ISE Assignment

Q1) Attemp any two

A) Design PDA for odd length of palindrome over language $\Sigma = \{a, b\}$.

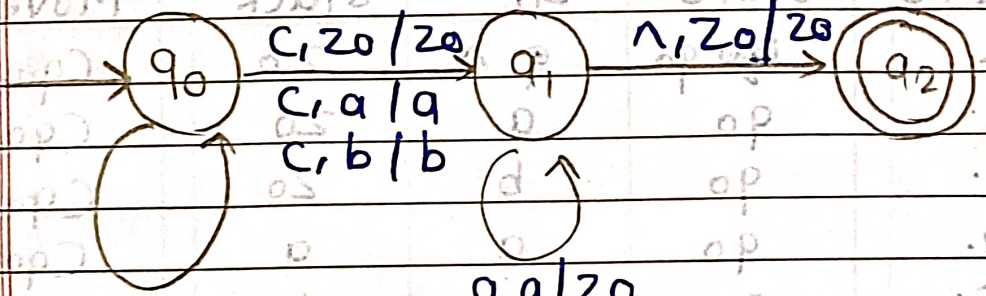
→ $L = \{xcx^R \mid x \in \{a, b\}\}$

L = aca., bcb, abcba., aabcbaa.

Move no	state	I/P	stack	Moves
1.	q0	∧	Z0	(q0, Z0)
2.	q0	a	Z0	(q0, aZ0)
3.	q0	b	Z0	(q0, bZ0)
4.	q0	a	a	(q0, aa)
5.	q0	b	b	(q0, bb)
6.	q0	a	b	(q0, a, b)
7.	q0	b	a	(q0, ba)
8.	q0	c	Z0	(q1, Z0)
9.	q0	c	a	(q1, a)
10.	q0	c	b	(q1, b)
11.	q1	a	a	(q1, ∧)
12.	q1	b	b	(q1, ∧)
13.	q1	∧	Z0	(q2, Z0)

For eg. check the string abcba be the palindrome or not.

$(q_0, abcba) \vdash (q_0, abcba, z_0)$
$\vdash (q_0, bcba, az_0)$
$\vdash (q_0, cba, baz_0)$
$\vdash (q_1, ba, baz_0)$
$\vdash (q_1, a, az_0)$
$\vdash (q_1, \wedge, z_0) \rightarrow$ accepted.



∧, z0 / z0
a, z0 / a z0
b, z0 / b z0
a, a / aa
b, b / bb
a, b / ab
b, a / ba

c) Write the steps to normalize CFG to CNF and generate CNF grammer for the following.

$S_0 \rightarrow S$
$S \rightarrow ASB$
$A \rightarrow aAS \mid a \mid \epsilon$
$B \rightarrow SbS \mid A \mid bb$

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→ Step 1:

$S_0 \to S$
$S \to ASB$
$A \to aAS \mid a \mid \wedge$
$B \to SbS \mid A \mid bb$

step 2

$S_0 \to S$
$S \to ASB \mid SB$
$A \to aAS \mid a \mid aS$
$B \to SbS \mid \wedge \mid bb \mid A$

step 3:-

$S_0 \to S$
$S \to ASB \mid SB \mid AS \mid S$
$A \to aAS \mid a \mid aS$
$B \to SbS \mid bb \mid A$

step 4:-

$S_0 \to S$
$S \to ASB \mid SB \mid AS \mid S$
$A \to aAS \mid a \mid aS$
$B \to SbS \mid bb \mid aAS \mid a \mid aS$

step 5:-

$S_0 \to S$
$S \to XB \mid SB \mid AS \mid S$
$A \to aX \mid a \mid aS$
$B \to SbS \mid bb \mid aX \mid a \mid aS$
$X \to AS$

step 6:-

$S_0 \to S$
$S \to XB \mid SB \mid AS \mid S$
$A \to YX \mid a \mid YS$
$B \to SZS \mid ZZ \mid YX \mid a \mid YS$
$X \to AS$
$y \to a$
$z \to b$

step 7:-

$S_0 \to S$
$S \to XB \mid SB \mid AS \mid S$
$A \to YX \mid a \mid YS$
$B \to WS \mid ZZ \mid YX \mid a \mid YS$
$X \to AS$
$y \to a$
$z \to b$
$W \to SZ$

step 8:

$S_0 \to XB \mid SB \mid AS$
$S \to XB \mid SB \mid AS$
$A \to YX \mid a \mid YS$
$B \to WS \mid ZZ \mid YX \mid a \mid YS$
$X \to AS$
$y \to a$
$z \to b$
$W \to SZ$

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Final Conversion of CFG to CNF

$S_0 \rightarrow XB \mid SB \mid AS$
$S \rightarrow XB \mid SB \mid AS$
$A \rightarrow YX \mid a \mid YS$
$B \rightarrow WS \mid ZZ \mid YX \mid a \mid YS$
$X \rightarrow AS$
$y \rightarrow a$
$z \rightarrow b$
$W \rightarrow SZ.$

Q2) Attempt any two.

A) Define FA, Design deteoministic FA for the RE $(b \mid ab^*ab^*)^*$ (even no of a's)

→ $RE = (b + ab^*ab^*)^*$

$L = \{w = \text{even no. of a's} \mid we \{a,b\}^*\}$

$L = (\Lambda, b, aa, aba, abab \ldots)$

QB) Discuss the difference between PDA and FA

Pushdown Automata	Finite Automata
1) For type-2 grammer we can design push-down automata.	For Type-3 grammer we can design finite automata.
2) PDA can read input symbol from an input tape and it has also access to an additional stack that allows it to store and retrive symbol.	An FA can only read input symbol from an input tape and does not have any additional memory
3) PDA has an stack as additional memory component allowing it to store and manipulate data based on current input and the top most symbol on the stack	FA does not have any additional memory apart from it's state transition.
4) PDA's are more powerful than FA's and can recognize CFL, which includes a border set of language than those recognize by FA's	FA can only recognize regular language, which are a subset of the CFL.
5) PDA can perform computations using a stack	FA are simpler machines that can only

enabling them to handle nested structure and enforce context sensative language	perform basic pattern machine and recognize regular pattern in the input
.) It gives acceptance of input alphabet by going up to empty stack and final state	It accepts the input input alphabets by going up to final states

Q) In concern with grammer define.

a) Production:- i) Production also known as rule or production rule. are statement that define how symbols in a formal grammer can be written or replaced.

They specify the possible transformation or derivations that can b applied to generate valid string in the language defined by grammer.

Example:-

$E \rightarrow E+T$

production state (E) can be written has an expression E+I

b) Variable:-

Variable, also known as non-terminal are symbols that represent synatic categories or place holder in a formal gammar.

They are used to define and generate the structure of valid string in the language defined by grammar

example:- In the context of context free gramer for a arthmetic expression

in $E \Rightarrow E+T$

variable E could be represented as expression

c) Terminals:-

Terminals are symbols that represent the basis units or indivisible elements of the language defined by a formal gammar

They are the actual symbols that appears in the valid strings generated by the gammar

Eg:- terminal could include numbers (eg. 0, 1, 2 ....) and arthmetic operators (eg. +, -)

d) Start Variable:-

The start variable, also known as the start symbol, is the special variable in a formal grammar that represent the initial or starting point

eg. $S \rightarrow A+B$

$A \rightarrow a \mid \epsilon$

$B \rightarrow b \mid \epsilon$

In this example S is the start symb