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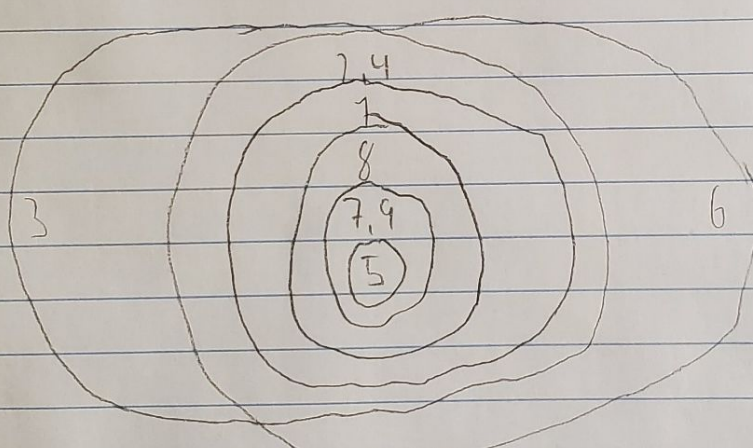
Prof. Cao

CSCI-262 Final
12/07/20

1) a) T
b) T
c) F
d) T
e) F
f) T
g) T
h) T
i) F
j) T

2)



(2) and (4) are equivalent
(7) and (9) are equivalent

3) a) Accepted: ε, 01
Rejected: 001, 00001

b) This language recognizes any string with the same number of 0's and 1's
Let $L = \{ w \in \{0,1\}^* \mid$ w has the same number of 0's & 1

c) Not a regular language

4) a) $Q \to ZV$

$Z \to AS \mid BS \mid a \mid b \mid \varepsilon$

$S \to AS \mid BS \mid a \mid b$

$V \to aaW \mid \varepsilon$

$W \to BW \mid b$

$A \to a$

$B \to b$

b) $Q \to ZQ \mid \varepsilon$

$Z \to AS \mid BS \mid a \mid b \mid \varepsilon$

$S \to AS \mid BS \mid a \mid b$

$A \to a$

$B \to b$

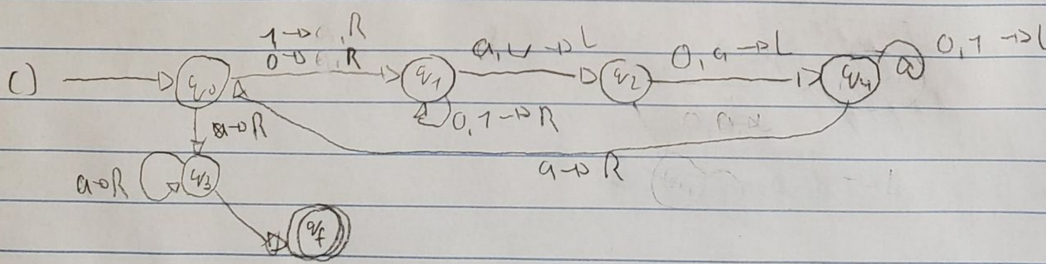
c) G_1 is in CNF

5) Let $A = \{ w \in \{0,1\}^* \mid w0^i \text{ and } |w| = i \}$

a) 001000 , 11110000

b) 1 , 11

c)



6) 1) a) Not accepted

b) Not accepted

c) Accepted

d) Not accepted

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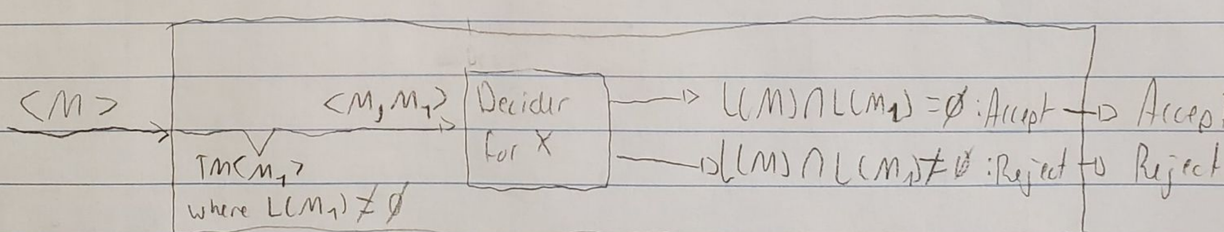
6) 2) 1) Yes
i) It is in the correct form as it contains single Turing machine encodings.
ii) It is a property of the language of a Turing machine.
iii) It is nontrivial
- Because some Turing Recognizable languages are of even length and some are not of even length

2) No.
i) (Same reason as previous response)
ii) (same reason as previous response)
iii) It is trivial
- Because all Turing Recognizable languages have $|L(M)| < 0$

3) 1) Rice's Theorem cannot be applied

2) Assume that E_{TM} is decidable to prove that X is undecidable via contradiction.



The intersection of an empty language and non-empty language will always be empty, therefore E_{TM} is undecidable.
Since E_{TM} is undecidable, then X must also be undecidable.