End Semester Exam

SUB : TOC
SUB CODE : CS2204
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(a) TRUE

A language is finite if it has a finite number of strings in it

$\therefore |L| < \infty$

We know that

① regular languages are context-free

② finite language is always regular

hence, finite language is context free.

(b) TRUE

Let G be a context free language such that

$G = (V, \Sigma, R, S)$

Let T be a parse tree generated by grammar G,

when height of parse tree is 1 then

max yield = longest yield of T = max(length (α)) $A \rightarrow \alpha \in R$

let it be 'p'

The maximum yield for next height is p^2,

Using mathematical induction, ~~the~~ the max yield is p^h where h is the height of the tree

Hence there excits an upper bound.

(4) (c) FALSE

Pumping theorem for the class of regular language can be used to prove, that a language is not regular. Regular language is a subset of CFL. So this language may or ~~may~~ may not be CFL. Hence we can't use pumping theorem for the class of regular language to prove that a language is CFL.

~~7(a)~~
~~$\{w_1 w_2 : w_1 \in \{a,b\}^*$~~

(1) (d)

FALSE

We know that regular languages are also context free and the intersection of class of regular lang. and CFLs are also context free.

Hence there might be some combinations of 2 CFLs whose intersection is also context free

(2)

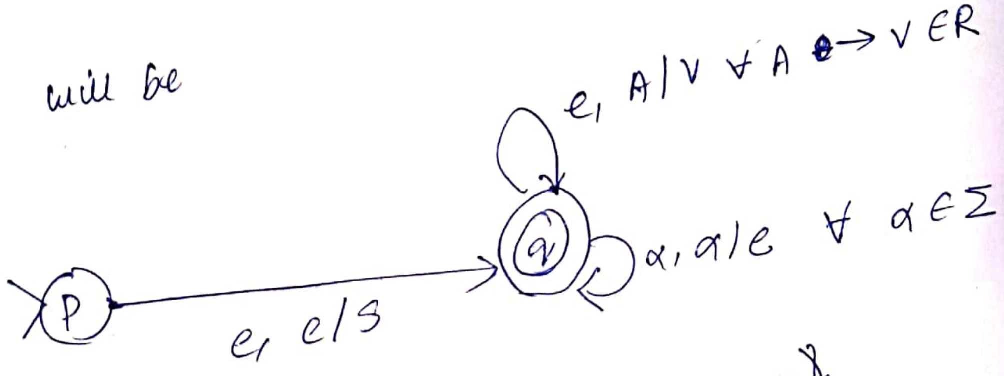
(a) $\{ w_1 w_2 : w_1 \in \{a, b\}^*, w_2 \in \{c, d\}^*$ and $|w_1| = 2$ ... that is length of w_1 is twice that of w_2

rules are :-

$$R = \{ \begin{array}{l} S \to aaSc \\ S \to bbSc \\ S \to abSc \\ S \to baSc \\ S \to aaSd \\ S \to bbSd \\ S \to abSd \\ S \to baSd \\ S \to e \end{array} \}$$

$\Sigma = \{a, b, c, d\}$

PDA will be



The PDA M = {K, Σ, Γ, Δ, F}

$K = \{p, q\}$

$\Sigma = \{a, b, c, d\}$

$\Gamma = \{a, b, S, c, d\}$

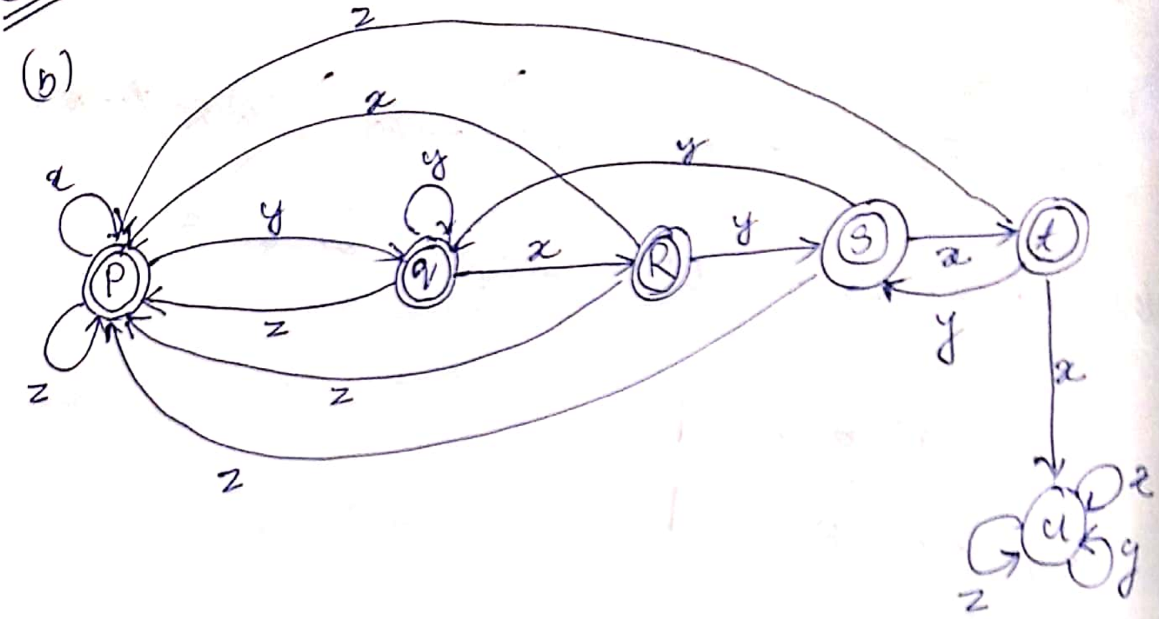
$\Delta = p$

$F = \{q\}$

/2] $\Delta = \{ (p, e, e, q, S), (q, e, S, q, aaSc)$
$(q, e, S, q, bbSc), (q, e, S, q, abSc)$
$(q, e, S, q, baSc), (q, e, S, q, aaSd)$
$(q, e, S, q, bbSd), (q, e, S, q, abSd)$
$(q, e, S, q, baSd), (q, a, a, q, e)$
$(q, b, b, q, e)\ (q, c, c, q, e)$
$(q, d, d, q, e)\ (q, e, S, q, e) \}$

