①

الف) $L = \{aaa, aaab, aaabb, aaabbb, aaabbbb,$
$aaaa, aaaab, aaaabb, aaaabbb, aaaabbbb, \dots \}$

$L_1 = aaaa^*(\lambda + b + bb + bbb + bbbb)$

ب) $L(ab+b)^* L(b) L(a+ab)^*$

$(L(ab) \cup L(b))^* \cdot L(b) (L(a) \cup L(ab))^*$

$\{b, ab\}^* \{b\} \{a, ab\}^* = \{b, ba, bab, baba, babab, \dots\}$

2)

$(n+m)$ is odd $\longrightarrow$ $\underline{n}$ odd $\underline{m}$ even $\rightarrow a(aa)^*(bb)^*$
$ \hookrightarrow \underline{n}$ even $\underline{m}$ odd $\rightarrow (aa)^* b(bb)^*$

$r = a(aa)^*(bb)^* + (aa)^* b(bb)^*$

≫) $L((\lambda + b + bb) aa^+) = L(\lambda + b + bb) L(aaa^+)$

$= (L(\lambda) \cup L(b) L(bb)) L(a) L(a^+)$

$(\{\lambda\} \cup \{b\} \cup \{bb\}) \{a\} \{a\}^+$

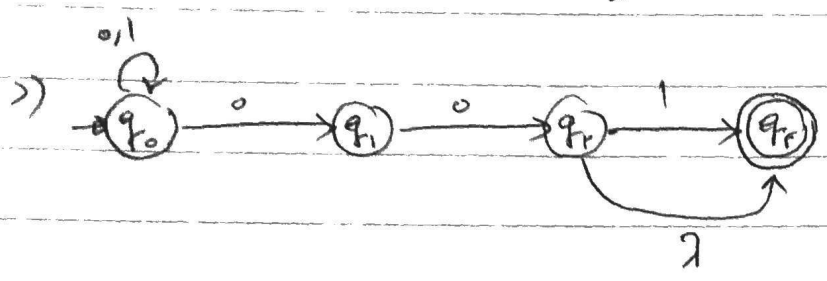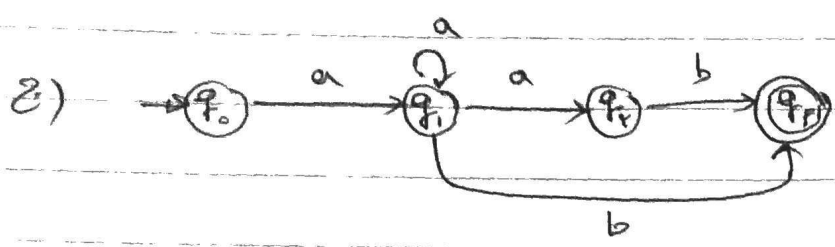$\{\lambda, b, bb\} \{a\} \{a, aa, aaa, \dots\}$

$= \{aa, aaa, aaaa, \dots, baa, baaa, \dots, bbaa, bbaaa, \dots\}$

$L(r) = \{b^m a^n : n \geq 1, m \geq 0\}$

الف) $r = 0^*1 \left(00^*1 + (10^*1)^* \right)^*$
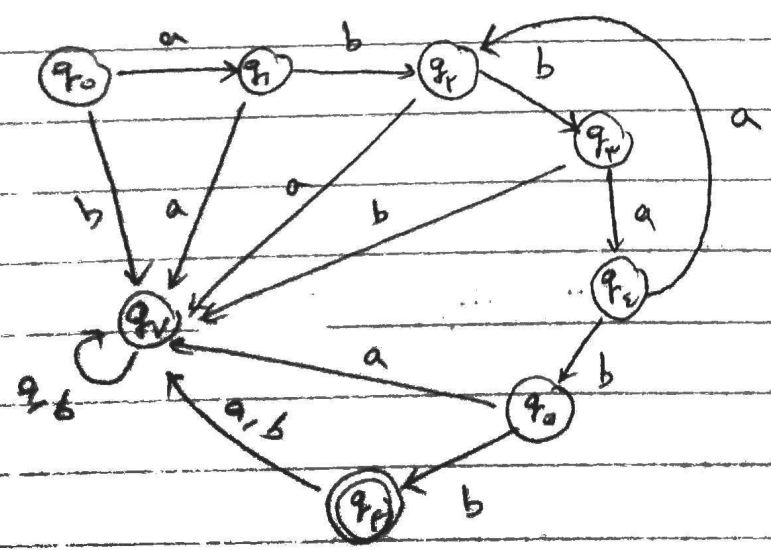
ب) $r = a^*b$

