Nom : ..... **Prénom:** ..... **Groupe :**.....

TEST - Answers

(Duration: 45 minutes - **No electronic devices or documents permitted)**

Exercise 1 (6 *pts*)

- Consider the following CFGs : G1, G2, G3 and G4

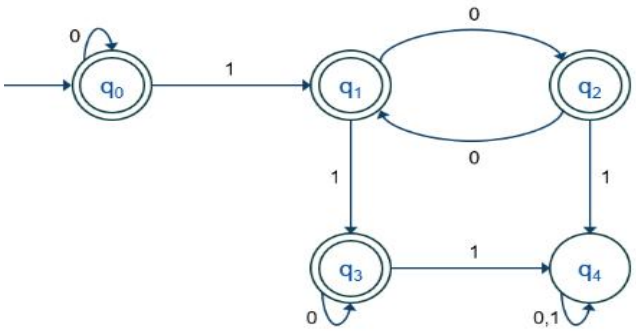
1. Check whether **G1** is **ambiguous or unambiguous**.
2. Remove **ε-productions** from **G2**.
3. Eliminate **left-recursion** in **G3**.
4. Describe the language defined by **G4** using a regular expression.

Grammar		Answer
G1	S → AaS | BaBb | Ab A → a | b B → b	This grammar is **ambiguous** for the string : 'babb' S ⇒ BaBb S ⇒ AaS S ⇒ **b**aBb S ⇒ **b**aS S ⇒ ba**b**b S ⇒ ba**Ab** S ⇒ ba**b**b (*1 pts*)
G2	S → XYX X → 0X | ε Y → 1Y | ε	S → XYX | XX | XY | YX | Y | X | ε X → 0X | 0 Y → 1Y | 1 (*2 pts*)
G3	S → Aa | b A → Ac | Sd | ε	By replacing A → **Sd** with **A → (Aa)d | bd :** S → Aa | b A → Ac | **Aa**d | **b**d | ε Eliminating left-recursion : S → Aa | b A → bdA' | A' A' → cA' | adA' | ε (*2 pts*)
G4	S → 0A1 | 1A0 A → 0A | 1A | ε	**0(0|1)*1 | 1(0|1)*0** (*1 pts*)

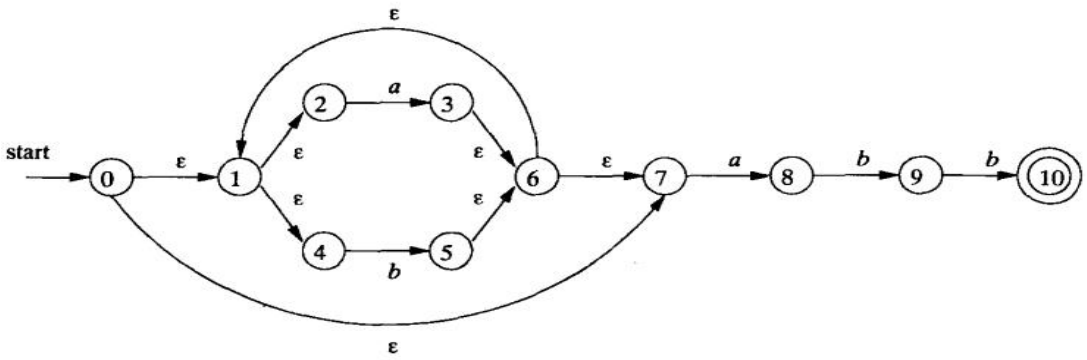
Exercise 2 (3 *pts*)

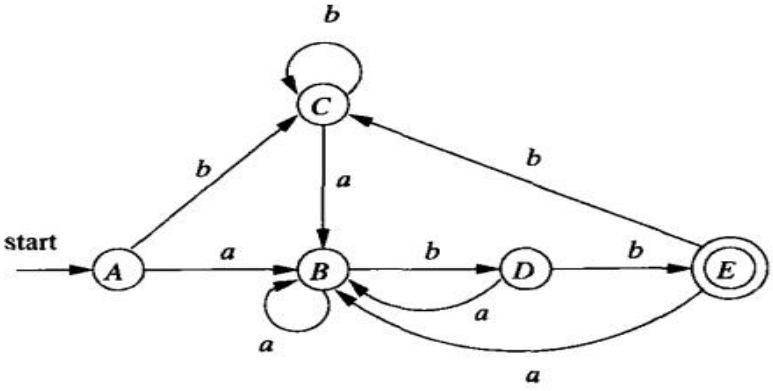
Let *L* be the language of all strings over {0,1} that **do not contain a pair of 1 that are separated by an odd number of symbols**.

- Give the state diagram of a **DFA with 5 states** that recognizes *L*.

DFA *(3 pts)*	

Exercise 3 (5 pts) : Convert the following NFA to a DFA :



Answer	
Final Transition Table	$\varepsilon - closure(0) = \{0, 1, 2, 4, 7\}$, $\varepsilon - closure(1) = \{1, 2, 4\}$, $\varepsilon - closure(2) = \{2\}$ $\varepsilon - closure(3) = \{3, 6, 7, 1, 2, 4\}$, $\varepsilon - closure(4) = \{4\}$ $\varepsilon - closure(5) = \{5, 6, 7, 1, 2, 4\}$, $\varepsilon - closure(6) = \{6, 7, 1, 2, 4\}$ $\varepsilon - closure(7) = \{7\}$, $\varepsilon - closure(8) = \{8\}$ $\varepsilon - closure(9) = \{9\}$, $\varepsilon - closure(10) = \{10\}$
State Diagram	

δ'	a	b
(1 pts) →{0, 1, 2, 4, 7}	{3, 6, 7, 1, 2, 4, 8}	{5, 6, 7, 1, 2, 4}
(1 pts) {3, 6, 7, 1, 2, 4, 8}	{3, 6, 7, 1, 2, 4, 8}	{5, 6, 7, 1, 2, 4, 9}
(1 pts) {5, 6, 7, 1, 2, 4}	{3, 6, 7, 1, 2, 4, 8}	{5, 6, 7, 1, 2, 4}
(1 pts) {5, 6, 7, 1, 2, 4, 9}	{3, 6, 7, 1, 2, 4, 8}	{5, 6, 7, 1, 2, 4, 10}
(1 pts) *{5, 6, 7, 1, 2, 4, 10}	{3, 6, 7, 1, 2, 4, 8}	{5, 6, 7, 1, 2, 4}