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Course Code :- CSI-317

Course Title :- Theory of Computing

∝ Final Exam

Ans-to-the-Q-No-2

(a)

Ambiguity: The quality or state of being ambiguous especially in meaning.

CFG: A context free grammar is a formal grammar which is used to generate all the possible patterns of strings in a given formula language.

(b)

Given,

$S \rightarrow I \mid SAS \mid I \mid S+S \mid S-S$

$I \rightarrow i \mid j \mid k$

Now,

$I \rightarrow i,\ I \rightarrow j,\ I \rightarrow k$

$S \rightarrow I,\ S \rightarrow i,\ S \rightarrow j,\ S \rightarrow k$ ---- (i)

$S \to \lambda$ ——(i)

$S \to SaS$

$S = a$ (from equation (ii) $S \to \lambda$) —— (iii)

$S \to SbS$

$S = b$ (from (ii) equation) —— (iv)

Now, (i), (iii) — (iv),

$S = iajbk$

∴ The terminal of string $iajbk$ is ambiguous.

Ans to the Q No 3

(a)

The Chomsky hierarchy classifies the formal language in the four types:

1. Type 0: Unrestricted grammars:

There are no restriction to define the productions. The languages generated by these grammars are known as recursively enumerable.

2. Type1: Restricted grammars:

These grammars generate Context-sensitive languages. These are of the form $\alpha \rightarrow \beta$, with the following condition $|\beta| >= |\alpha|$, i.e. length of β is greater than length of α.

3. Type 2: Context free grammar:

These grammar generate context-free languages. The productions are of the form $A \rightarrow \alpha$. Here $\alpha \in (V \cup T)^*$. Here α represents a sentinal form.

4. Type 3: Regular grammar:

These grammars generate regular languages. These could be of the form $A \rightarrow a$ or $A \rightarrow aB$.

Here,

T = Terminal $(a, b, \ldots)$

V = Variables $(A, B, \ldots)$

$\alpha, \beta \in (V \cup T)^*$

Q)

Difference between Regular Expressions & Context free grammar —

Regular Expression	Context free grammar
① Lexical rules are quite simple in case of Regular Expressions.	① Lexical rules are difficult in case of Context free grammar.
② Notations are easy to understand.	② Notations are quite complex to understand.
③ It is easy to construct efficient recognizer from Regular Expressions.	③ By using this, it is very difficult to construct the recognizer.

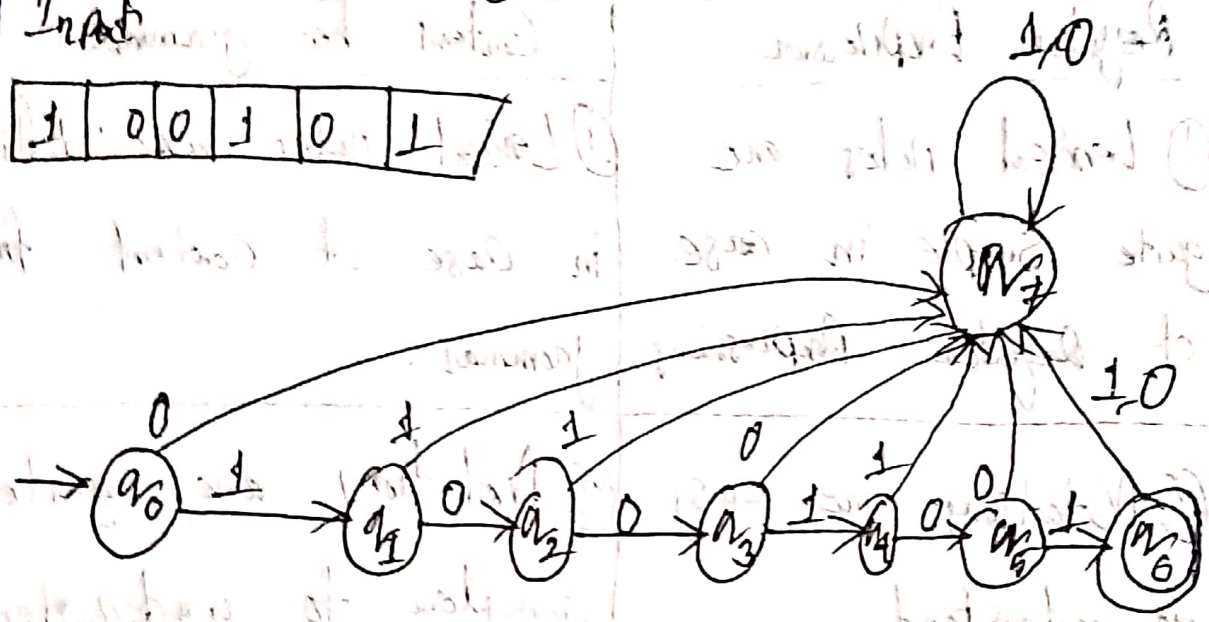
(c)