ج)

د)

الف)

راه اول: نوشتن اشتقاق و بدست آوردن زبان گرامر

$S \rightarrow abA \rightarrow abbaB \rightarrow abbabb$

$S \rightarrow abA \rightarrow abbaB \rightarrow abbaaA \rightarrow abbaabaB \rightarrow abbaabbabb$

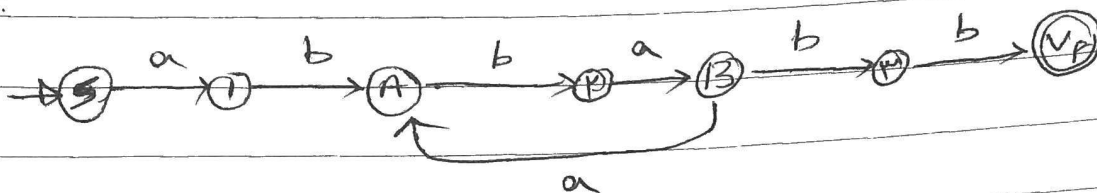$S \rightarrow abA \rightarrow \ldots\ldots \rightarrow abb\,aabaab\,abb$
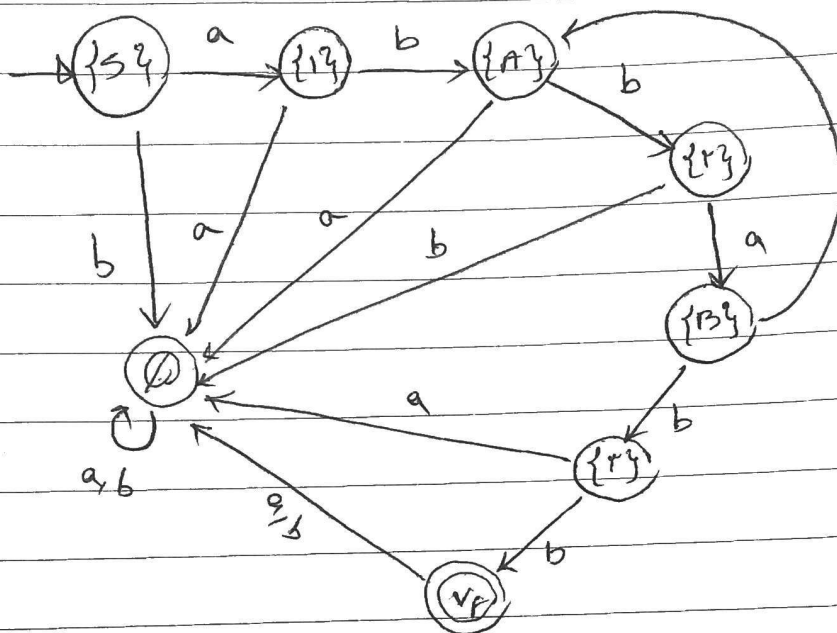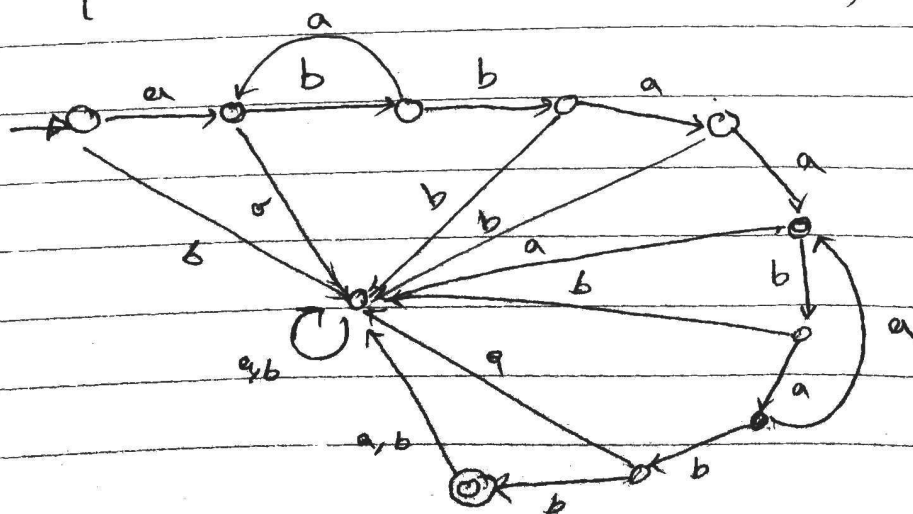
$L_{G} = \{ w: (abb)(aab)^n (abb) ; n \geqslant 0 \}$

