Quiz 1

1. This is a **test** problem; its grade will be ignored.

   There are DFA's that do not accept any languages.

   (a) True

   (b) False

2. If L is any regular language, then every subset of L is regular.

(a) True

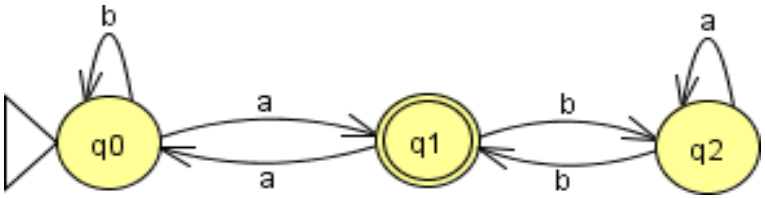
(b) False

3. The union of any language L and its complement $\bar{L}$ is always regular, even if L is not regular.

(a) True

(b) False

4. Which of the following strings is accepted by this DFA?



(a) $baab$

(b) $abab$

(c) $abaa$

(d) $aaab$

5. The languages $L_1 = \{1, 10\}^*$ and $L_2 = \{1, 10, 11\}^*$ are the same, that is, $L_1 = L_2$.

(a) True

(b) False

6. A DFA can accept several languages.

(a) True

(b) False

Quiz 2

1. The language $L = \{a^n : \ n \neq 3 \text{ and } n \neq 4\}$ is regular.

   (a) True

   (b) False

2. Let $\Sigma = \{a, b\}$, $L_1 = \{a^n : n \geq 0\}$, and $L_2 = \{b^n : n \geq 0\}$. Then $(L_1 L_2)^2 = ...?$

(a) Σ^*

(b) $\{a^n b^n a^n b^n : n \geq 0\}$

(c) $\{a^{2n} b^{2n} : n \geq 0\}$

(d) $\{a^n b^n a^m b^m : m, n \geq 0\}$

(e) $\{a^n b^m a^i b^j : m, n, i, j \geq 0\}$

3. Let Σ be any alphabet. Then the language $\emptyset^*\Sigma^* = \ldots.$?

(a) $\emptyset$

(b) Σ

(c) $\{\lambda\}$

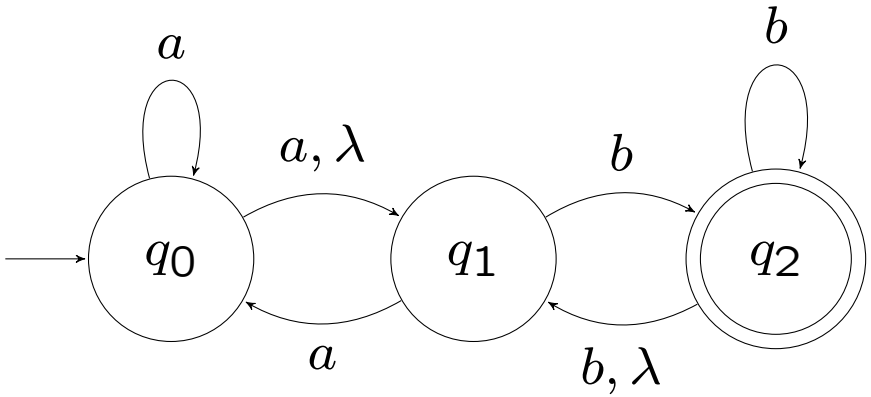
(d) Σ^*

4. For every language L, the empty string λ is in L^* but $\lambda \notin L^+$.

   (a) True

   (b) False

5. Which of the following is correct about the NFA below?



(a) δ(q0,b)={q2}

(b) δ(q0,b)={q0,q2}

(c) δ(q0,b)={q1,q2}

(d) δ(q0,b)={q0,q1}

Quiz 3

1. Suppose L is any language. If $L = L^R$, then L is regular.

   That is, if a language L and its reverse L^R include the same set of strings, then L is regular.

   (a) TRUE

   (b) FALSE

2. The regular expression $(a^* + b^*)$ and $(a + b)^*$ are equivalent.

   (a) TRUE

   (b) FALSE

3. What is the number of strings with the **shortest length** in the language denoted by the following regular expression?

$$r = (a+b)^*(a+b)(a+b)^*(a+b)(a+b)^*$$

(a) 0

(b) 1

(c) 2

(d) 3

(e) 4

4. Suppose regular expressions r_1 and r_2 represent the same language. Which of following is a regular expression for the language $L(r_1) \cap L(r_2)$?

