Push Down Automata (PDA) :-

→ A mathimatical model that corresponds analogously to CFL's that can be generated from CFG's is called PDA's.

Machine halt

Yes/Accept if string accepted by PDA

No/reject if string rejected by PDA

Evening

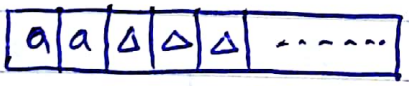
Ex-1

$$a^+ = \{ a, aa, aaa, \dots \}$$

for string 'aa'

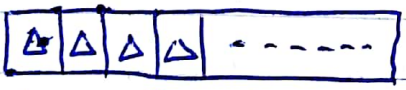
WEDNESDAY 23 رجب ١٠

THURSDAY 24 رجب ١١



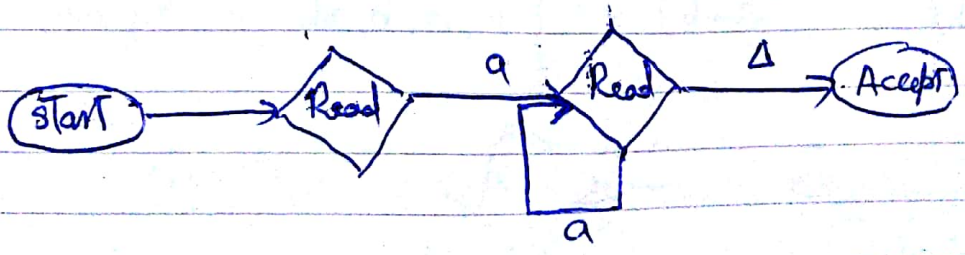
→ input tape

if the tape is blank, then



we read from left to right and right side is infinite and no back tracking is allowed here.

