Question

CSE331|Automata and Computability
FINAL EXAMINATION|SUMMER 2021

Total Marks: 25

Duration: 60 minutes for answering + 15 minutes for submission

[Answer all the questions. Understanding the questions is part of the exam]

Final Exam Written Responses Submission Guide (READ CAREFULLY):

1. Take pictures of your **hand-written** responses for **Q4 and Q5**. Digitally written responses will be disregarded. Submitting the questionnaire is optional.
2. Make sure your pictures are **not blurry & all vertically rotated**.
3. Convert all your pictures to **a single pdf**.
   You can use Camscanner or Adobe Scan or other similar tools. Here is a tutorial using Adobe Scan. You can use online tools like Small PDF or Adobe PDF Compressor to compress a pdf on the go. They will reduce the file size of your pdf without reducing quality.
4. The size of the pdf should be small (not larger than 10 MB).
5. Rename your pdf in the format **Section_Student_id_name.pdf** e.g. 1_17101010_Marin Abdullah.pdf. (Do NOT add *leading zeros* before the section number)
6. **Submit the pdf only after making sure that you adhere to the submission rules stated above. Failing to do so will result in a 20% penalty.**
7. **You can submit the form only once.**

You are taking "Final Exam Question" as a timed exam. The timer on the right shows the time remaining in the exam. To receive credit for problems, you must select "Submit" for each problem before you select "End My Exam". **Show Less**

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10. **The google form** will be open during the whole exam period. **However, For every 5 minutes late, 5 marks will be deducted.**
11. **Even if you are late, try to submit via the form. Email submission prior to the consent of your theory faculty will be disregarded anyway.**

CLICK HERE TO OPEN THE SUBMISSION FORM

Question 1

0.0/4.0 points (graded)

Q1. Consider the following grammar G, where S is the start symbol -

$$S \rightarrow AB \mid C$$

$$A \rightarrow 0A1 \mid 01$$

$$B \rightarrow 2B \mid 2$$

$$C \rightarrow 0C2 \mid 0D2$$

$$D \rightarrow 111D \mid 1$$

Which of the following languages is the language of G?

- $L = \{w \mid w = 0^i1^j2^k,\ \text{where } i, j, k \geq 1 \text{ and } i = j \text{ or } i = k\}$
- $L = \{w \mid w = 0^i1^j2^k,\ \text{where } i, j, k \geq 1 \text{ and } i = j \text{ or } (i = k \text{ and } j = 3n,\ n \geq 1)\}$
- $L = \{w \mid w = 0^i1^j2^k,\ \text{where } i, j, k \geq 0 \text{ and } i = j \text{ and } i = k\}$
- $L = \{w \mid w = 0^i1^j2^k,\ \text{where } i, j, k \geq 1 \text{ and } i = j \text{ or } (i = k \text{ and } j = 3n + 1,\ n \geq 0)\}$

$$S \rightarrow aPb \mid Pa$$

$$P \rightarrow QP \mid \epsilon$$

$$Q \rightarrow a \mid b$$

- ◯ Yes, it is ambiguous.
- ◯ No, it is not ambiguous.

Q3. Select all possible sentential forms while deriving *aababbab* from the CFG given below-

$$S \rightarrow aSbS \mid bSaS \mid \epsilon$$

- ☐ *aaSbSb*
- ☐ *aaSbabS*
- ☐ *aSSbS*
- ☐ *aSbbSS*
- ☐ *aaSbSbS*

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$C \rightarrow 0C \mid 0D$

$D \rightarrow 1D22 \mid 122$

Which of the following strings can be produced by the variable C?

- 000
- 00121
- 1111
- 0112222

Submit You have used 0 of 1 attempt

Question 2

0.0/4.0 points (graded)

Let L be a language. The strings of language L are defined by the following rules -

1. All strings of L are binary strings

2. All strings of L either start with an even-length binary palindrome which is followed by the substring 11, or start with an odd-length binary palindrome which is followed by the substring 00

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[A] Which one of the following grammars produces even-length binary palindrome?

