25 / 50 Samir Faci

2.4.5

a.) $\{ww^r : w \in \{a,b\}^*\}$

$a^n bba^n$ $n \geq 1$ $a^{n-1} = x$ $a^1 = y$ $bba^n = z$

if we pump y down to zero... we have $a^{n-1}bba^n \notin L$

$a^{n-1}bbaa^{n-1}$ $a^{n-1} = x$ $bba = y$ $a^{n-1} = z$

if we pump y up we have aaa.... abbaabba .... aa $\notin$ L

and finally:

$a^n bbaa^{n-1}$ $a^n bb = x$, $a = y$, $a^{n-1} = z$

as with the first case, if we pump it down to zero we have an expression a subset that doesn't belong to L. Since it fails the pumping lema, it cannot be expressed with an r.e.

b.) $\{ww : w \in \{a,b\}^*\}$

abab $n \geq 1$

$ab^n ab^n \in L$ however if we look at $ab^n ab^n$ where $x=e$ $ab^n = y$, $ab^n = z$ as soon as we pump i then the exp $\notin$ L

Similarly, if we look at $ab^n ab^n$ $ab^n = x$ $ab^n = y$ $z=e$ we see that L is not pumpable that cannot be expressed as an r.e.

c.) $\{ww : w \in \{a,b\}^*\}$

$ab^n ba^n$ $n \geq 1$ $a = x$ $b^n = y$ $ba^n = z$ pump it down and you get $aba^n \notin$ L

Σ^* is regular

$a^n b^n \subset \Sigma^*$ is not !!

2.4.8

a.) Every subset of a regular language is regular.

also. By pumping lema definition, we take a subset of a regular language to prove that the language is not regular by breaking the lema. The premise of the lema theorem is that every subset of an r.e. is reguar, therefore the statement above it **true.**

b.) Every regular language has a regular proper subset.

Let A be an r.e A= { a} the only proper subset of {a} is e which isn't an r.e., therefore the statement is **false.**

c.) if L is regular, then so is {xy: x is ∈ L and y ∉ L }

$L \cap \bar{L}$ is regular

y concatenated with L defines a whole new language. Let y ∈ A' if A' is a language it can be either regular or irregular. Concatenating an r.e. With A' doesn't guarantee that A' ∪ L is an re. Therefore the statement if **false.**

d.) {w: w = w^r } is regular

is not a regular a regular because the language L cannot be represented by any DFA since it contains an unlimited number of states. The statement if **false.**

e.) if L is an r.e, then so is {w: w ∈ L and w^r ∈ L }

let L= {a*,b*} which is regular, let $a^i b^i \subseteq$ {a*,b*}. since $a^i b^i$ is not regular, then statement above if **false.**

f.) If C is any set of regular languages, then ∪C is a regular language

True, since the class of languages are closed under ∪ therefore the union of all ~~partitions are~~ still regular.

g.) {xyx^r: x,y ∈ Σ*} is regular

False. You'd need an infinite number of states of track down the x^r and that cannot be represented as a DFA, therefore it not regular.

$xyx^r = \Sigma^*$

if $x = e$.