CSE331
Assignment 02
Derivation, Parse Tree, Ambiguity Solution

You may find a few more solutions from the practice sheet in the Ambiguity Practice Solution-1 pdf.

Problem 5 (CO3): Derivations, Parse Trees and Ambiguity (10 points)

Take a look at the grammar below and solve the following problems.

$$A \rightarrow 1A \mid 1C \mid 0B \mid 00A$$
$$B \rightarrow 0A \mid 1B \mid 00B$$
$$C \rightarrow 0C0 \mid 0C1 \mid 1C0 \mid 1C1 \mid \varepsilon$$

(a) **Give** a leftmost derivation for the string 01011001. (3 points)

(b) **Sketch** the parse tree corresponding to the derivation you gave in (a). (2 points)

(c) **Demonstrate** that the given grammar is ambiguous by showing two more parse trees (apart from the one you already found in (b)) for the same string. (3 points)

(d) **Find** a string w of length six such that w has exactly one parse tree in the grammar above. (1 point)

(e) **Desgin** an unambiguous Context Free Grammar for the language represented by the given ambiguous grammar. (1 point)

Marking Criteria

True for all questions:

- **Failing to identify the starting variable correctly, will be awarded with 0**
- **Any production rule has been used which is not in the given grammar, will be awarded with 0**
- **No marks if someone derives/parse for a wrong string.**

Question (a):

- A correct derivation is worth the full points.
- Any derivation that is not leftmost or makes use of production that isn't in the grammar is worth 0 points.

Question (b):

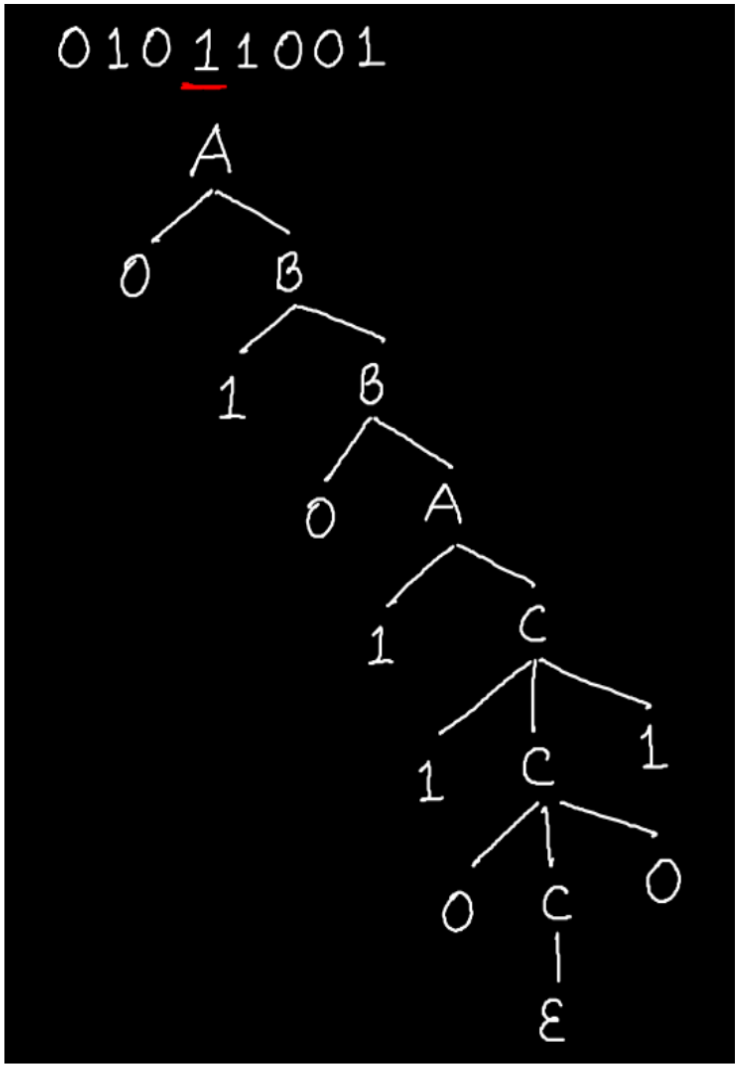
- Full 2 points if the given parse tree corresponds to the derivation given in (a).
- In any other scenarios, award 0.

