CSCE 222 [505] Discrete Structures for Computing
Fall 2015 – Philip C. Ritchey

Problem Set 10

Due dates: Electronic submission of LaTeX and PDF files of this homework is due on **4 December 2015 (Friday) before 11:30 a.m.** on gradescope (`http://gradescope.com`).

Names of Group Members
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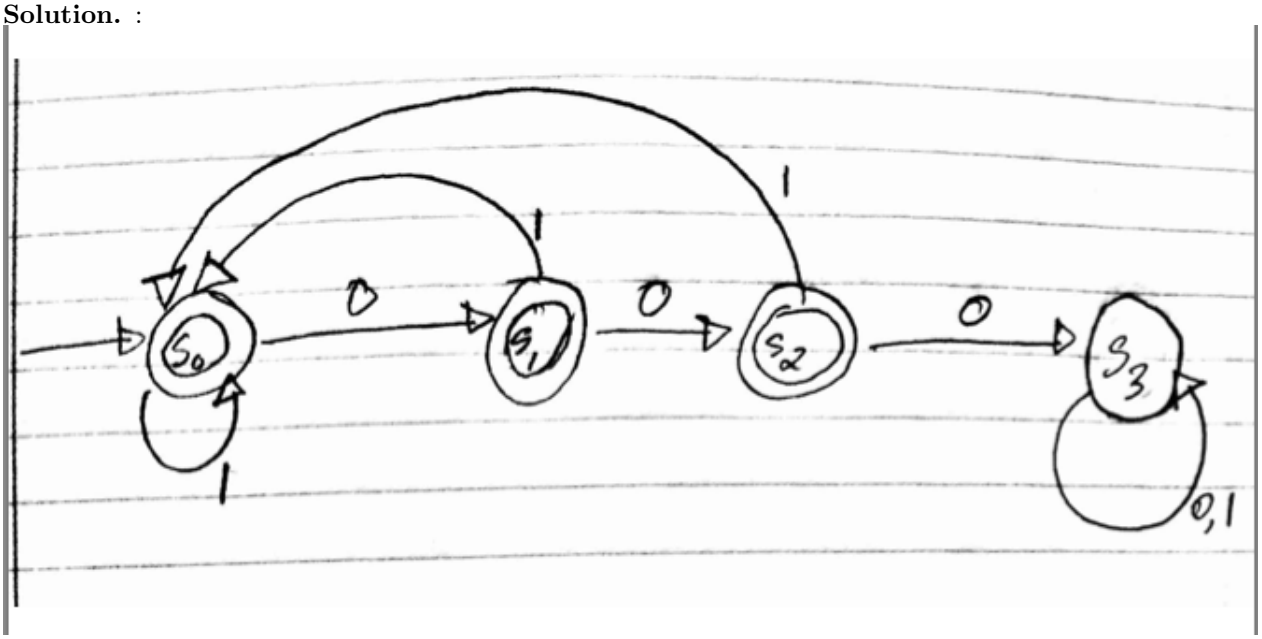
Resources. http://www3.cs.stonybrook.edu/ cse350/slides/turing2.pdf
http://www3.cs.stonybrook.edu/ cse350/slides/turing2.pdf
http://www.cs.odu.edu/ toida/nerzic/390teched/tm/definitions.html
https://www.youtube.com/watch?v=taClnxU-nao
https://www.youtube.com/watch?v=SFfJB6VfiBc

Problem 1. (12 points) Section 13.3, Exercise 26.

