CSC 355: Compiler Design Midterm

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Question 1: Reg Lang

(a) This regular expression recognizes a language that contains strings of (ab) and (ba), that is not empty. Valid example: ab. Invalid example: ϵ, *abb*

(b) ... a followed by any number of a or b. Valid: a. Invalid: bb

(c) ... any number of a or b that ends with abb. Valid: abb. Invalid: abbaa

(d) ... any number of a followed by any number of (b then any number of a, then b, then any number of a). Valid: ababa, a. Invalid: ba, aaababababaaa

(e) ... a string consisting only of a and b, that contains at least three separate substring of "ab". Valid: abababab. Invalid: abaa

Question 2: Reg Exp

We assume `\d` is defined as `0-9`.

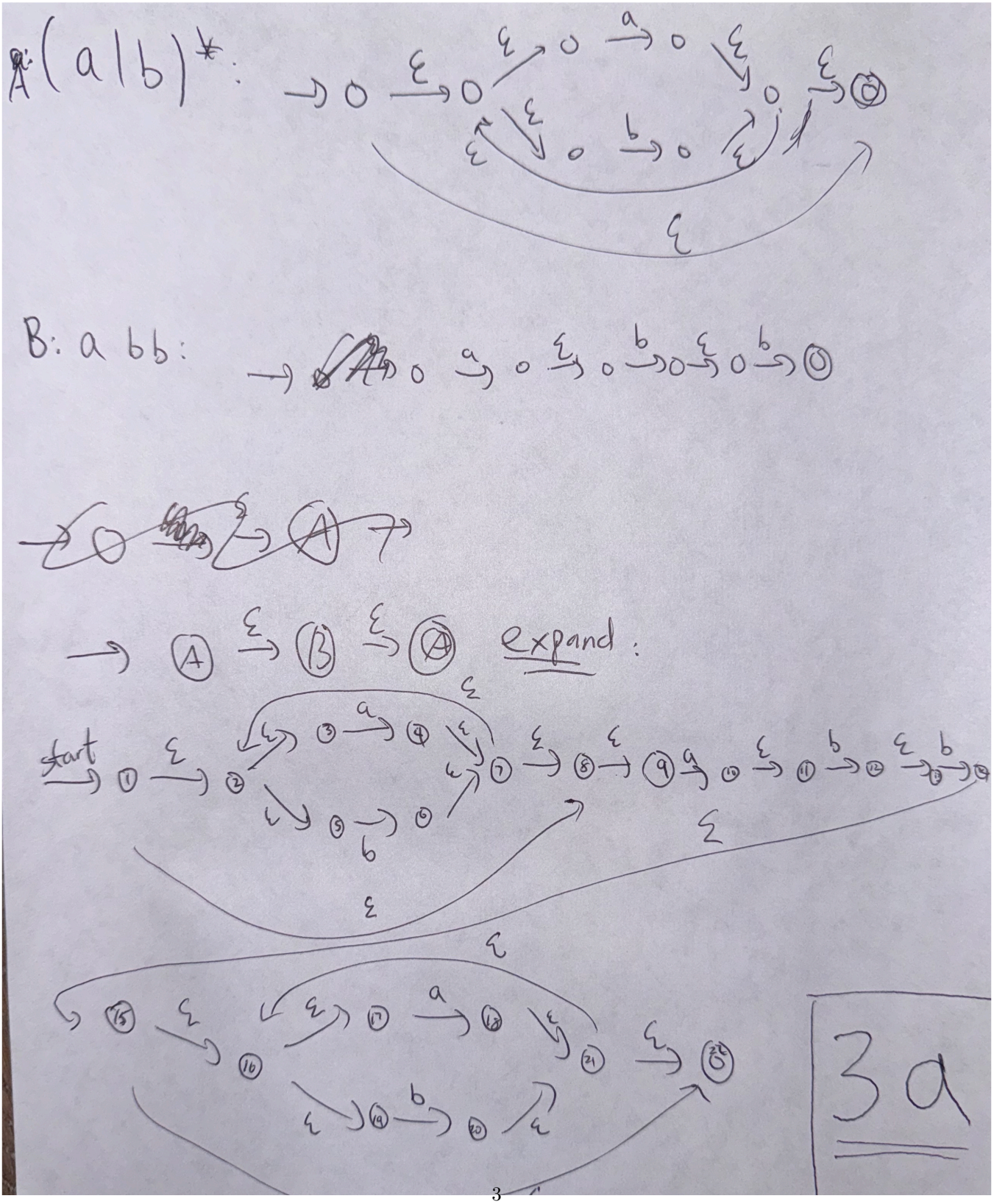
1. `\(\d{3}\)\d{3}-\d{4}`
2. We assume we want to match for both "double varname;" and "double varname = float;":

   `^double\s+[A-z][A-z\d_]*(\s+=\s+\d+.\d+)?;$`
3. `[ab]*babb[ab]*`
4. Assume any year is valid, but month have to be in range (01-12), day must be in range (01-31):

   `(0[1-9]|1[0-2])(\/|-)([0-2][1-9]|3[01])(\/|-)\d{2}(\d{2})?`
5. Assume username and subdomain can be one letter: `[A-z](.?[A-z\d]+)*@[A-z]+(.[A-z]+)+`

Question 3: NFA

(a)



(b) A string made up of a or b that contains the substring of "abb".

(c) An ϵ-transition is a transition between states that consume an empty string. An ϵ-transition is key in MYT algo that construct a NFA by using systematic rules to synthesis base cases using concat, union, or kleenex star, because we connect these base cases with ϵ-transitions. States that are connected by ϵ-transition are merged into the same state in DFA (one NFA state can be merged into multiple DFA states).

