Faculty of Computers and Information — Menoufia University — Subject: Compiler Design

Department: Computer Science — Year: 2021/2022

2nd, Semester Mid-Term Exam. — Time allowed: 50 Minutes

Date: 9/4/2022 — Full Mark: 20

| Name: | Section: |
|---|---|

**Answer the following questions:**

**Question-1 (10 marks):**

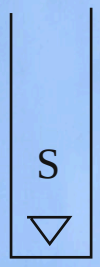
1. Show one-state pushdown machine and recursive descent parser (**Only S()**) for the following grammar:

$S \rightarrow 0S1$

$S \rightarrow 1$

**One-state Pushdown Machine**

| | 0 | 1 | ↵ |
|---|---|---|---|
| S | Rep(1S0) Retain | Rep(1) Retain | Reject |
| 0 | pop advance | Reject | Reject |
| 1 | Reject | pop advance | Reject |
| ▽ | Reject | Reject | Accept |

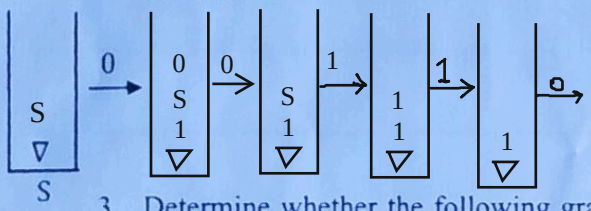



initial

**Recursive Descent Parser**

```
void S() {
  if(inp=='0'){
     inp = getInp() ;
     S() ;
     if(inp=='1')
        inp = getInp() ;
     else  reject() ;  }
  else if(inp=='1')
        inp = getInp() ;
  else   reject() ;
}
```

2. Show the sequence of stacks for the pushdown machine you created above for this input string, **010010**.

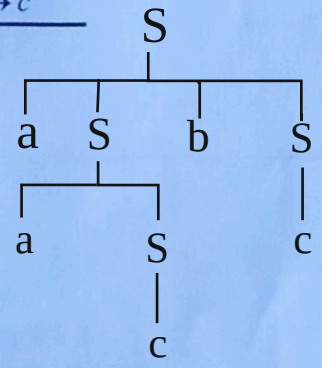



3. Determine whether the following grammar is ambiguous. If so, show two different derivation trees for the same string of terminals, and show a left-most derivation corresponding to each tree.

$S \rightarrow aSbS$

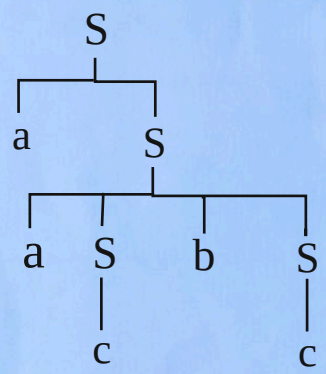
$S \rightarrow aS$

$S \rightarrow c$




left most derivation

S==> aSbS==>aaSbS==>>aacbS==>>aacbc




left most derivation

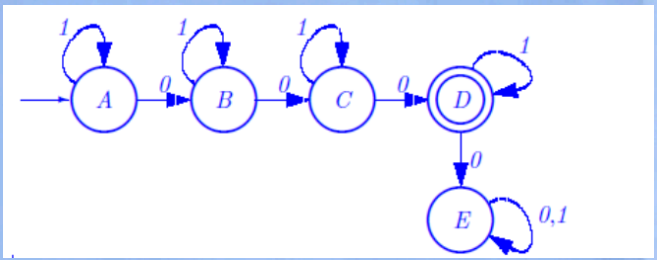
S==>aS==>aaSbS==>aacbS==>aacbc

this is Ambiguous

**Question-2 (10 marks):**

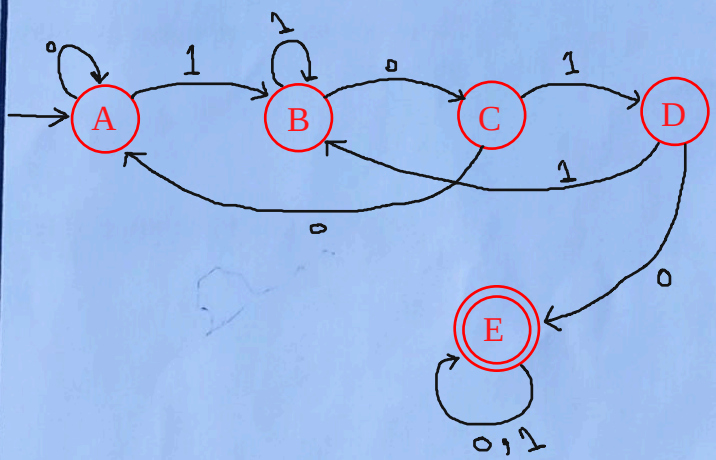
1. Show a finite state machine in either state graph or table form for the language
   a) Strings containing exactly three zeros.
   b) Strings containing 1010.

**a) Strings containing exactly three zeros**




| | 0 | 1 |
|---|---|---|
| A | B | A |
| B | C | B |
| C | D | C |
| *D | E | D |
| E | E | E |

**c) Strings containing 1010**




2. Write regular expressions for each description. The alphabet is the binary digits {0, 1}.
   a) All strings which contain three sequential ones.
   b) All strings which contain exactly one 0.
   c) All strings which contain at least three zeros.
   d) All strings which contain an even number of 1s and any number of 0s.

| | |
|---|---|
| **a)** (0+1)*111(0+1)* | **b)** 1*01* |
| **c)** (0+1)*0(0+1)*0(0+1)*0(0+1)* | **d)** 0*(10*10*)* |

3. Describe the languages denoted by the following regular expressions
   a) a(a+b)*a
   b) a*ba*ba*ba*

| | |
|---|---|
| **a)** Strings start by a and end by a<br>لازم كل string ال يطلع من هذه ال language يبتدي بحرف ال a وينتهي بحرف ال a<br>aa , aaa , aba , aaba , aababa | **b)** Strings containing at least three b<br>string بيحتوي علي الاقل ثلاثه من ال b<br>bbb , abbb , abababa , aabaabaabaa |

اللهم صلي وسلم وبارك علي محمد في الملأ الأعلي الي يوم الدين

*With my best wishes*
*Dr. Ibrahim A. Elgendy*