Then PDA would be



Evening

رجب ١٤٣١

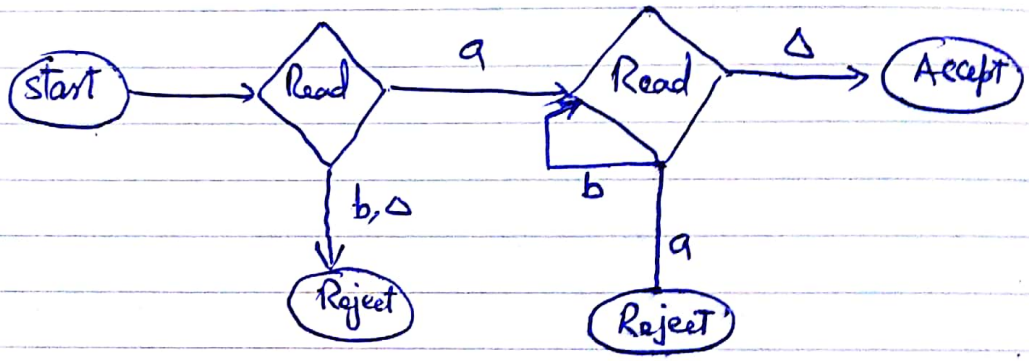
JUNE 2010

JUNE

M	T	W	T	F	S	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

Examples of PDA's for Regular languages :-

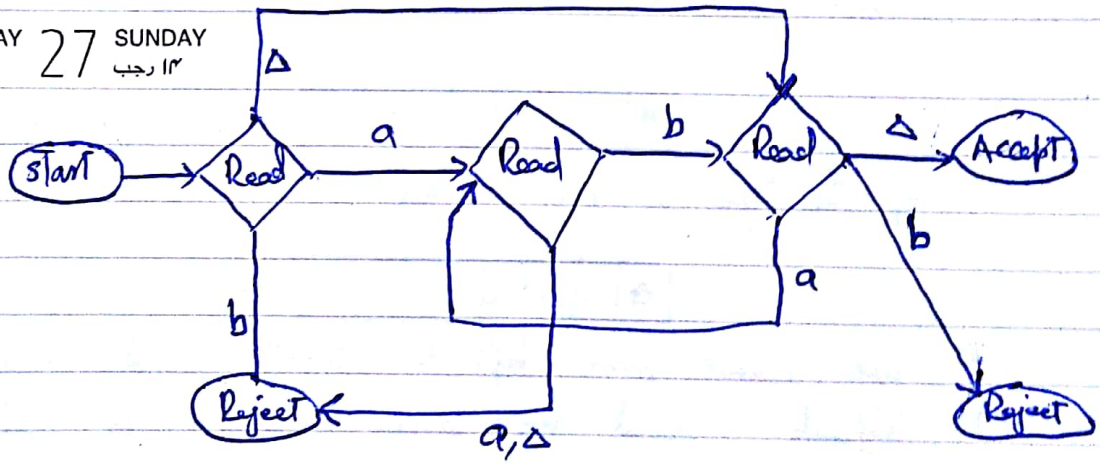
(i) $ab^* = \{a, ab, abb, abbb, \dots\}$



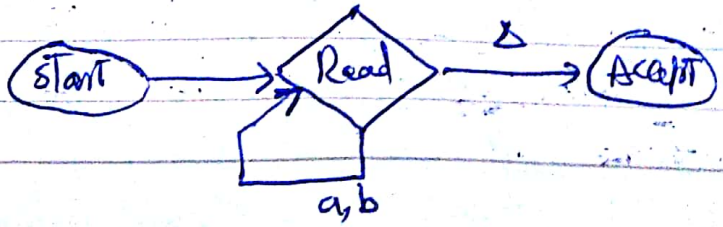
(ii) $(ab)^* = \{\Lambda, ab, abab, ababab, \dots\}$

25 FRIDAY ١٢ رجب

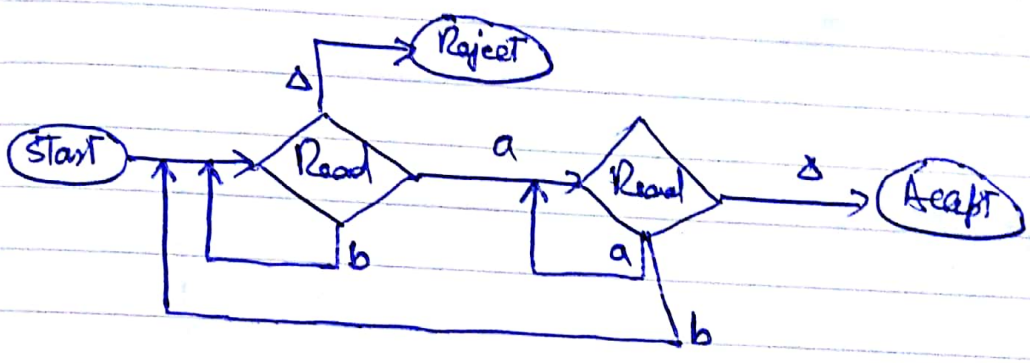
26 SATURDAY ١٣ رجب 27 SUNDAY ١٤ رجب



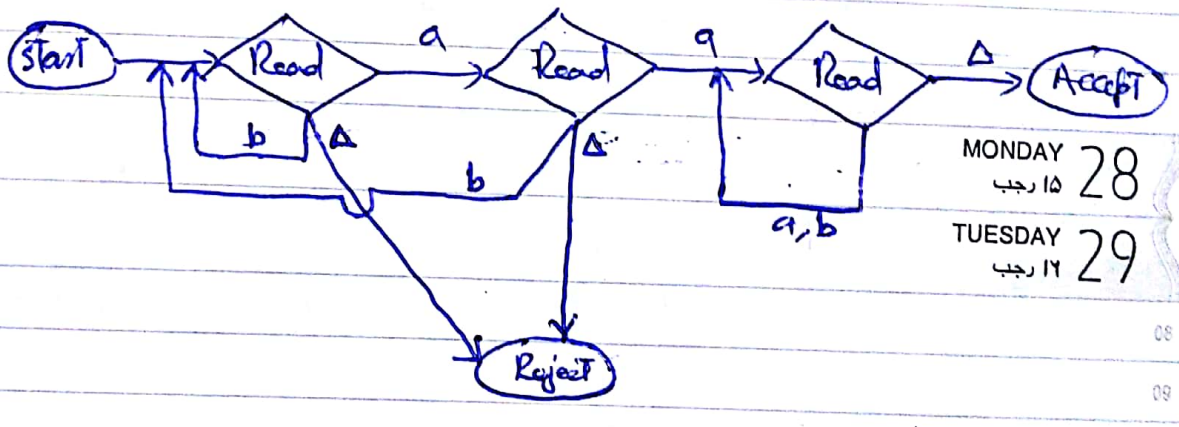
(iii) $(a+b)^* = \{\Lambda, a, b, ab, ba, bb, aa, \dots\}$