   (a) r_1

   (b) $L(r_1)$

   (c) $r_1 \cap r_2$

   (d) $L(r_1 \cap r_2)$

   (e) All of the above

5. Suppose L and its reverse L^R are both regular languages (over Σ). Which of the following is always correct?

(a) $L - L^R$ is regular

(b) $L \cup L^R = \Sigma^*$

(c) $L \cap L^R = \emptyset$

(d) $LL^R = \emptyset$

Quiz 4

1. The language generated by the following grammar is regular.

$$S \to 0S \mid A \mid \lambda$$
$$A \to 1A \mid S$$
$$B \to \lambda \mid 0$$

(a) True

(b) False

2. Consider again the same grammar G in the previous question. Which of the following regular expressions denotes $L(G)$?

$$S \to 0S \mid A \mid \lambda$$
$$A \to 1A \mid S$$
$$B \to \lambda \mid 0$$

(a) $(0 + 1)^*$

(b) 0^*1^*

(c) $0^* + 1^*$

(d) 1^*0^*

3. Of the following strings, which one is generated by grammar?

$S \to aaS \mid bA$
$A \to bA \mid bbA \mid aS \mid a$

(a) λ
(b) aaa
(c) $bbbab$
(d) $baba$
(e) aab

4. If G is a non-linear grammar, then G is not *equivalent* to any regular grammar.

   (a) True

   (b) False

5. Which of the following regular expressions is not *equivalent* to all the others?

   (a) $(0 + 1)^*$

   (b) 0^*1^*

   (c) $(0^*1^*)^*$

   (d) $(1^*0^*)^*$

Quiz 5

1. The language generated by the following grammar is infinite.

$$S \to aS \mid A$$
$$A \to Sb$$

(a) True

(b) False

2. Let L be an infinite language over Σ. Let m be any integer and w be a string in L whose length is at least m. If there are substrings x, y, z in Σ^*, where $w = xyz$, $|xy| \leq m$, and $|y| \geq 1$ such that for all $i \geq 0$ we have $xy^iz \in L$, then L is regular.

   (a) True

   (b) False

3. The language $L = \{a^n b^m : n \neq m\}$ is regular.

   (a) True

   (b) False

4. If L_1 and L_2 are any non-regular languages, then $L_1 \cap L_2$ is also non-regular.

   (a) True

   (b) False

5. Let L be a language over $\Sigma = \{a, b, c\}$ such that each string in L has more a's than c's. Then L is regular.

   (a) True

   (b) False

Quiz 6

1. Which of the following is not a unit-production?

   (a) $A \to A$

   (b) $A \to B$

   (c) $S \to a$

2. Every finite language is context-free.

   (a) True

   (b) False

   (c) Don't know!

3. Consider the following statements (I) and (II):

   I. *Some context-free grammars generate regular languages.*

   II. *All regular grammars generate context-free languages.*

   Of the following statements, which one is correct?

   (a) I and II are both true

   (b) I is false but II is true

   (c) I is true but II is false

   (d) None of the above

4. Every context-free language can be generated by some CFG that has no ambiguity.

   (a) True

   (b) False

   (c) Don't know!

5. Which list includes all the *nullable* variables in this CFG?

$S \to AaB \mid aaB$
$A \to BC \mid aB$
$B \to aB \mid \lambda$
$C \to aA \mid aSB \mid B$

(a) C onlly

(b) B and C

(c) A and B

(d) A, B, and C

(e) A, B, C, and S

Quiz7

1. Which of the following orders is **not** recommended to clean-up a CFG?

   (a) Remove λ productions before unit productions.

   (b) Remove unit productions before useless productions.

   (c) Remove unit productions before λ productions.

   (d) Remove λ productions before useless productions.

2. An instantaneous description (p, w, x) of a PDA M describes a transition in M. The components p, w, and x indicate what (in the order)?

