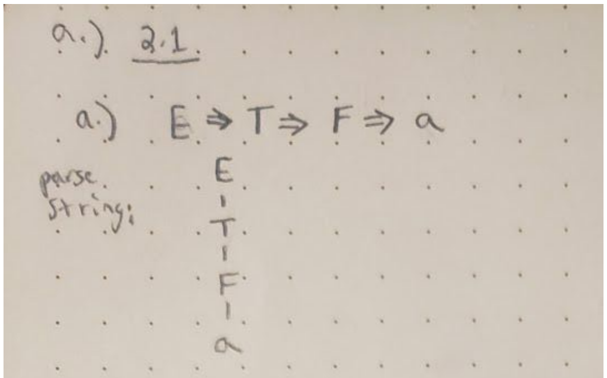
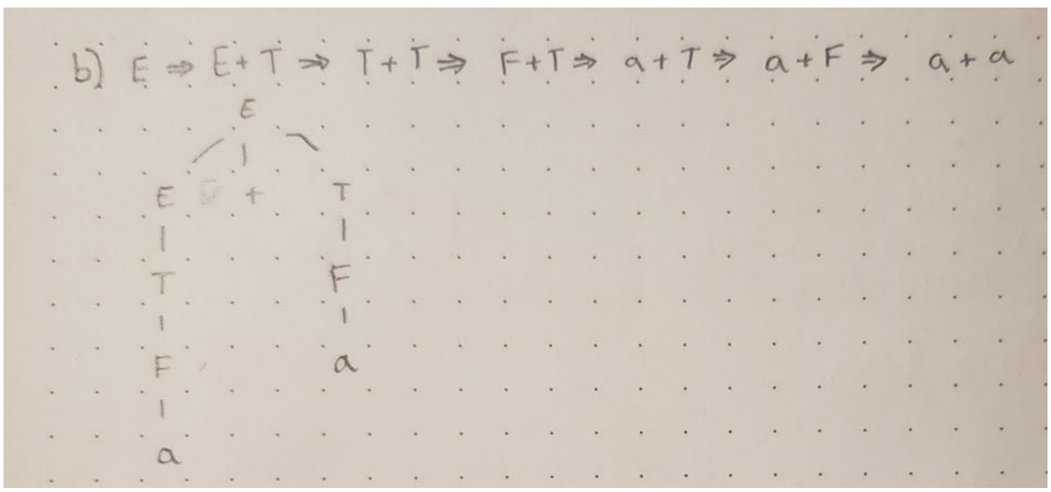
Joseph O'Neill CSIS 616 - HW2

a. **2.1**

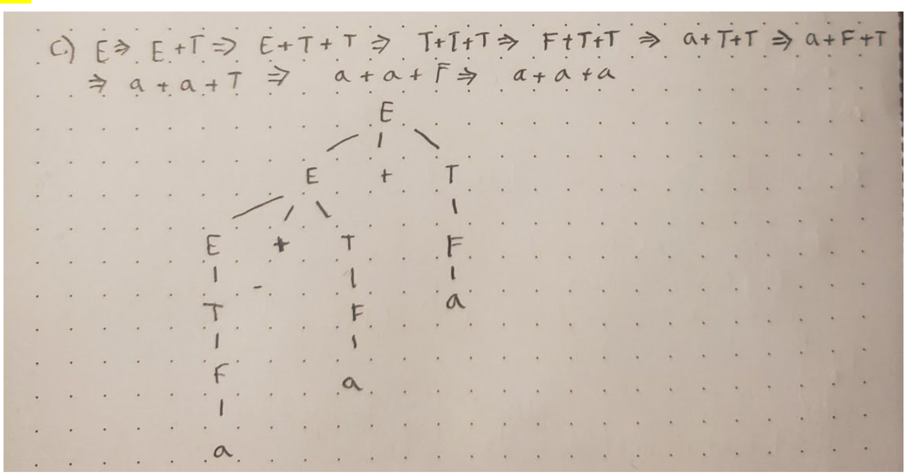
A.