(IV) – $\Sigma = \{a, b\}$ and L $\triangleq$ which ends with 'a'



(V) – L $\triangleq$ Contain substring 'aa'



H.W Design PDA for "$a^n b^n$"

Theorem: Every CFG has a PDA

General (Construction of PDA Using CFG)

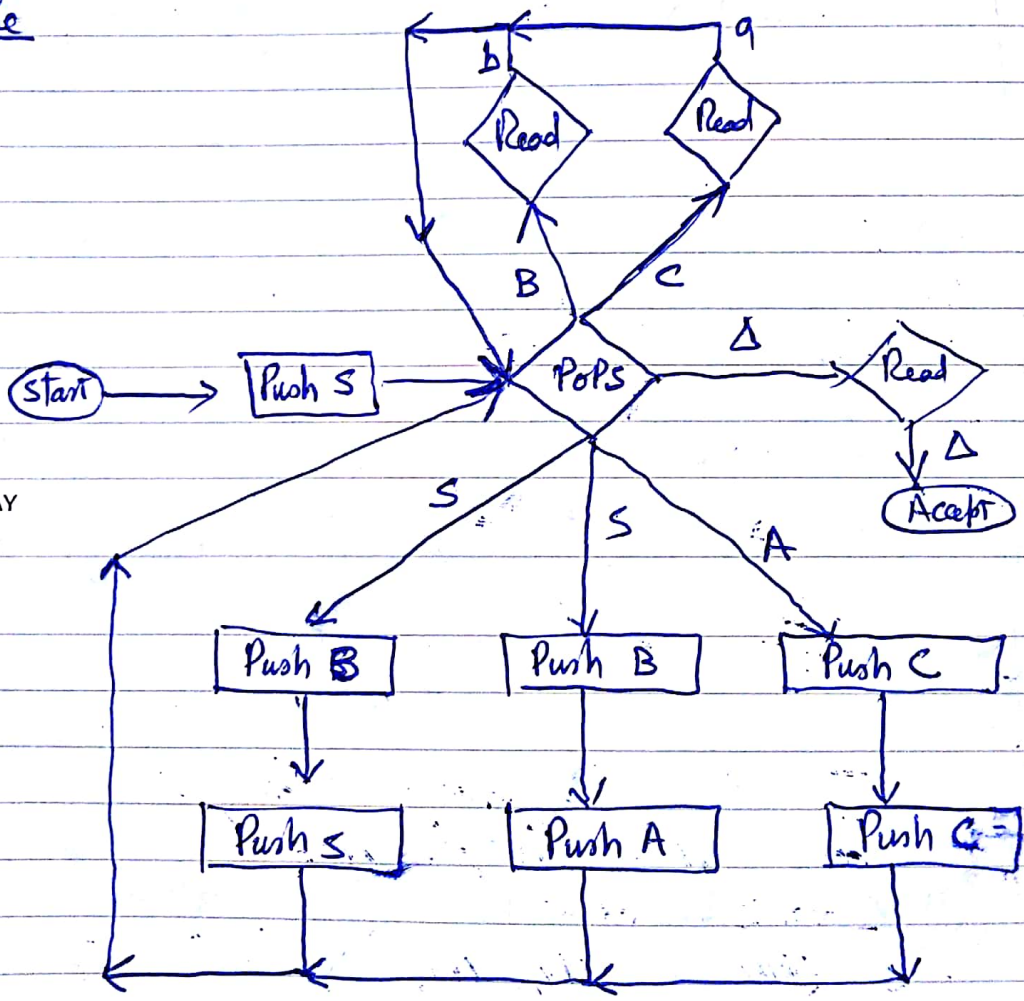
→ if a word is generated by CFG, Then that word should also be accepted by its respective PDA.