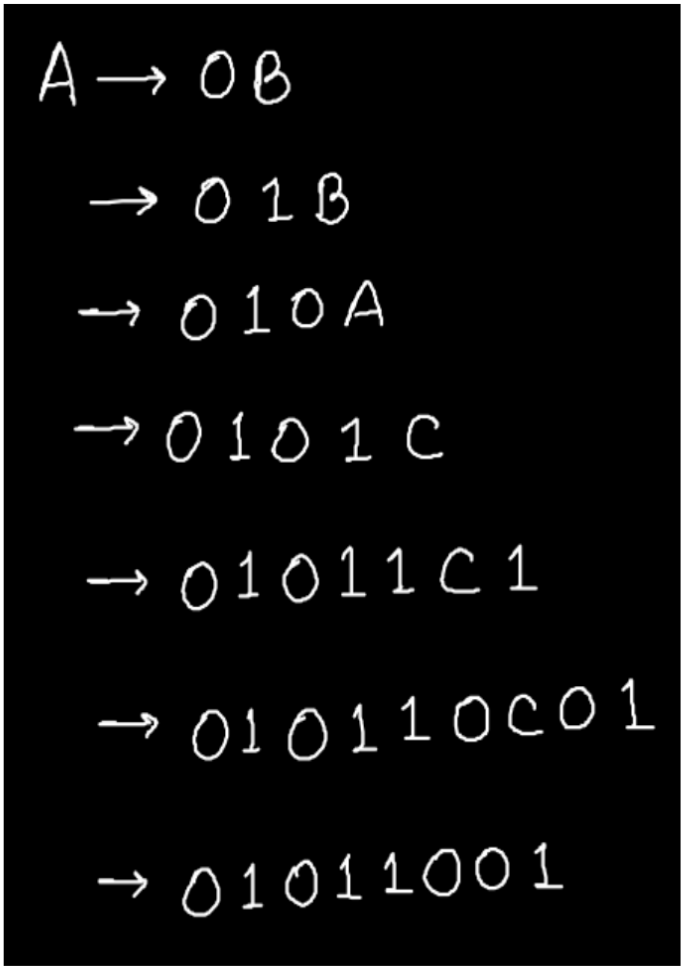
Question (c):

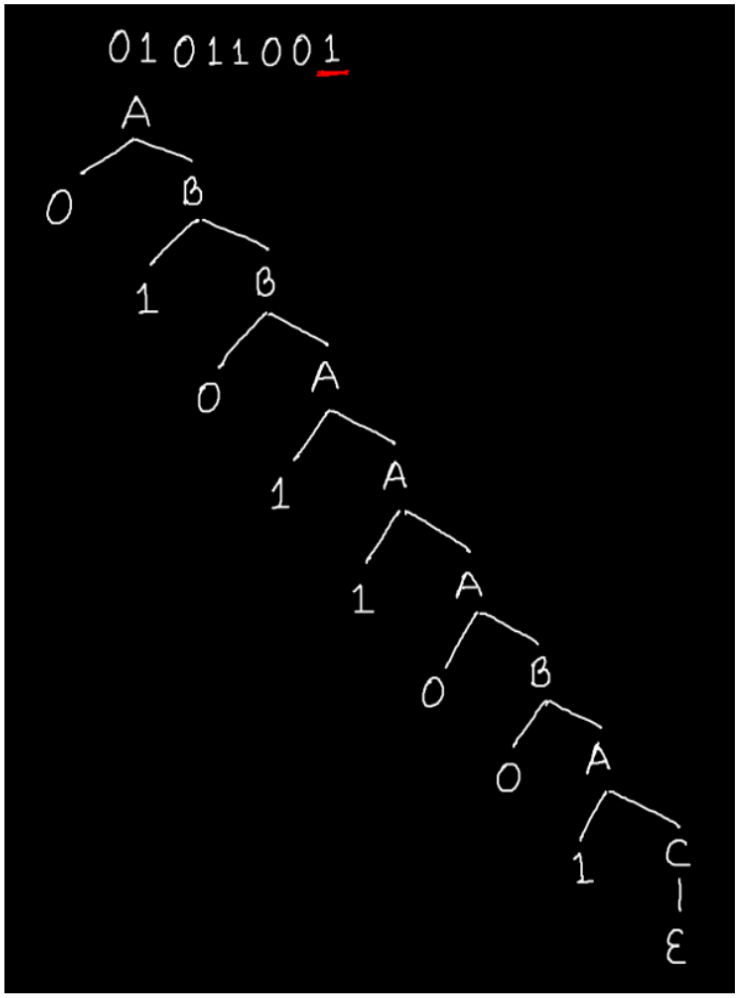
- 1.5 points for each correct parse tree
- No marks if the Parse tree of (b) has been repeated
- No marks for wrong parse tree.

Solution Question: a,b,c.

There are three parse trees.