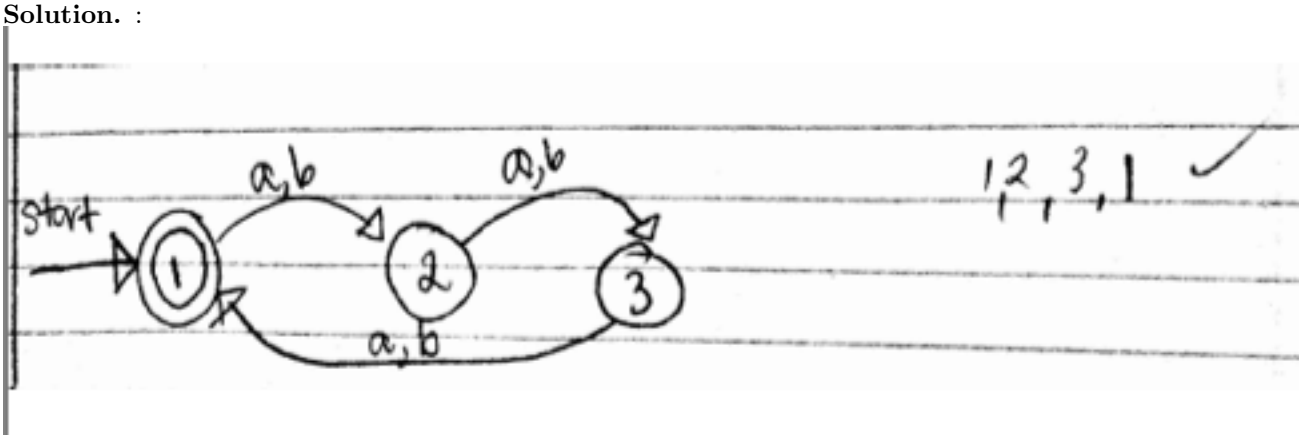
Solution. :



Problem 2. (12 points) Construct a NFA that recognizes the language

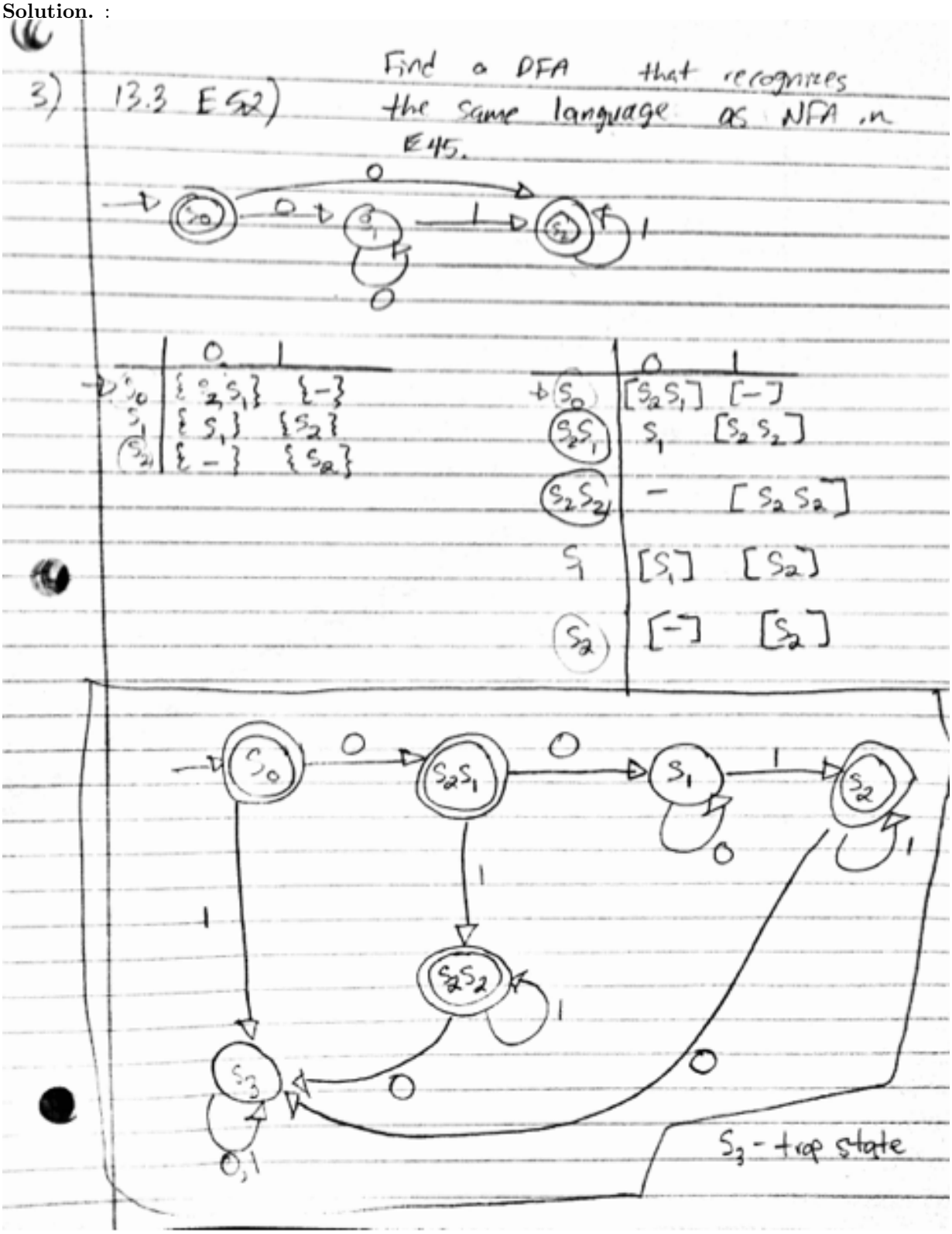
$$L = \{w \in \{a, b\}^* \mid w \text{ starts and ends with the same symbol}\}$$