- ◯ $S \rightarrow 0S0 \mid 1S1 \mid 0 \mid 1$
- ◯ $S \rightarrow 0S0 \mid 1S1 \mid 00 \mid 11$
- ◯ $S \rightarrow 0S1 \mid 1S0 \mid 0 \mid 1$
- ◯ $S \rightarrow 0S1 \mid 1S0 \mid 00 \mid 11$
- ◯ $S \rightarrow 0S1 \mid 1S0 \mid \epsilon$

[B] Which one of the following grammars is the grammar for the language L?

◯

$$S \rightarrow A \mid B$$

$$A \rightarrow 0A011 \mid 001A111 \mid 00 \mid 11$$

$$B \rightarrow 0A000 \mid 1B100 \mid 0 \mid 1$$

$$B \rightarrow D00$$

$$C \rightarrow 0C0 \mid 1C1 \mid 00 \mid 11$$

$$D \rightarrow 0D0 \mid 1D1 \mid 0 \mid 1$$

$$S \rightarrow A \mid B$$

$$A \rightarrow A11$$

$$B \rightarrow B00$$

$$A \rightarrow 0A0 \mid 1A1 \mid 0 \mid 1$$

$$B \rightarrow 0B0 \mid 1B1 \mid 00 \mid 11$$

[C] Which one of the following *RegEx* is equivalent to the *CFG* below?

$$S \rightarrow PQ$$

$$P \rightarrow RP \mid 1P \mid \epsilon$$

$$Q \rightarrow 0Q \mid \epsilon$$

$$R \rightarrow 01R \mid \epsilon$$

- $(0 + 1)^*$
- $((0 + 1)^*1)^*0^*$

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- ◯ (01 + 1 + 0) *
- ◯ None of the above

[D] Context-free Language is a superset of Regular Language.

- ◯ True
- ◯ False

Submit You have used 0 of 1 attempt

Question 3

0.0/4.0 points (graded)

Q. In the final step we get the CNF form eventually. However, we consider a certain form as CNF. Consider the following grammar:

S --> B + D

B --> a

D --> c

- ◯ S
- ◯ B
- ◯ D
- ◯ None of the above

Q. If we replace the '+' sign with a newly introduced variable, suppose that is 'P', it will look like this:
S --> BPD

B --> a

D --> c

P --> +

Does it now have CNF form?

- ◯ Yes
- ◯ No
- ◯ It was in CNF form before, now it is not in CNF
- ◯ Both of them are in CNF form

Q. Which of the following grammers is in Chomsky Normal

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◯ P--> PR|€; R--> a;

◯ All of the above

◯ None of the above

Submit You have used 0 of 1 attempt

[Answer using pen and paper]

Question 4 [1 + 2 + 3 = 6 points]

Consider the following grammar (which is in CNF). **Determine** whether the string *abaaa* belongs to the language of this grammar or not, using the CYK algorithm.

a. **Complete** the CYK table

b. **Show** the calculation of filling the table very clearly for the following cells- $X_{1,5}$, $X_{2,5}$ and $X_{3,5}$

$S \rightarrow AB \mid b$

$A \rightarrow AA \mid a \mid b$

$B \rightarrow BB \mid a$

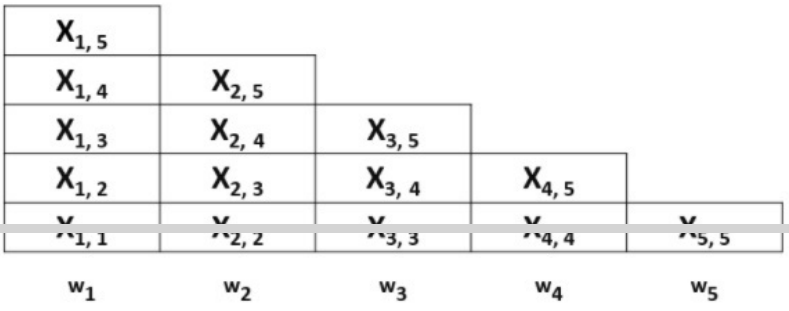

Figure for Question 4

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language L.

$$L = \{a^n b^m a^n \mid n > 1, m > 1\}$$

Looking for the submission link?
You'll find it just before Question 1, make sure you have read the guidelines.

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