JULY

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

→ if a word can not be generated by CFG then it will be rejected by corresponding PDA

Example



30 WEDNESDAY
١٧ رجب

1 THURSDAY
١٨ رجب

$S \rightarrow SB$

$S \rightarrow AB$

$A \rightarrow CC$

$B \rightarrow b$

$C \rightarrow a$

it is better that your CFG should be in CNF form, otherwise it is possibility that some rules stucks or not.

The Rules followed During Construction

→ if non-terminals on R.H.S of production
e.g $NT \rightarrow NT_1\ NT_2 \text{ —— } NT_i$

then Push on stack in reverse direction

Evening

→ if all terminals on R.H.S of production
e.g $NT \rightarrow T_1\ T_2\ T_3 \text{ —— } T_i$

then read in forward direction

FRIDAY 2 رجب ۱۹
SUNDAY 4 رجب ۲۱ SATURDAY 3 رجب ۲۰

→ if $NT \rightarrow T_1\ T_2\ T_3 \text{ —— } T_i\ NT_1\ NT_2 \text{ —— } NT_i$

Then read in forward direction ($T_1\ T_2 \text{ —— } T_i$) and Push NT_i', NT_{i-1}', —— NT_1 in reverse order

→ $NT \rightarrow \underbrace{NT_1\ NT_2 \text{ —— } NT_i}_{1}\ \underbrace{T_1\ T_2 \text{ —— } T_i}_{2}$

Then Push in reverse order the non terminals while NT_i is Push twice and read the remaing terminals $T_1\ T_2 \text{ —— } T_i$ in forward direction.

Evening

→ $NT \rightarrow T_1\ T_2 \text{ —— } T_i\ NT_1\ NT_2 \text{ —— } NT_i\ T_1'\ T_2' \text{ —— } T_i'$

Then

(i) Read $T_1 T_2 \dots T_i$ in forward

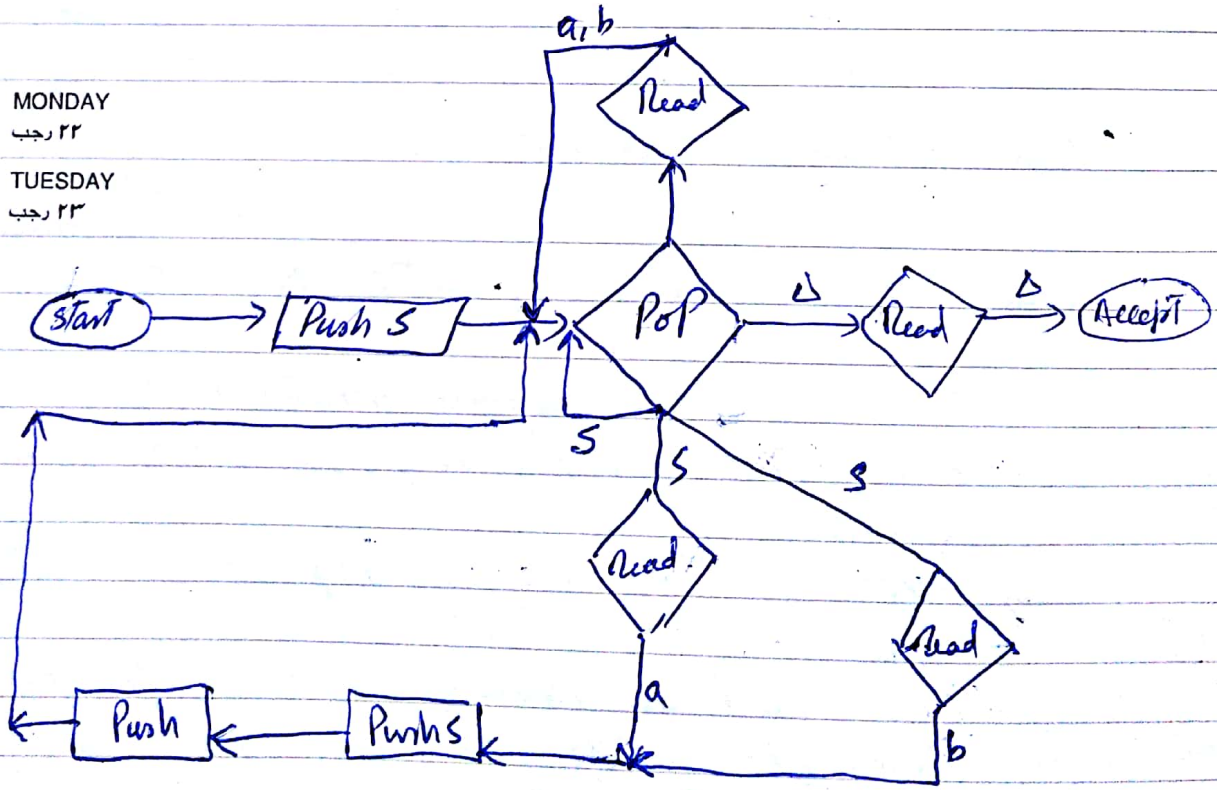
(ii) Push NT's in reverse while Pushed NT_2 twicely.

