of the following strings is NOT in L(G)?

a. 19 b. 7 c. 30 d. 11

17. Let G = ({A, S}, {0, 1}, P, S), where P is: S → 1A1, A → λ | 0A, which of the following strings is NOT in L(G)?

a. λ b. 11 c. 101 d. 100001

18. Select a *correct* grammar to describe the language $\{aa, aaaa, \dots, a^{2n}, \dots\}$

a. S → $a \mid aS$ c. S → $aa \mid aaS$

b. S → $\lambda \mid a \mid aS$ d. S → $\lambda \mid aa \mid aaS$

19. The Pigeonhole principal states that: if m objects are placed into n holes, where … …, then some holes contain at least 2 objects.

a. m > n b. m ≥ n c. m < n d. m ≤ n

20. Let G = ({S, A, B}, {a, b}, P_2, S), where P is: S → AB, A → aA |a, B → b| bB, then G is a context-free grammar.

a. True b. False

Question 2: **(10 Marks)**

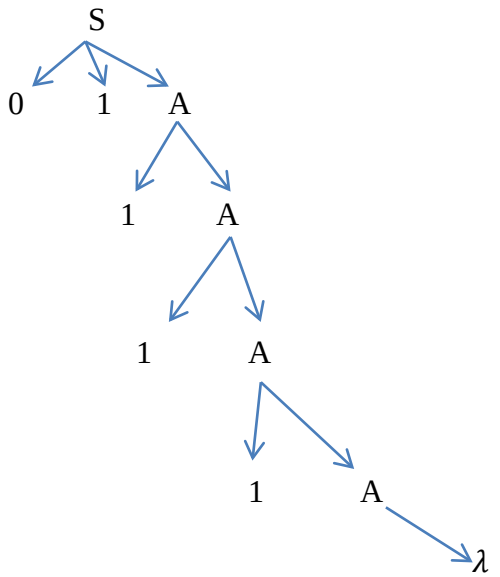
1) Construct a grammar to describe the language $\{01^n : n \geq 1\}$, and then show by either a derivation or a parse tree that the string 01111 can be derived from the constructed grammar. (4 Marks)

Answer: one possible correct grammar:

S → 01A , A → 1A | λ

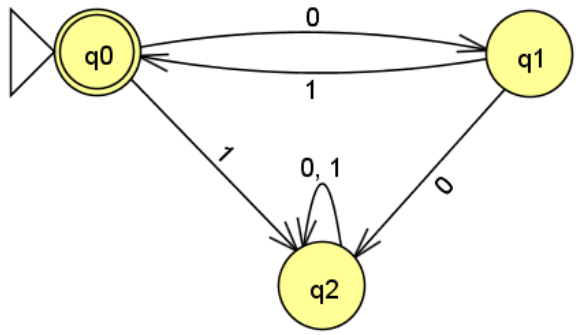
By derivation: S ⇒ 01A ⇒ 011A ⇒ 0111A ⇒ 01111A ⇒ 01111λ ≡ 01111

By parse tree:

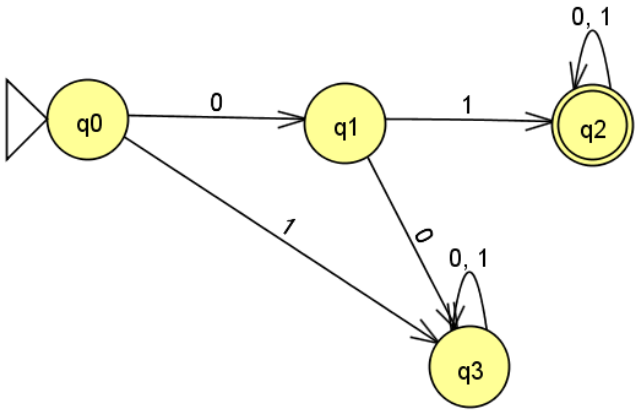


2) Show that the language {λ, 01, 0101, ... } is regular. (2 Marks)

Answer: by either a regular grammar: $S \rightarrow \lambda \mid 01\ S$ or by finite machine:



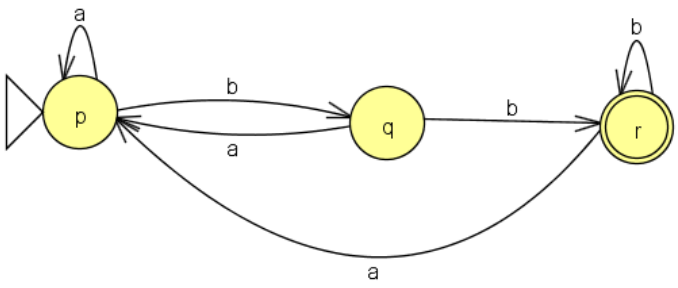
3) Design a finite state machine to describe the language $\{01w : w \in \{0,1\}^*\}$ (2 Marks)



4) Consider the finite machine given by the table:

		a	b
Start	p	p	q
	q	p	r
Final	r	p	r

Draw the transition graph for the machine, and then describe its language. (2 Marks)



L = { ubb: u ∈ {a, b}*}