   (a) (current state, current input, stack content)

   (b) (current input, stack content, current state)

   (c) (current state, stack content, current input)

   (d) (current input, current state, stack content)

   (e) None of the above

3. Which of the following languages **cannot** be accepted by a DPDA?

   (a) $\{w : w \in \{a, b\}^*, n_a(w) + 2n_b(w) = 3k, k \geq 0\}$

   (b) $\{w : w \in \{a, b\}^*, w = w^R, |w| = 2k + 1, k \geq 0\}$

   (c) $\{a^n b^n c^n : n \leq 335\}$

   (d) All of the above

4. The transition $(q_2, AB) \in \delta(q_1, a, A)$ in a PDA M indicates that in state q_1, on seeing a on the input and A on top of stack, M can go to state q_2 and do which of the following?

   (a) push AB on to the stack.

   (b) push BA on to the stack.

   (c) push B on to the stack.

   (d) pop A and push AB on to the stack.

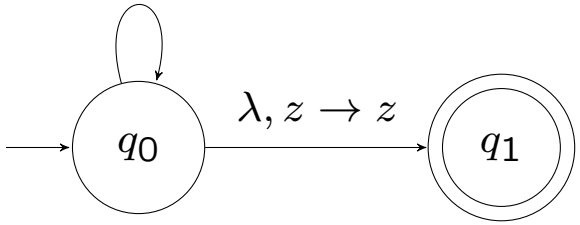
   (e) pop A and push B on to the stack.

5. Of the given strings, which one is **not** accepted by this PDA?

$a, z \to Az$

$a, A \to AA$

$b, A \to \lambda$



(a) $ababbabab$

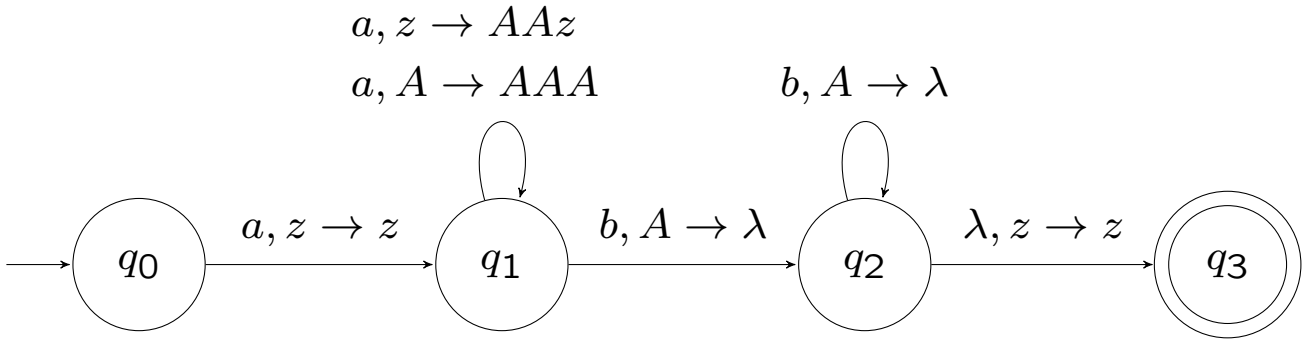
(b) $abaababb$

(c) $abbabbaa$

(d) $aaaabbbb$

Quiz 8

1. The following PDA is deterministic.



(a) True

(b) False

2. Consider the statements S1 and S2 defined as follows:

   S1. Some context-free grammars generate regular languages.
   S2. All regular grammars generate context-free languages.

   Which of the following is correct?

   (a) S1 is False but S2 is True.

   (b) S1 is True but S2 is False.

   (c) S1 and S2 are both True.

   (d) None of the above.

3. Suppose L_1 and L_2 are non-regular but context-free languages. Then $L_1 \cup L_2$ is also non-regular but context-free.

   (a) True

   (b) False

   (c) I really don't know!

4. Suppose L_1 is regular and $L_1 \cup L_2$ is a context-free language. Then L_2 is context-free.

   (a) True

   (b) False

   (c) I really don't know!

5. Suppose M is an NPDA for a language L such that for any string in L, the stack size used is at most k, for some fixed integer k. What can we conclude about L?

   (a) L is regular.

   (b) L is not regular but context-free.

   (c) L is not context-free.

   (d) We can't conclude anything.

Quiz 9

1. Suppose a Turing Machine M is currently at state q and the current tape symbol (under the head) is a. If the transition $\delta(q, a)$ is not defined for M, then we can conclude that ...

