CSCE 222 [Sections 502, 503] Discrete Structures for Computing
Spring 2017 – Hyunyoung Lee

Problem Set 10

Due dates: Electronic submission of *yourLastName-yourFirstName-hw10.tex* and *yourLastName-yourFirstName-hw10.pdf* files of this homework is due on **Tuesday, 5/2/2017 *before* the beginning of class** on `http://ecampus.tamu.edu`. You will see two separate links to turn in the .tex file and the .pdf file separately. Please do not archive or compress the files. A signed paper copy of the pdf file is due on **Tuesday, 5/2/2017** at the beginning of class. **If any of the three submissions are missing, your work will not be graded. Late submissions of any form will not be accepted.**

Name: Joseph Martinsen **Section: 503**

Resources. (All people, books, articles, web pages, etc. that have been consulted when producing your answers to this homework)
http://madebyevan.com/fsm/

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.

Signature: ____

In this problem set, you will earn total $100 + 5$ (extra credit) points.

Problem 1. (10 points) Section 13.1, Exercise 4, page 856

Solution.

1.

$$\begin{aligned} S &\to 1S \\ &\to 11S \\ &\to 11100S \\ &\to 111000 \end{aligned}$$

2. 111001 does not belong in the language because the only production that terminates with a terminal is $S \to 0$ which results in every member in the language must end with 0, which 111001 does not.

3.

$$L(G) = \{1^n 0^m | n \geq 0, m \geq 3\}$$

Problem 2. (10 points) Section 13.1, Exercise 6 a), b), c), and d), page 856

Solution.
a)

$$L(G) = \{abbb\}$$

b)

$$L(G) = \{aba, aa\}$$

c)

$$L(G) = \{abb, abab\}$$

d)

$$L(G) = \{a^{2n} | n \geq 2\} \cup \{b^n | n \geq 1\}$$

Problem 3. (16 points) Section 13.1, Exercise 14, page 856

Solution.

1.

$$\begin{aligned} &G = (V, T, S, P) \\ &V = \{0, 1, S\} \\ &T = \{0, 1\} \\ &P = \{S \to 10, S \to 01, S \to 101\} \end{aligned}$$

2.

$$\begin{aligned} &G = (V, T, S, P) \\ &V = \{0, 1, A, S\} \\ &T = \{0, 1\} \\ &P = \{S \to 00A1, A \to AA, A \to 0, A \to 1\} \end{aligned}$$

3.

$$\begin{aligned} &G = (V, T, S, P) \\ &V = \{0, 1, A, B, S\} \\ &T = \{0, 1\} \\ &P = \{S \to A0, B \to \lambda, A \to 11B, A \to 1B1, A \to B11, B \to 0B\}^* \end{aligned}$$

*0 is not even because you can not divide up 0 objects into two groups

4.

$$
\begin{aligned}
G &= (V, T, S, P) \\
V &= \{0, 1, A, B, S\} \\
T &= \{0, 1\} \\
P &= \{S \to AB, A \to B0, B \to A1, A \to \lambda, B \to \lambda\}
\end{aligned}
$$

Problem 4. (12 points) Section 13.1, Exercise 18, page 856

Solution.

1.

$$
\begin{aligned}
G &= (V, T, S, P) \\
V &= \{0, 1, A, S\} \\
T &= \{0, 1\} \\
P &= \{S \to 0A, A \to 11A, A \to \lambda\}
\end{aligned}
$$

2.

$$
\begin{aligned}
G &= (V, T, S, P) \\
V &= \{0, 1, S\} \\
T &= \{0, 1\} \\
P &= \{S \to 0S11, S \to \lambda\}
\end{aligned}
$$

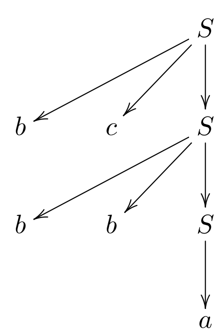
3.