B.



C.

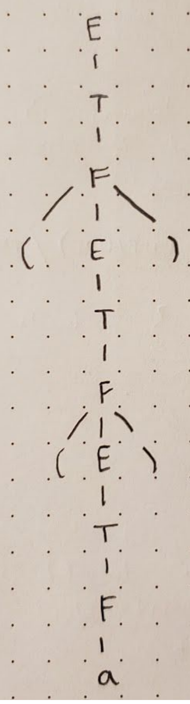


D.

((a))

2.1

d) $E \Rightarrow T \Rightarrow F \Rightarrow (E) \Rightarrow (T) \Rightarrow (F) \Rightarrow ((E)) \Rightarrow ((T))$
$\Rightarrow ((F)) \Rightarrow ((a))$



b. 2.4

D.

d) {w | the length of w is odd and its middle sym. is 0}

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

$P \Rightarrow 0 \mid 0S0 \mid 0S1 \mid 1S0 \mid 1S1$

$V = \{P\}$

$\Sigma = \{0, 1\}$

$S = S_0$

E.

e) $A_1 = \{w \mid w = w^R$, that is, w is a palindrome$\}$

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

$P \Rightarrow \varepsilon \mid P0P \mid P1P \mid P$

$V = \{P\}$

$\Sigma = \{0, 1\}$

$S = S_0$

F.

f) $A_1 = \emptyset$ (The empty set)

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

$P = \{\ \}$ $\qquad L(G) = \{\ \}$

$V = \{\ \}$

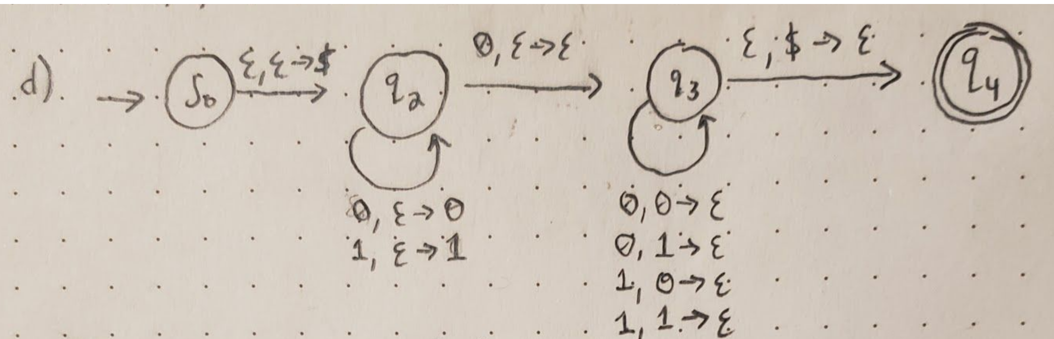
$\Sigma = \{0, 1\}$

$S = \{\ \}$

c. 2.5

D.

d)



$Q = \{S_0, q_2, q_3, q_4\}$

$\Sigma = \{0, 1\}$

$\Gamma = \{0, 1, \$\}$

$F = \{q_4\}$

$\delta =$

$(s_0, \varepsilon, \$) \Rightarrow (q_2, x)$ $\qquad (q_3, 0, 0) \Rightarrow (q_3, \varepsilon)$

$(q_2, 0, 0) \Rightarrow (q_2, x)$ $\qquad (q_3, 0, 1) \Rightarrow (q_3, \varepsilon)$

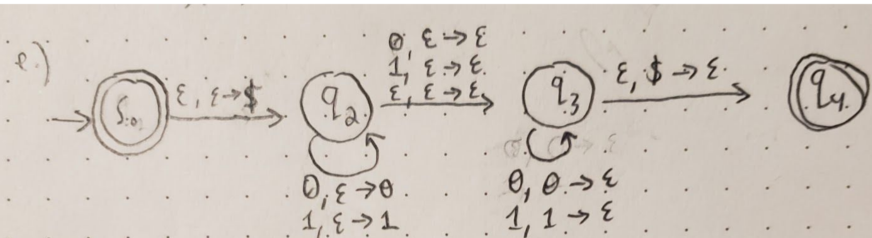
$(q_2, 1, 1) \Rightarrow (q_2, x)$ $\qquad (q_3, 1, 1) \Rightarrow (q_3, \varepsilon)$

$(q_2, 0, \varepsilon) \Rightarrow (q_3, x)$ $\qquad (q_3, 1, 0) \Rightarrow (q_3, \varepsilon)$

$(q_3, \varepsilon, \$) \Rightarrow (q_4, \varepsilon)$

E.

e.)