(الف)

NFA:

DPA:

روش اول:

ب) $S \to abS \to abA \to abbaB \to abbabb$

$S \to abS \to abA \to abbaB \to abbaaA \to abb\,aa\,babb$

$S \to abS \to ababS \to ababab S$

$\to ababab A$

$\to ababab\,ba$

$\to ab\,ab\,abb\,aab\,abb$

$L = \{(ab)^n (abb)(aab)^m (abb) : n, m \geq 0\}$

روش دوم: نوشتن DPA حاصل می‌شود

‫(۱۱۱)‬ $L = \{a^n b^m : n \leq 4, m \leq 4\}$

$r = (\lambda + a + aa + aaa)(\lambda + b + bb + bbb + bbbb)$

‫گرامر:‬ $S \to aA \mid bB \mid \lambda$

$A \to aB \mid aaB \mid abB \mid aabB \mid \lambda$

$B \to b \mid bb \mid bbb \mid \lambda$

‫گرامر ۲:‬ $S \to Bb \mid Aa \mid \lambda$

$B \to Ab \mid Abb \mid Abbb \mid Aab \mid Aabb \mid Aabbb \mid \lambda$

$A \to a \mid aa \mid \lambda$

NFA:
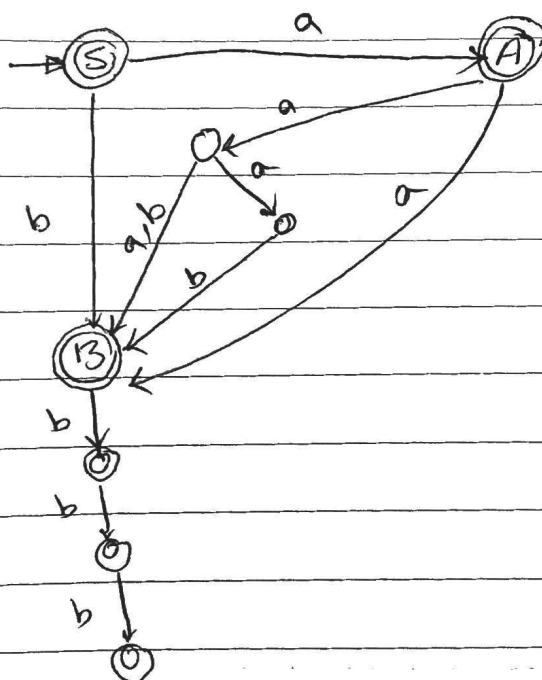
‫هم گرامر و هم NFA کردیم.‬
‫کردن زبان را رسم‬
‫کنید تا قابل قبول وقت‬

