Assignment 2

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Ans Q.1.

$L = \{0^m 1^n \mid m \neq n, m,n \geq 0\}$

Example strings 0, 1, 001, 0001, 011, 00111 etc

Thus

$L = \{0^m 1^n \mid m > n\} \cup \{0^m 1^n \mid m < n\}$

Thus consider

S1 to be $\{0^m 1^n \mid m > n\}$

S2 to be $\{0^m 1^n \mid m < n\}$

Thus we can write $S \rightarrow S1 \mid S2$

Now S1 can be generated by adding only 0 or if I add 1 then I have to add 0.

Thus $S1 \rightarrow 0S11 \mid 0S1 \mid 0$

Similarly S2 can be generated by adding only 1 or adding 1 for every 0 added

Thus $S2 \rightarrow 0S21 \mid S21 \mid 1$

Thus, CFG is $S \rightarrow S1 \mid S2$

where $S2 \rightarrow 0S21 \mid S21 \mid 1$

where $S1 \rightarrow 0S11 \mid 0S1 \mid 0$

Q.2. $S \to \epsilon \mid aSbS \mid bSaS$

Solution:-

$L(G) =$ It is the set of all strings with equal number of a's and b's

Proof

$S \to \lambda$
$S \to aSbS$
$S \to bSaS$

$S \to \lambda$ $\quad$ $S \to \lambda$
$S \to aSbS$ $\quad$ $S \to bSaS$

ab, aabb
abab,
aabbab

a(abab)b
a(aabbab)b
a(aabb)b

We Ob~~servate~~ Observe that in any string we can start with

a or b

$\swarrow a \quad \searrow b$

ab $\quad$ ba

Q2. continued...

Now we can add ab or ba anywhere in these strings (essentially anywhere) not in the first position, but we can do that using reverse of that string

Thus in any string we can say that number of a's and b's are equal

Thus $L(G) = \{w \mid w \in \{a,b\}^* \text{ where } |a| = |b|\}$

in simple words of the form where there are equal number of a's and b's.

Q3

i) $\{w \mid$ every odd position of w is $1\}$

Ans $\{10, 11\}^*$

ii) $\{w / w$ has 010 as substring$\}$

Ans $(0+1)^* (010) (0+1)^*$

iii) $\{w / w$ has odd number of 0's and even number of 1's$\}$

Ans $(00)^* 1^* (00)^*$

iv) $\{w \mid$ length of w is at most $5\}$

$\{$ 00000 + 00001 + 00010 + 00011
+
⋮
upto 11111 $\}$

(All such binary number of length 5)

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v) {w | w does not contain the substring 110}

Answer $\cancel{(0+10)^* (\lambda + 1 + 11)}$

$$0^* (100^*)^* 1^*$$

Also we can have, $(0 \cup 10)^* 1^*$

vi) {w | w is any string except 11 and 111}

Answer $(\epsilon \cup 1) \cup (0 \cup 10 \cup 110 \cup 1110 \cup 1111)(0 \cup 1)^*$

vii) $\{\epsilon, 0\}$

Answer $(0 + \lambda)$

viii) The empty ~~sto~~ set

Answer (ϕ)