$$
\begin{aligned}
G &= (V, T, S, P) \\
V &= \{0, 1, A, S\} \\
T &= \{0, 1\} \\
P &= \{S \to 0S0, S \to A, S \to \lambda, A \to \lambda, A \to 1A\}
\end{aligned}
$$

Problem 5. (10 points) Section 13.1, Exercise 24, page 857

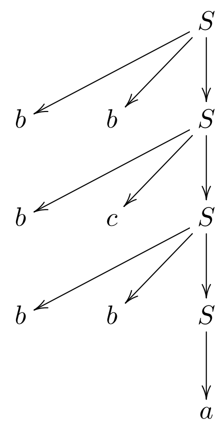
Solution.

1.



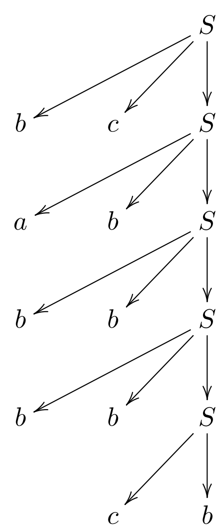
Results in *bcbba*

2.



Results in *bbbcbba*

3.



Results in *bcabbbbbcb*

Problem 6. (6 points) Section 13.2, Exercise 2 a), page 864

Solution.

	f		g	
	Input		Input	
State	0	1	0	1
s_0	s_1	s_2	1	0
s_1	s_0	s_3	1	0
s_2	s_3	s_0	0	0
s_3	s_1	s_2	1	1

Problem 7. (6 points) Section 13.2, Exercise 4, page 864

Solution.

Problem 8. (12 points) Section 13.3, Exercise 8, page 875

Solution.

1. Let $A = \{a\}$. This results in $A^2 = \{aa\}$. $\{a\} \nsubseteq \{aa\}$ which disproves the statement.
2.
3. $A\{\lambda\}$ concatenated results in simply A because λ is the empty set. This results in $A\{\lambda\} = A$ which is the given statement.
4.
5. A^* contains A^0. $A^*A \to A^0A = A^{0+1} = A^1 = A \neq A^0 \leftarrow A^*$. Therefore the given statement is false.
6. Let $A = \{\lambda, 1\}$ which results in $A^2 = \{\lambda, 1, 11\}$. $|A^2| = 3$ and $|A| = 2$ which results $|A|^2 = 4$ which is not 3 resulting in the given stament being false.

Problem 9. (12 points) Section 13.3, Exercise 10, page 875

Solution.

1. Yes
2. No
3. Yes
4. Yes
5. No
6. No

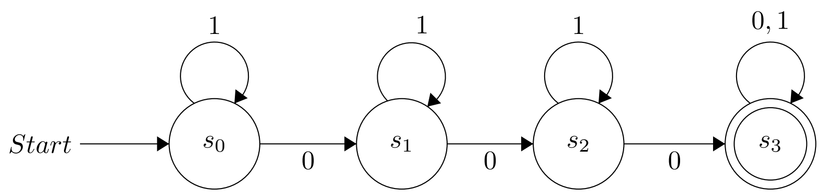
Problem 10. (5 points) Section 13.3, Exercise 16, page 876

Solution.

$$\{\lambda\} \cup \{1\}\{0,1\}^* \cup \{0\}\{1\}^*\{0\}\{0,1\}^*$$

Problem 11. (6 points) Section 13.3, Exercise 28, page 876

Solution.



Checklist:

- ☐ Did you type in your name and section?
- ☐ Did you disclose all resources that you have used?
  (This includes all people, books, websites, etc. that you have consulted)
- ☐ Did you sign that you followed the Aggie honor code?
- ☐ Did you solve all problems?
- ☐ Did you submit both the .tex and .pdf files of your homework separately to the correct link on eCampus?
- ☐ Did you submit a signed hardcopy of the pdf file in class?