$Q = \{ s_0, q_2, q_3, q_4 \}$

$\Sigma = \{ 0, 1 \}$

$\Gamma = \{ 0, 1, \$ \}$

$F = \{ s_0, q_4 \}$

$\delta =$

$(s_0, \varepsilon, \$) \Rightarrow (q_2, \$Z)$

$(q_2, 0, 0) \Rightarrow (q_2, 0Z)$

$(q_2, 1, 1) \Rightarrow (q_2, 1Z)$

$(q_2, 0, \varepsilon) \Rightarrow (q_3, X)$

$(q_2, 1, \varepsilon) \Rightarrow (q_3, X)$

$(q_2, \varepsilon, \varepsilon) \Rightarrow (q_3, X)$

$(q_3, 0, 0) \Rightarrow (q_3, \varepsilon)$

$(q_3, 0, 1) \Rightarrow (q_3, \varepsilon)$

$(q_3, 1, 0) \Rightarrow (q_3, \varepsilon)$

$(q_3, 1, 1) \Rightarrow (q_3, \varepsilon)$

$(q_3, \varepsilon, \$) \Rightarrow (q_4, \varepsilon)$

F.

F) $\rightarrow$

$Q = \{ \}$

$\Sigma = \{ 0, 1 \}$

$\Gamma = \{ 0, 1, \$ \}$

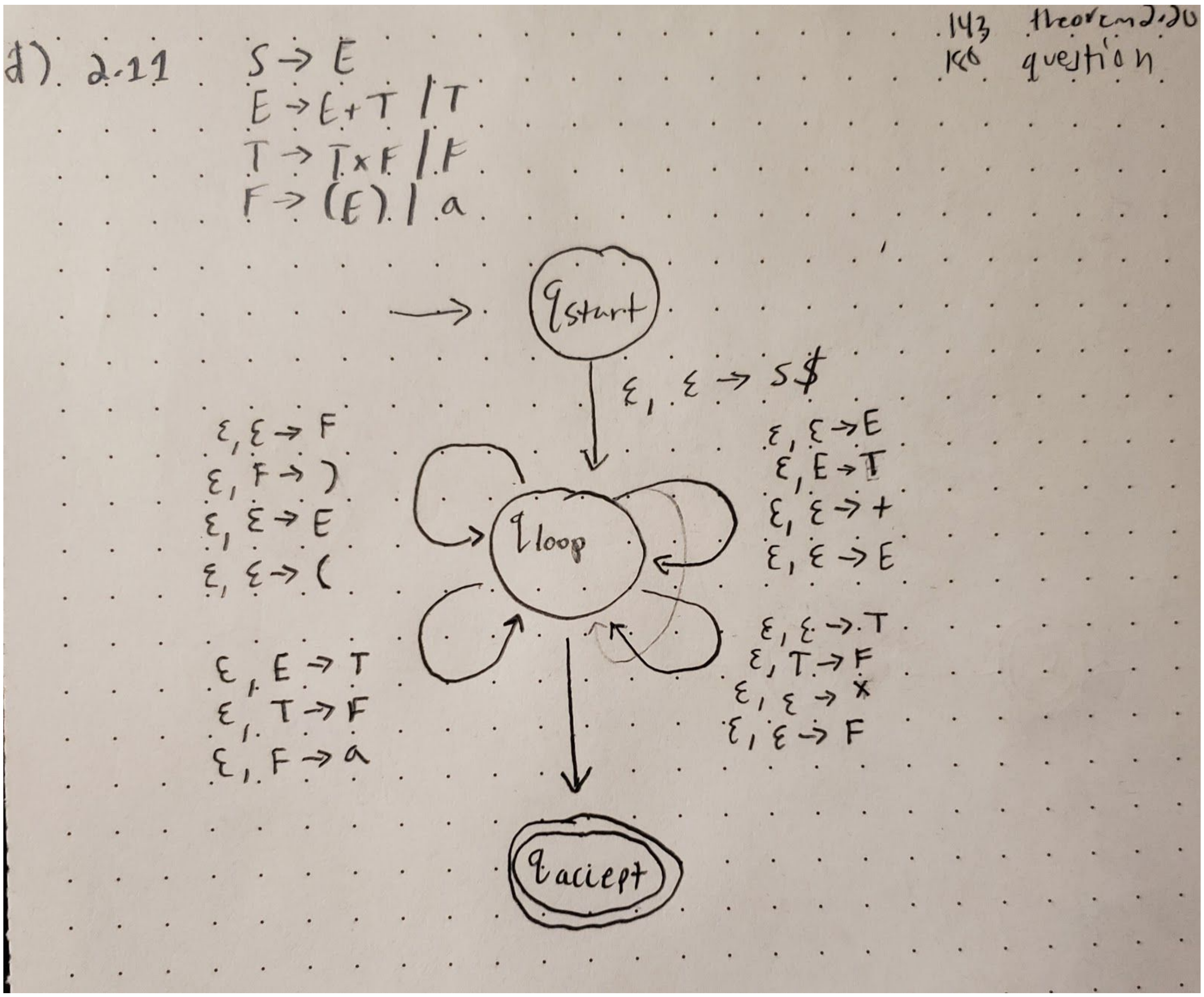
$F = \{ \}$

$\delta = \{ \}$

empty set so no states

no movement, no stack

d. 2.11


d). 2.11
S → E
E → E+T | T
T → T×F | F
F → (E) | a
143 theorem 2.20
160 question
q_start
ε, ε → S$
ε, ε → F
ε, F →)
ε, ε → E
ε, ε → (
ε, E → T
ε, T → F
ε, F → a
q_loop
ε, ε → E
ε, E → T
ε, ε → +
ε, ε → E
ε, ε → T
ε, T → F
ε, ε → ×
ε, ε → F
q_accept

e. 2.13

F) 2.13