ix) All strings except the empty string

Ans $0(1+0)^*$

We can also have

$1(1+0)^*$

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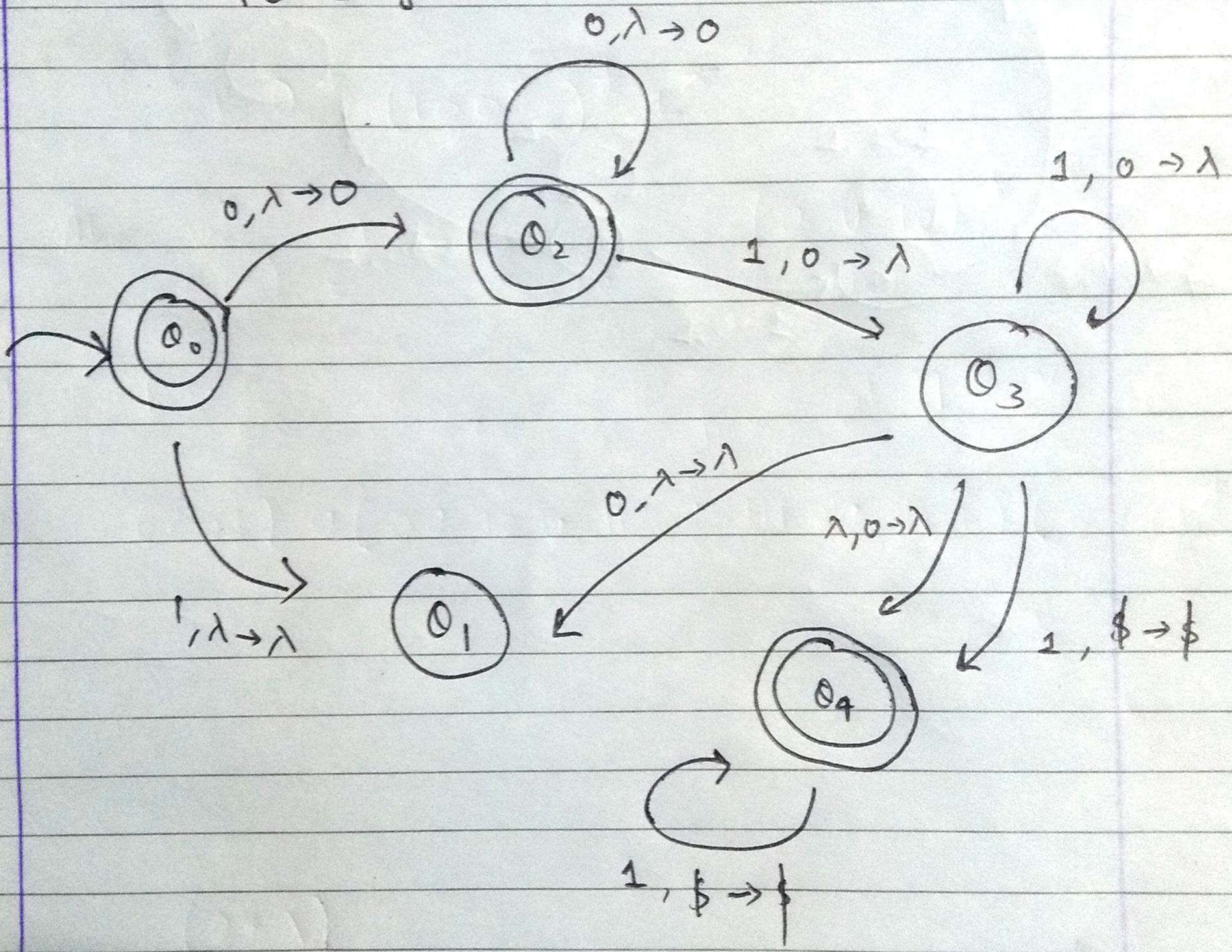
4) Construct a PDA for the language in Q1 of IT468 /Home Work 1

Ans.

$\{0^m 1^n\}$



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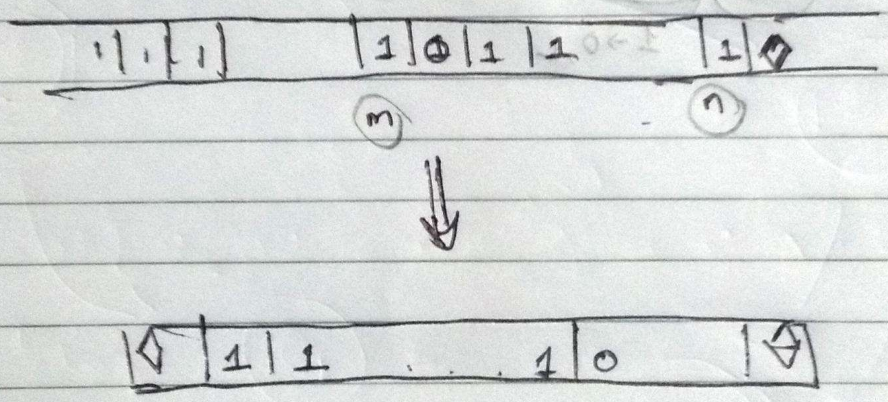
Q.5) Turing Machine for 2 Natural number m & n

Input :- $0^m 1 0^n$

Output :- 0^{m-n}

Thus Tape



Continued... P.T.O

Thus the Turing Machine is.

Q:5 Continued