$A \rightarrow 0B$

$\rightarrow 01B$

$\rightarrow 010A$

$\rightarrow 0101A$

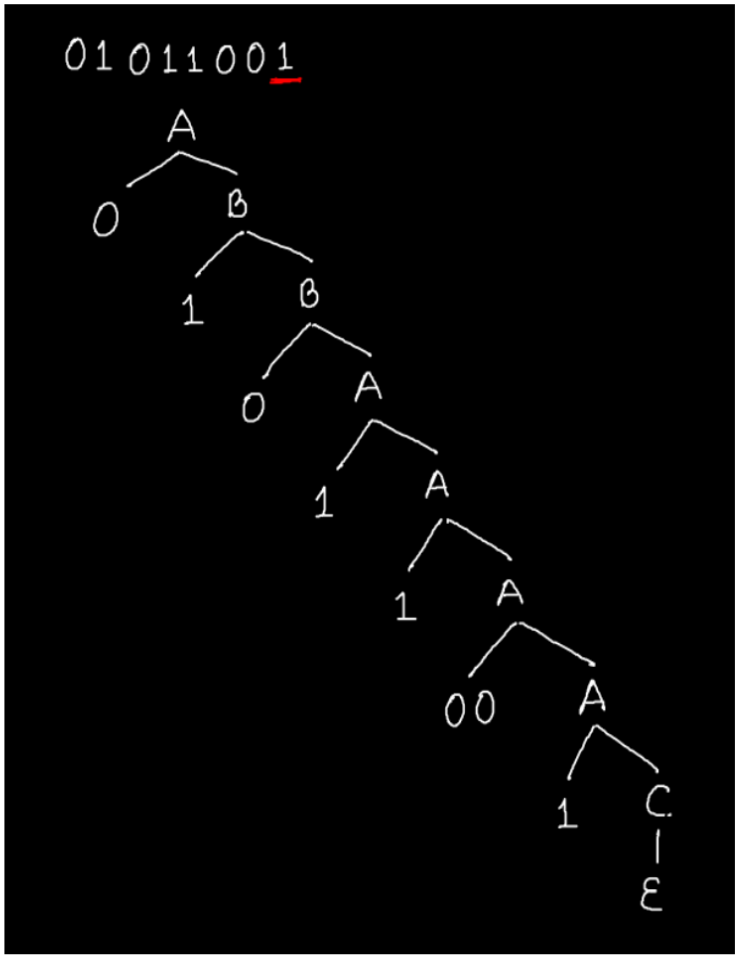
$\rightarrow 01011A$

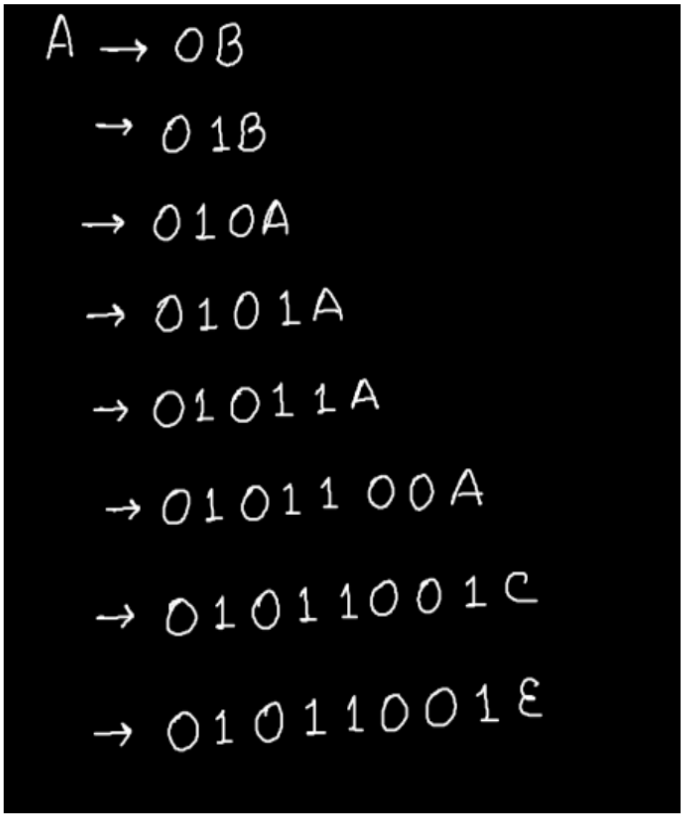
$\rightarrow 010110B$

$\rightarrow 0101100A$

$\rightarrow 01011001C$

$\rightarrow 01011001\varepsilon$

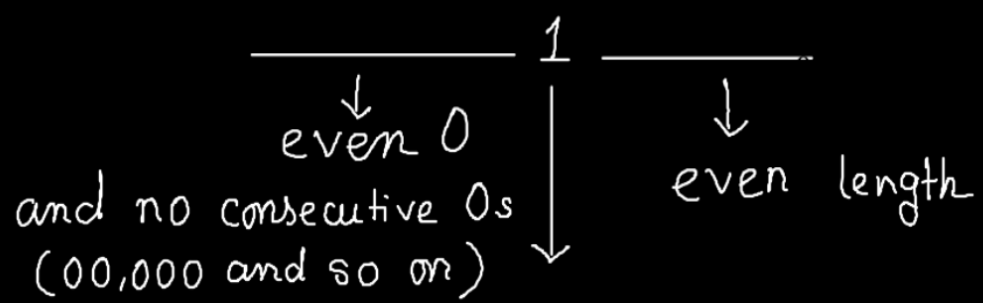




Question (d):

The language is to parse the strings which contain at least one 1, such that there is an even number of 0s before the 1, and the remaining length is even after the 1.

(d) The format of the string will be



Exactly one such 1, which has these two properties

010100, 110000, 010101, 010110, 110001, 110010, 110100, 111000, 011011, 011101, 101011, 101101, 110011, 110110, 111001, 111010, 110111, 111011