2.9 let $G=\{V, \Sigma, R, S\}$, we know that $\Sigma=\{a,b,c\}$, R is following rules:

$S \to U|V$

$U \to Uc|A$

$A \to aAb|\varepsilon$

$V \to aVa|B$

$B \to bBc|\varepsilon$

G is ambiguity, for abc, we have

$S \Rightarrow U \Rightarrow Uc \Rightarrow Ac \Rightarrow aAbc \Rightarrow a\varepsilon bc \Rightarrow abc$

or

$S \Rightarrow V \Rightarrow aVa \Rightarrow aB \Rightarrow abBc \Rightarrow ab\varepsilon c \Rightarrow abc$

2.13 a. $L_1 = 0^i \# 0^j$ where $i \geq 0$ and $j \geq 0$

$L_2 = 0^i \# 0^{2i}$ $i \geq 0$

$L(G) = L_1 \cup L_2$

b. assume $L(G)$ is regular, let $S = 0^p \# 0^{2p} \in L$,

let $xy = 0^p$ $|xy| \leq p$, so y must be all 0,

$xyz = 0^p \# 0^{2p}$

$xy^0z = 0^{p-k} \# 0^{2p}$

xy^0z doesn't belongs to L, so L is not regular

4.3 we construct the following T/M:

M = "On input <A> where A = (Q, Σ, δ, q, F) is a DFA

1. Construct a new DFA B = (Q, Σ, δ, q, Q-F)
2. ~~R~~ run T/M T in theory 4.4 to see is L(B) = ∅
3. ~~if L(B)~~ if T accept, ~~L(B) =~~ accept
4. if T reject, then reject"

because L(A) ∪ L(B) = Σ*, so if L(B) = ∅, the L(A) = Σ*

~~Q~~5.1 ALLCFG is undecidable, Define ~~G~~ CFG G_0 to make $L(G_0) = \Sigma^*$

Let M be a T/M that decide EQ_{CFG} and construct T/M S to decide ALL_{CFG},

S = "on input <G>, where G is a CFG;

1. Run M on input $\langle G, G_0 \rangle$
2. if M accept, accept, if M reject, reject"

because ALL_{CFG} is undecidable, so ~~we can~~ M ~~can~~ ~~will reject~~ can not decide if G is equal to G_0, therefore EQ_{CFG} is undecidable.