Solution. :



Problem 3. (12 points) Section 13.3, Exercise 52

Solution. :



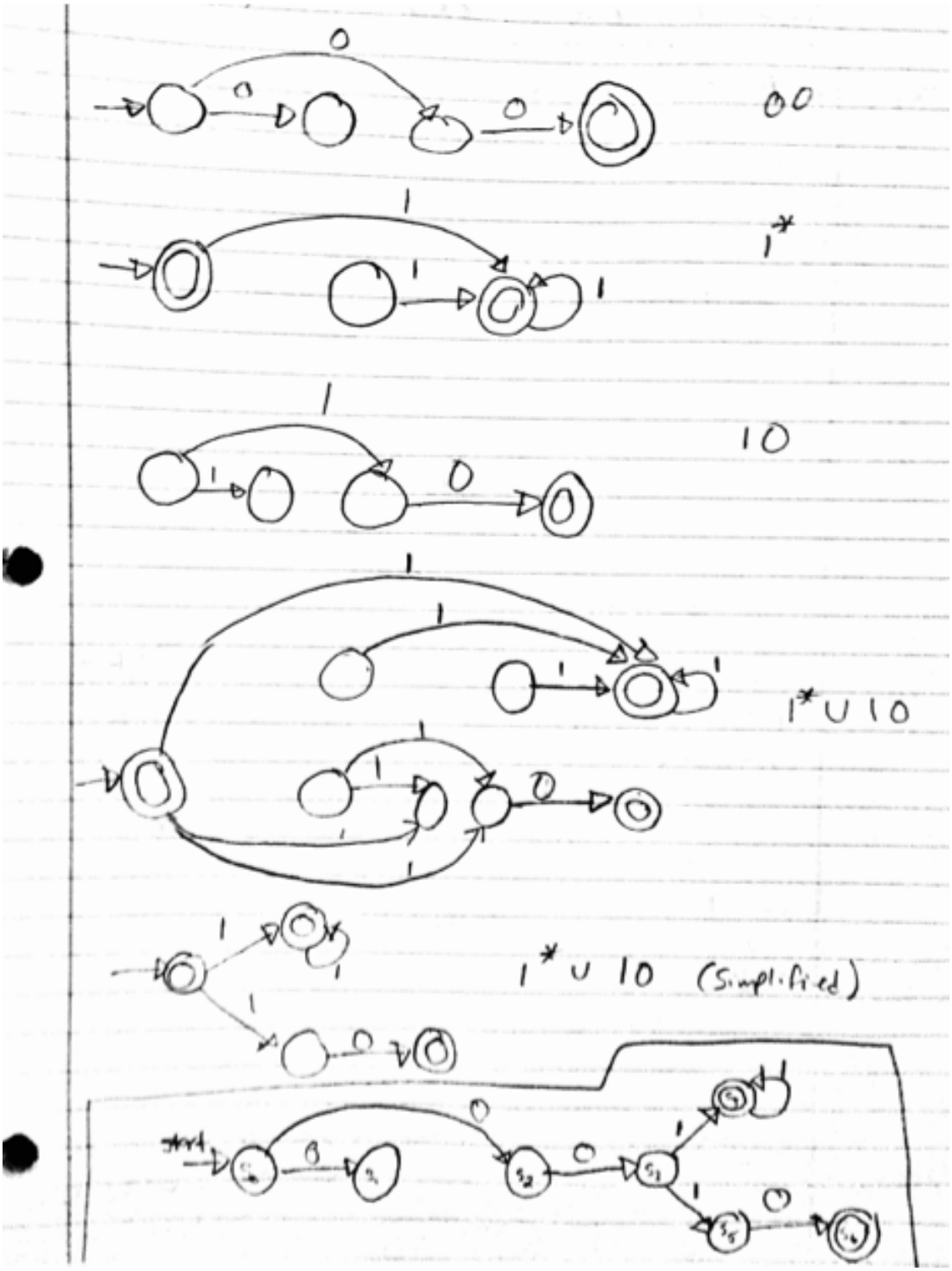
Problem 4. (12 points) Section 13.3, Exercise 46 (give your answer as a regular expression)

