Faculty of Computers and Artificial Intelligence
Cairo University

Mid-term Exam

Program:	**Computer Science**	**Date:**	**14/4/2022**
Course Name:	**Compilers**	**Duration:**	**1 hour**
Course Code:	**CS419**	**Total Marks:**	**20 marks**
Instructor(s):	**Dr. Amin Allam**		

تعليمات هامة:

- حيازة التليفون المحمول مفتوحا داخل لجنة الأمتحان يعتبر حالة غش تستوجب العقاب وإذا كان ضرورى الدخول بالمحمول فيوضع مغلقا فى الحقائب .
- لا يسمح بدخول سماعة الأذن أو البلوتوث .
- لايسمح بدخول أي كتب أو ملازم أو أوراق داخل اللجنة والمخالفة تعتبر حالة غش .

- **Exam consists of 12 equal-weight multiple-choice questions in 2 pages.**
- **Record in the bubble sheet exactly ONE answer for each question.**

Qa ⇒ For questions 1 to 6, consider the subset construction algorithm to convert the following NFA to DFA (without minimization). Let $T(s,a) = r$ means that there exists a direct transition (edge) in the NFA that starts from state s and ends at state r having the label a. The possible transition labels are $\{\varepsilon, a, b\}$.

- The NFA consists of 7 states (labelled from 0 to 6) and the following 11 transitions:
$T(0,\varepsilon) = 1, T(0,\varepsilon) = 4, T(1,a) = 2, T(2,\varepsilon) = 6, T(2,b) = 3, T(4,\varepsilon) = 5, T(4,a) = 6,$
$T(4,b) = 1, T(5,b) = 6, T(6,b) = 3, T(6,\varepsilon) = 3.$
- The start state of the NFA is 0 and the accepting state is 3.

1 The start state of the resulting DFA is the ε-closure of state 0 in the original NFA, which is:
A {0} B {0,1} C {0,1,2} D {0,1,4} E {0,1,4,5}

2 The following state belongs to the resulting DFA:
A {1} B {2} C {3} D {5} E {6}

3 The following state belongs to the resulting DFA:
A {1,2,3} B {1,2,4} C {1,2,6} D {1,3,6} E {1,4,6}

4 The following state belongs to the resulting DFA:
A {2,3,6} B {2,4,5} C {2,4,6} D {3,4,5} E {3,4,6}

5 The number of transitions (edges) labelled a in the resulting DFA (without including transitions to or from the hidden error state) is:
A 1 B 2 C 3 D 4 E 5

6 The number of transitions (edges) labelled b in the resulting DFA (without including transitions to or from the hidden error state) is:
A 1 B 2 C 3 D 4 E 5

BNF | LL | 1) NFA → DFA
2) NFA → DFA Minimize

Qb ⇒ For questions 7 to 12, consider the DFA minimization algorithm to minimize the following DFA to construct an equivalent DFA with the minimum number of states. Let $T(s,a) = r$ means that there exists a direct transition (edge) in the DFA that starts from state s and ends at state r having the label a. The possible transition labels are $\{a,b\}$.

- The original DFA consists of 5 states (labelled from 0 to 4) and the following 10 transitions:
  $T(0,a) = 1, T(0,b) = 3, T(1,a) = 2, T(1,b) = 4, T(2,a) = 1, T(2,b) = 4,$
  $T(3,a) = 2, T(3,b) = 4, T(4,a) = 4, T(4,b) = 4.$
- The start state of the original DFA is 0 and the accepting state is 4.

7 The number of states in the resulting DFA (without including the hidden error state) is:
A 1 B 2 C 3 D 4 E 5

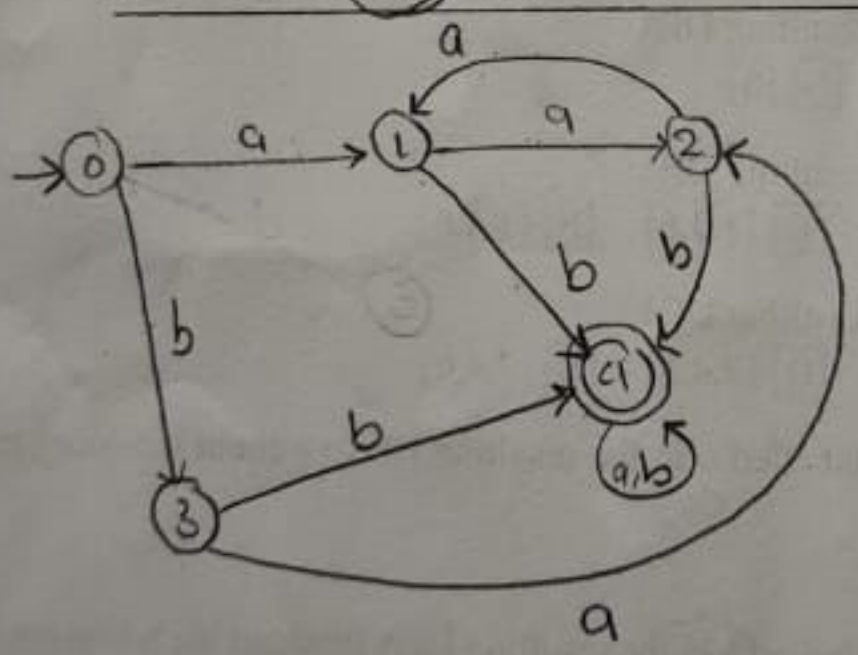
8 The following state belongs to the resulting DFA:
A {0} B {0,1} C {0,2} D {0,1,2} E {0,1,2,3}

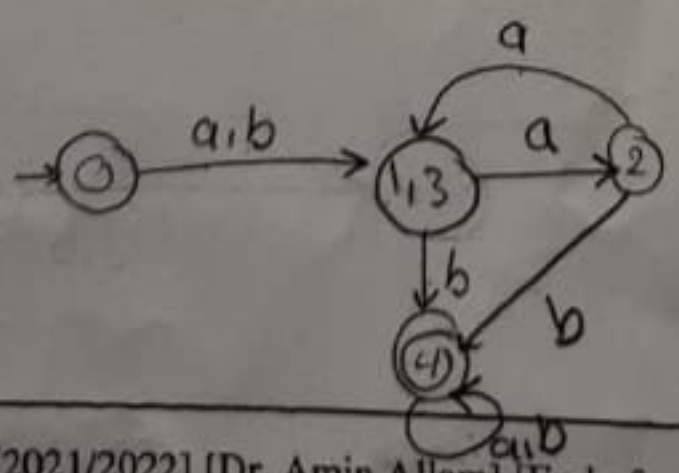
9 The following state belongs to the resulting DFA:
A {1} B {1,2} C {1,2,3} D {1,3} E {1,2,3,4}

10 The following state belongs to the resulting DFA:
A {2,3} B {2,4} C {2,3,4} D {3,4} E {4}

11 The number of transitions (edges) labelled a in the resulting DFA (without including transitions to or from the hidden error state) is:
A 1 B 2 C 3 D 4 E 5

12 The number of transitions (edges) labelled b in the resulting DFA (without including transitions to or from the hidden error state) is:
A 1 B 2 C 3 D 4 E 5





not	0,1,2,3
Final	4

G1	0
G2	1,3
G3	2
G4	4