ب)

$$\overline{L_2} = \{a^n b^m , n<r\} \cup \{a^n b^m \ n>f\}$$

$$\Downarrow \qquad\qquad\qquad\qquad \Downarrow$$

$$r_1 = b^* + ab^* + aab^* \qquad\qquad r_? = a^* bbbbbb^*$$

$$r = r_1 \vee r_? = b^*{}_{+}ab^* + aab^* + a^* bbbbb b^*$$

NFA :

$bbbbb \longrightarrow$ state $\overline{i\ 5\ \subsetwise}$

يسار القواعد :
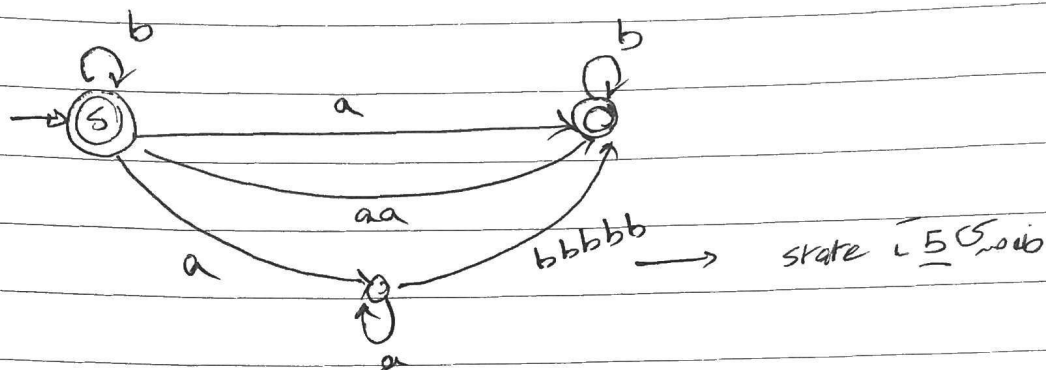
$$S \to bS \mid \lambda$$
$$S \to aE \mid aA \mid aaF$$
$$A \to aA \mid bbbbbF$$

يمين القواعد :

$$S \to Sb \mid \lambda$$
$$S \to Fa \mid Faa \mid Abbbb$$
$$A \to Aa \mid Fa$$
$$F \to Fb \mid \lambda$$

جـ)

~~0/0/00/00/001/00~~ $r = (1^* 01)^* 00 (1^*)$

NFA :

يسار القواعد :
$$S \to 1S \mid 0A$$
$$A \to 0F \mid 1S$$
$$F \to 1F \mid \lambda$$
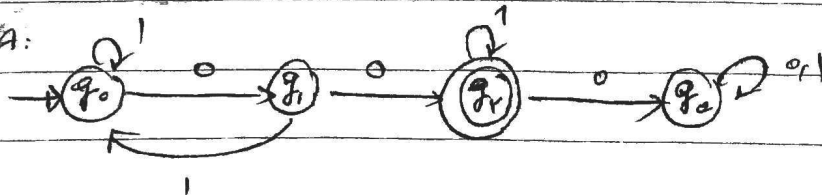
يمين القواعد :
$$S \to S1 \mid A0$$
$$A \to F0$$
$$F \to F1 \mid A1 \mid \lambda$$

>) $r = (a+b)^* \, abb \, (a+b)^*$

NFA:

أبسط طريقة : $S \to aS \mid bS \mid aB$
$B \to bbF$
$F \to aF \mid bF \mid \lambda$

طريقة ثانية : $\Sigma \to S_a \mid S_b \mid Abb$
$A \to Fa$
$F \to Fa \mid Fb \mid \lambda$