(iii) Read $T_1' T_2' \dots T_i'$ in forward direction

→ Only start symbol 'S' is Pushed first

✓ Example

$S \to aSa \mid bSb \mid \Lambda$



for 'abba'

stack	input Tape	
Δ	abba	
ΔS	abba	
Δ	abba	(Spop)
ΔSS	abba	
ΔS	abba	(SPOP)
ΔSSS	abba	
ΔSS	abba	(S POP)
ΔSS	abba	
ΔS	abba	(S POP)
ΔS	abba	
Δ	abba	(S POP)
	abbaΔ	

WEDNESDAY 7 رجب ۲۴

THURSDAY 8 رجب ۲۵

Definition of PDA

A pushdown automaton (PDA) is a 7-tuple $M = \{Q, \Sigma, \Gamma, q_0, z_0, A, \delta\}$ where

Q is a finite set of states

Σ and Γ are finite sets (input & stack alphabets)

q_0, the initial state

z_0, the initial stack symbol $\in \Gamma$

A, the accepting state

$\delta: Q \times (\Sigma \cup \{\Delta\}) \times \Gamma \rightarrow$ The set of finite subset of $Q \times \Gamma^*$

رجب ١٤٣١

JULY 2010

JULY

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Acceptance by a PDA :-

If $M = (Q, \Sigma, \Gamma, q_0, z_0, A, \delta)$ is a PDA and $x \in \Sigma^*$, x is accepted by M if $(q_0, x, z_0) \vdash_M^* (q, \Lambda, \alpha)$ for some $\alpha \in \Gamma^*$ and some $q \in A$. (The stack may or may not be empty when x is accepted, because α may or may not be Λ.) A language $L \subseteq \Sigma^*$ is said to be accepted by M if L is precisely the set of strings accepted by M. In this case, we write $L = L(M)$.

Defn of DPDA :-

9 FRIDAY ٢٦ رجب

10 SATURDAY ٢٧ رجب 11 SUNDAY ٢٨ رجب

let $M = \{Q, \Sigma, \Gamma, q_0, z_0, A, \delta\}$ be a PDA. M is deterministic if there is no configuration for which M has a choice of more than one move.

A language L is DCFL, if there is a DPDA accepting L.