Regular expression,

$R = 1^*00^*1(0+1)^*$

Input

1	0	0	1	0	1



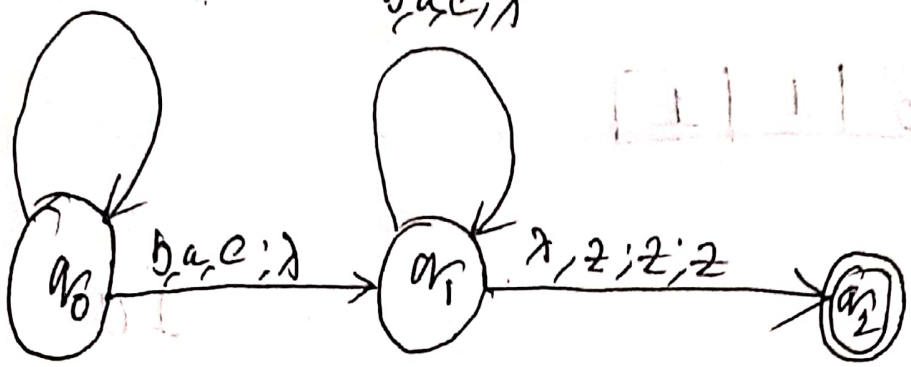
Ans to the Q.No. 4

(a)

a,a,a;aaa

a,z;az;az

b,a,c;λ



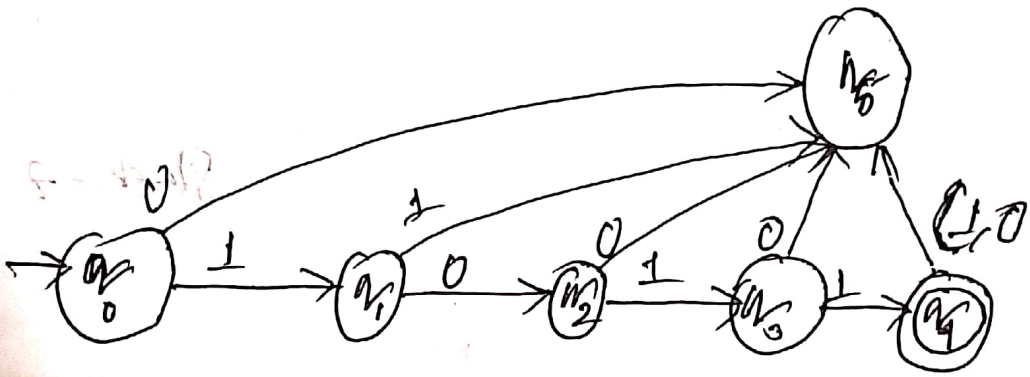
Stack = z

Ans to the Q No 4 (b)

L = {w | w is a binary string that contains 1101 as a substring}

Input

1	0	1	1



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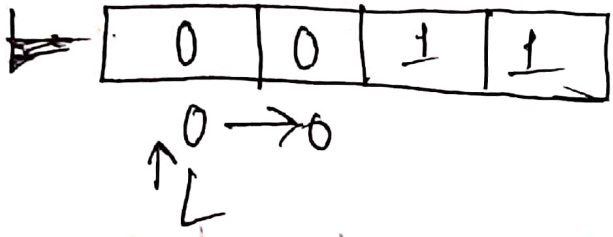
Ans to the Q No 6

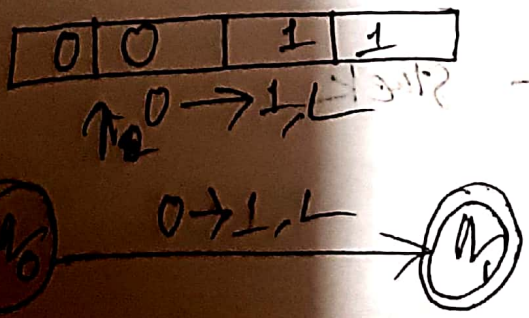
(a)

A mathematical model of a hypothetical computing machine which can use a predefined set of rules to determine a result from a set of input variables.

(b)



(c)



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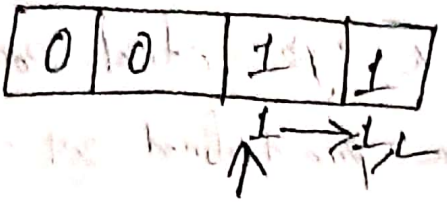
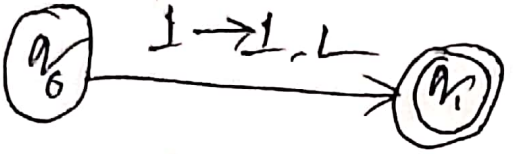
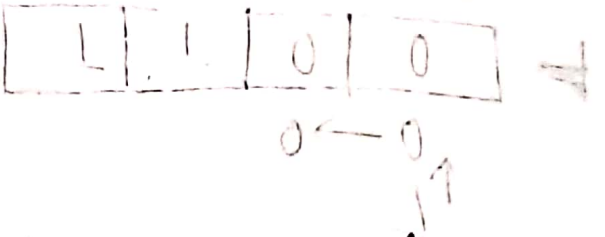
(a)





(b)



(c)

The machine halts in a state if there is no transition to follow.

Underflow happens when we try to pop an item from an empty stack.