Solution. :
λ will be accepted because final state is start state
need 1 from s_o to reach s_1
{10{0,1}} will reach s_o

therefore: ({10{0,1}}) * {λ,1}

Problem 5. (12 points) Section 13.4, Exercise 12c

Solution. :



Problem 6. (12 points) Section 13.4, Exercise 6

Solution. :
a) $(\lambda \cup 0 \cup 1)(\lambda \cup 0 \cup 1)(\lambda \cup 0 \cup 1)$
b) 001^*0
c) $0^*(0 \cup 100)^*$
d) $0^*(0 \cup 10)^*00$ ——cannot contain 1^* or 11
e) take 0 in between 11 and taking kleene closure of the whole part:
$(0^*10^*10^*)^*$

Problem 7. (12 points) Section 13.5, Exercise 8

Solution. :
If we find a 0 we replace it with 1, and if we find a 1, we just make the head to the right, the first blank cell will indicate end of input string and will halt.
so:
(S_o, 0, S_o, 1, R), (S_o, 1, S_o, 1, R) and (S_o, B, S_1, B, R), when machine is in state S_1 it will halt.

Problem 8. (12 points) Section 13.5, Exercise 16

Solution. :

S_8 is final state
$(S_0, 0, S_1, M, R)$, $(S_1, 0, S_2, M, R)$ - check if two 0's are found next to each other and mark them M
$(S_2, 0, S_2, 0, R)$, $(S_2, 1, S_3, 1, R)$ - goes right until value 1 is found
$(S_3, 1, S_3, 1, R)$, (S_3, B, S_4, B, L), (S_3, M, S_4, M, L) - goes right until blank cell or marked cell is found
$(S_4, 1, S_5, M, L)$ - if cell left of blank or marked cell is one, then mark it and go to next state
(S_5, M, S_7, M, R), (S_7, M, S_8, M, L) - checks cell left of current cell is marked as well as it checks if the current cell is marked, if so then machine terminates
$(S_5, 1, S_5, 1, L)$, $(S_5, 0, S_6, 0, L)$ - goes left if the cell is 1 until a 0 cell is found
$(S_6, 0, S_6, 0, L)$, (S_6, M, S_0, M, R) - goes left if the cells are 0 until a marked cell is found

Problem 9. (4 points) Section 13.5, Exercise 30

Solution. :
A) Decision problem, since we can say yes or no if the sequence is in increasing order or not.
B) Decision problem, since we can say yes or no if we can or cant color the graphs with three colors so that no two adjacent vertices are the same color.
C) Not a decision problem since answer would be a number.
D) Decision problem since we can answer with a yes or a no.

Aggie Honor Statement: On my honor, as an Aggie, I have neither given nor received any unauthorized aid on any portion of the academic work included in this assignment. Furthermore, I have disclosed all resources (people, books, web sites, etc.) that have been used to prepare this homework.

Checklist:

1. Did you type your full name and that of all collaborators?
2. Did you abide by the Aggie Honor Code?
3. Did you solve all problems and start a new page for each?
4. Did you submit your PDF file?