(2)

(b)



M = { K = { p, q, r, s, t, u }, Σ = { x, y, z }.

δ = (p, y, q), (p, x, p) (p z p)
(q, x, r), (q, y, q), (q, z q)
(r, x, p), (r, y, s), (r, z, p)
(s, x, t), (s, y, q), (s, z, p)
(t, x, u), (t, z, p), (t, y, s)
(u, x, u), (u, y, u), (u, z, u)

$ = p

F = { p, q, r, s, t }

}

$2(c) = \{a^i b^j c^i : i, j \geq 0\}$ [PDA]

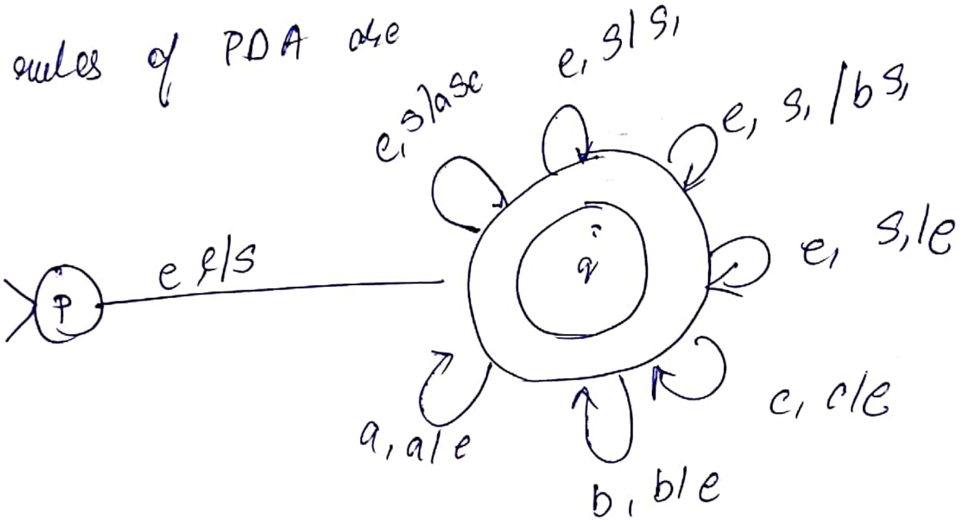
$L = \{ \omega \in \{a, b, c\}^* \mid a^i b^j c^i, \; i, j \geq 0 \}$

rules of CFG be

$R = \{ S \to aSc$
$\quad S \to S_1$
$\quad S_1 \to bS_1$
$\quad S_1 \to e \}$

$\Sigma = \{a, b, c\}$

rules of PDA are



the PDA $= (K, \Sigma, \Gamma, \Delta, s, F)$

$K = \{p, q\}$
$\Sigma = \{a, b, c\}$
$\Gamma = \{a, b, c, S, S_1\}$
$\Delta = \{ (p, e, e, q, S), (q, e, S, q, aSc), (q, e, S_1, q, bS_1)$,
(q, e, S, q, S_1),
(q, e, S_1, q, e) (q, a, a, q, e)
(q, b, b, q, e), $(q, c, c, q, e) \}$

$s = p$ $\quad F = \{q\}$

Scanned with CamScanner

(3)

(a) given $\{a^i b^j c^j d^i : i, j \geq 0\}$ [CFG]

the context free grammar
$G = (V, \Sigma, R, S)$ is constructed as:

$R = \{ S \to aSd$

$S \to S_1$

$S_2 \to bS_1c$

$S_2 \to e \}$

$V = \{S, S_1, a, b, c, d\}$

$\Sigma = \{a, b, c, d\}$

$S = S$

This generates the language given above

Scanned with CamScanner

(3) (b) $\{a^i b^j c^i d^j : i, j \geq 0\}$ [UG]

the rules for the unrestricted grammar is defined below

~~$S \rightarrow S_1 S_2$~~
~~$S_2 \rightarrow b S_2 d$~~
~~$S_1 \rightarrow [$~~

~~$S \rightarrow S_1 S_2$~~
~~$S_2 \rightarrow$~~

$$R = \{ \begin{aligned} S &\rightarrow S_1 S_2 \\ S_1 &\rightarrow a S_1 C \\ S_2 &\rightarrow B S_2 d \\ S_1 &\rightarrow [\\ S_2 &\rightarrow] \\ CB &\rightarrow BC \\ C] &\rightarrow]C \\ [B &\rightarrow b[\\ [] &\rightarrow e \end{aligned} \}$$

Let the unrestricted grammar be $G = (V, \Sigma, R, S$

$V = \{a, b, c, d, S_1, S, S_2, B, C, [,]$

$\Sigma = \{a, b, c, d\}$

$S = S$

R as written above.