CSc 135
Lu

Test 1

Last Name Davis First Name Trevor Grade _____/100

1. (40%) Find **RG, RE, nfa** (in table form), and **TG,** and for the following language on {a, b}: All words that end in either a or bbb.

Regular grammer (RG)

$G = (V, T, S, P)$

V = variable T = terminal

S = Start P = Production

$G = \{(S, A, B), (a, b), S, P\}$

P: $S \rightarrow aS \mid bS \mid A$

$A \rightarrow a \mid B$

$B \rightarrow bbb$

Regular expression (RE)

- the language cannot be an empty set. It has to end with "a" or "bbb"

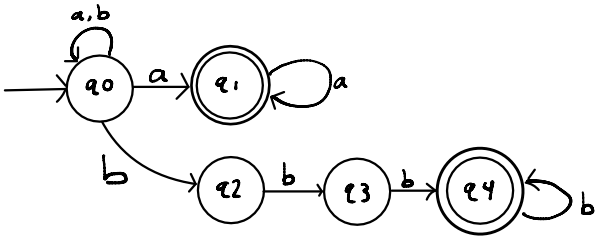
$(a + bbb)$

- nothing else is specified so we assume it can start with any combination of a or b

$(a + b)^*$

$(a+b)^*(a+bbb)$

NFA



	a	b
→ q0	{q0, q1}	{q0, q2}
(q1)	{q1}	—
q2	—	{q3}
q3	—	{q4}
(q4)	—	{q4}

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2. (20%) Give a formal recursive definition of Regular Expression **(RE).**

$\emptyset$ is a regular expression denoting the empty set
λ is a regular expression denoting empty language
For every $a \in \Sigma$, a is a regular expression denoting $\{a\}$

If r_1 and r_2 are regular expressions then $r1^*$, $r1+r2$, $r1r2$, $(r1)$, are all regular expressions

$$L=(r_1+r_2) = L(r1) \cup L(r2)$$
$$L(r1 \cdot r2) = L(r1) \cup L(r2)$$
$$L((r1)) = L(r_1)$$
$$L(r_1^*) = (L(r1))^*$$

3. (20%) Give a formal definition of Nondeterministic Finite Automata (**NFA**).

A nondeterministic finite accepter is defined by the quintuple
$M=(Q, \Sigma, \delta, q_0, F)$ where:

Q, Σ, q_0, F are defined as for deterministic finite accepters but
$\delta: Q \times (\Sigma \cup \{\lambda\}) \longrightarrow 2^Q$

the range of δ is in the Powerset 2^Q so its value is not a single element of Q but a subset of it
we also allow λ as the second argument of δ. Meaning a transition can be made without consuming an input symbol

4. (20%) Construct a FA (in TG) that accepts the language generated by the RG.

A → aB
B → abA| b

Terminals	Nonterminals
a	A
b	B

$L = \{ab, aabab, aababab, \cdots\}$

• the language reaches an accept state by b