   (a) M hangs at state q.

   (b) M halts at q and accepts the input.

   (c) M halts at q and rejects the input.

   (d) M loops forever if q is a non-final state.

   (e) None of the above.

2. For every *non-deterministic* PDA P, there is a *deterministic* Turing Machine that accepts $L(P)$.

   (a) True

   (b) False

3. Given any language L, we can find a TM M such that:

   - M always halts in a final state for every string $w \in L$ and
   - M always halts in a non-final state for every string $w \notin L$

   (a) True

   (b) False

4. Which of the following is NOT part of an instantaneous description (configuration) of a Turing Machine?

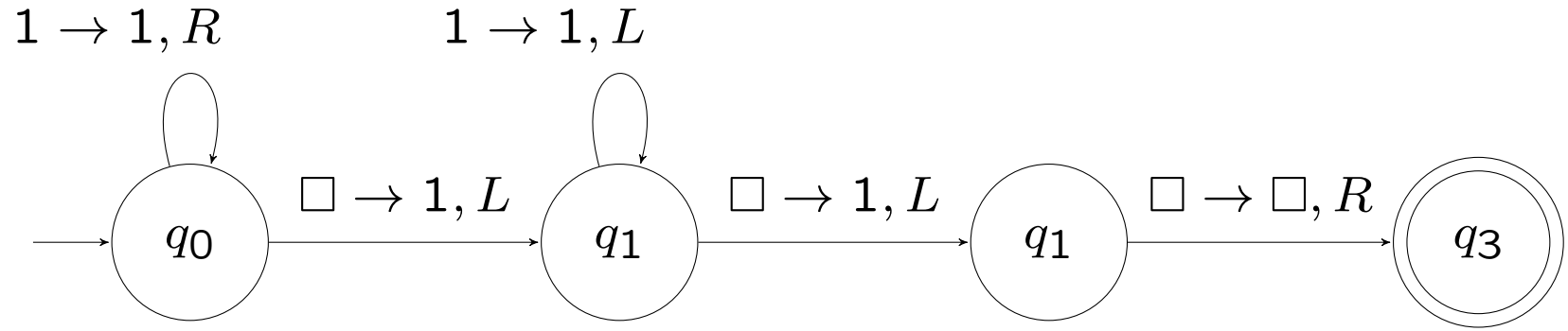
   (a) The input string

   (b) The current state

   (c) The tape content

   (d) The current R/W Head position

5. What is the function computed by the following Turing machine, where $\square$ is the blank symbol of the tape?



(a) $f(n) = n - 1$

(b) $f(n) = n$

(c) $f(n) = n + 1$

(d) $f(n) = n + 2$

Quiz 10

1. Which of the following Turing Machines (TM) can simulate other TMs?

   (a) Nested Turing Machines

   (b) Universal Turing Machine

   (c) Turing Machines that always terminate on all inputs

   (d) Turing Machines that do not terminate on some inputs

   (e) I really don't know!

2. A Turing Machine M is currently at state Q, the tape content is $AB23XYZ$, the read/write head is under the symbol 3, and $\delta(Q, 3) = (P, 5, R)$ is one of transitions of M. Which of the following is the current instantaneous description (ID) of M?

   (a) $QXYZ$

   (b) $AB2Q3XYZ$

   (c) $AB25QXYZ$

   (d) $AB2P5XYZ$

   (e) Je ne sais pas!

3. Which of the following statements is correct?

   (a) Some DFAs are equivalent to Turing Machines.

   (b) Some Turing machines are equivalent to DFAs.

   (c) both (a) and (b)

   (d) (a) but not (b)

4. Which of the following statements is correct?

   (a) There are more programs than Turing Machines

   (b) There are more languages than Turing Machines

   (c) There are more programs than languages

   (d) None of the above

5. Of the following operations, which one can NOT be done by Turing Machines?

   (a) Insert a string

   (b) Delete a symbol

   (c) Copy a string

   (d) Check if the string "335" appears on the tape

6. The quizzes were helpful for learning the course materials.

   (a) Yes

   (b) No

   (c) So so

7. You would like the quizzes more if ...?

   (a) Graded

   (b) Not graded

   (c) No difference (means you like the quizzes but grading or not grading does not matter).