Union Example :-

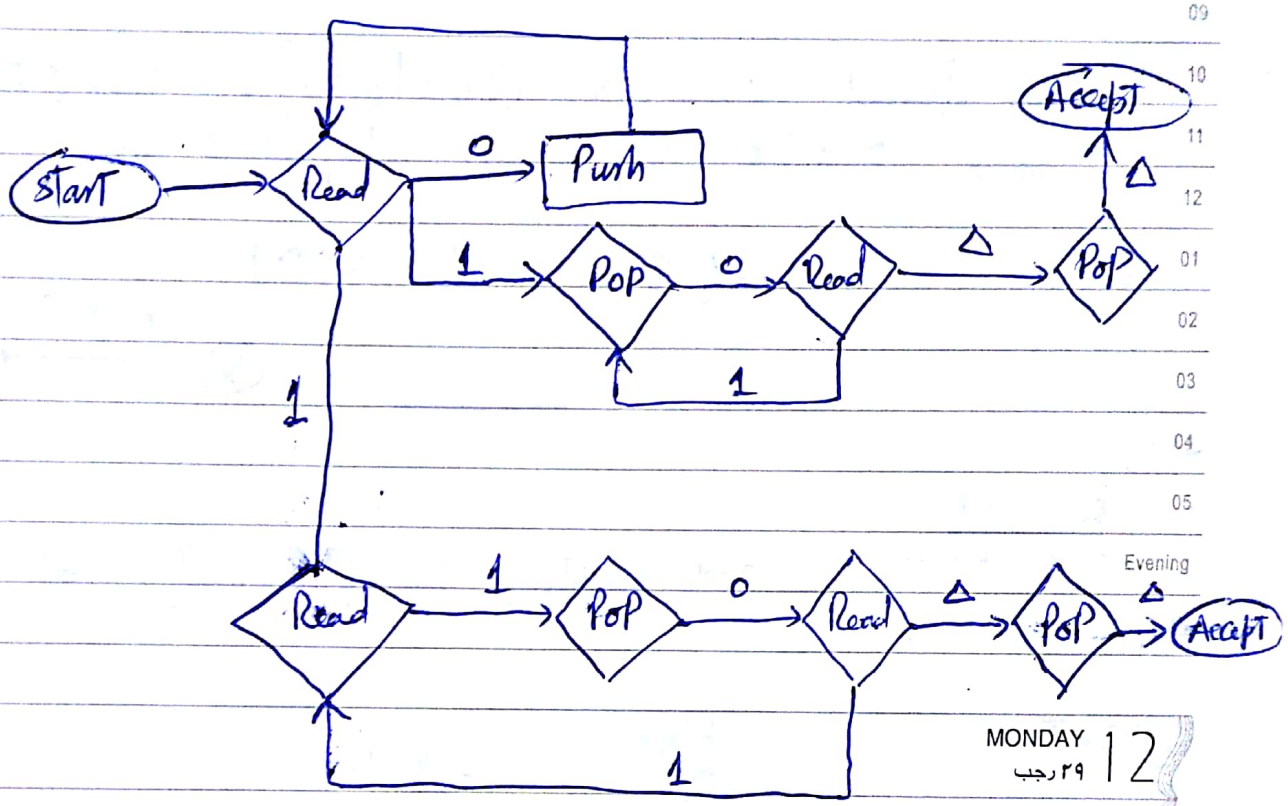
$0^n 1^n \cup 0^n 1^{2n}$ where $n \geq 1$

JULY

M	T	W	T	F	S	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

رجب ١٤٣١

JULY 2010



MONDAY 12 رجب ٢٩

TUESDAY 13 رجب ٣٠

H.W PDA if possible $0^n1^n0^n$

Defn of Turing Machine

A turing machine (TM) is a 5-Tupple $T = \{Q, \Sigma, \Gamma, q_0, \delta\}$, where

Q is a finite set of states, assumed not to Contain h_a or h_r

Σ and Γ are finite set (input and tape alphabets)

q_0, the initial state

$\delta: Q \times (\Gamma \cup \{\Delta\}) \to (Q \cup \{h_a, h_r\}) \times (\Gamma \cup \{\Delta\}) \times \{R, L, S\}$ is a partial