a) L(G) is a language that each string must have at least 1 '#' within its string.

b) We assume that L(G) is regular. It has to have a pumping lemma of length P, all strings longer than P can be pumped

Lets say $S = 0\#00$ $\quad P = 1$

Also $S = xy^1z \rightarrow xy^2z$

Case 1: $\underbrace{0}_{x}\underbrace{\#0}_{y}\underbrace{0}_{z} \Rightarrow 0\#0\#0 \in A$

However $|xy| \nleq P$

Since it was pumped once no other possible deviations would allow $|xy| \leq P$, therefore it is a contradiction and is not a regular language

f. 2.14

f.)

2.14

$A \to BAB \mid B \mid \varepsilon$
$B \to \theta\theta \mid \varepsilon$

$S_0 \to A$
$A \to BAB \mid B \mid \varepsilon$
$B \to \theta\theta \mid \varepsilon$

$\to$

$S_0 \to A$
$A \to BAB \mid B \mid \varepsilon$
$B \to \theta\theta$

$S_0 \to A$
$A \to BAB \mid B \mid BB \mid BA \mid AB$
$B \to \theta\theta$

$\downarrow$

$S_0 \to A$
$A \to BAB \mid BB \mid BA \mid AB \mid \theta\theta$
$B \to \theta\theta$

$\downarrow$

$$\boxed{\begin{array}{l} S_0 \to BAB \mid BB \mid BA \mid AB \mid \theta\theta \\ A \to BAB \mid BB \mid BA \mid AB \mid \theta\theta \\ B \to \theta\theta \end{array}}$$