Question 4: Deterministic FA

$$\epsilon\text{-closure}(1) = \{1, 2, 3, 5, 8, 9\} : A \tag{1}$$

$$\epsilon\text{-closure}(\text{move}(A, a)) = \epsilon\text{-closure}(\{4, 10\}) = \{7, 2, 3, 5, 8, 9, 11, 4, 10\} : B \tag{2}$$

$$\epsilon\text{-closure}(\text{move}(A, b)) = \epsilon\text{-closure}(\{6\}) = \{6, 7, 2, 3, 5, 8, 9\} : C \tag{3}$$

$$\epsilon\text{-closure}(\text{move}(B, a)) = \epsilon\text{-closure}(\{4, 10\}) = B \tag{4}$$

$$\epsilon\text{-closure}(\text{move}(B, b)) = \epsilon\text{-closure}(\{6, 12\}) = \{6, 12, 7, 2, 3, 5, 13\} : D \tag{5}$$

$$\epsilon\text{-closure}(\text{move}(C, a)) = \epsilon\text{-closure}(\{4, 10\}) = B \tag{6}$$

$$\epsilon\text{-closure}(\text{move}(C, b)) = \epsilon\text{-closure}(\{6\}) = C \tag{7}$$

$$\epsilon\text{-closure}(\text{move}(D, a)) = \epsilon\text{-closure}(\{4\}) = C \tag{8}$$

$$\epsilon\text{-closure}(\text{move}(D, b)) = \epsilon\text{-closure}(\{14, 6\}) = \{14, 6, 7, 2, 3, 5, 8, 9, 15, 16, 17, 19, 22\} = E \tag{9}$$

$$\epsilon\text{-closure}(\text{move}(E, a)) = \tag{10}$$

I probably messed up somewhere but I did create one heuristically below.

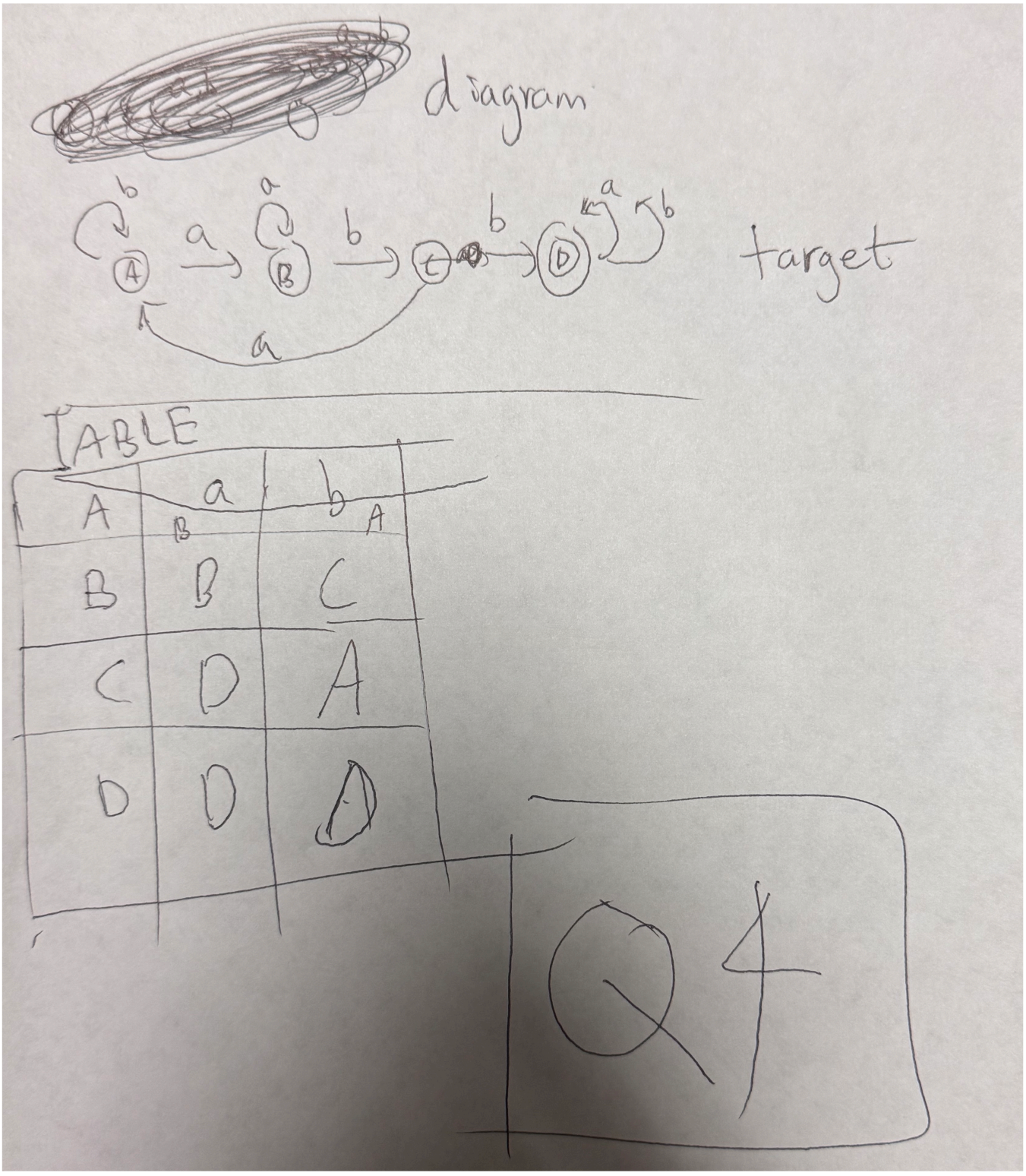


diagram
target
TABLE
A
B
C
D
a
b