# CSC236 – Problem Set 8

There are two components of this problem set. The preliminary question is not marked or submitted: it is there as a suggested exercise that you should do early to make sure that you're on track. The problem set itself is what you will submit for marks.

*Get in the habit of starting work early* – the less time you give yourself, the more stressed you'll find yourself each week!

To avoid suspicions of plagiarism: at the beginning of your submission, **clearly state any resources (people, print, electronic) outside of your group, the course notes, and the course staff, that you consulted**.

**The PDF file you submit must be typed**, scanned handwritten submissions will not be marked.

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## Preliminary: Not Marked

This question is an opportunity for you to check your understanding of the topics and practice writing formal solutions. This is a valuable *learning opportunity* – if you see that you're at a loss, get help quickly!

For each of the following languages, give a regular expression that matches the language. You should also give some explanation (not a formal proof) that your regular expression is correct.

1. $L = \{w \in \{0,1\}^* \mid w \text{ starts with 01 but does not end with 01}\}$
2. $M = \{w \in \{0,1\}^* \mid \text{the fifth symbol from the right of } w \text{ is a 1}\}$

## Problem Set: due November 18, 2016 22:00, required filename: ps8sol.pdf

Answer each question completely, always justifying your claims and reasoning. Your solution will be graded not only on correctness, but also on clarity.

Answers that are technically correct that are hard to understand will not receive full marks. Mark values for each question are contained in the [square brackets].

**You may work in groups of up to THREE to complete these questions.**

1. **[6]** For each of the following languages, give a regular expression that matches the language. For full marks, you must also give some explanation (not a formal proof) that your regular expression is correct. **Note:** You must use the regular expression notation introduced in the lecture. Other kinds of notations will not be accepted.

   (a) $L = \{w \in \{0,1\}^* \mid \text{The number of 0's in } w \text{ is a multiple of 3}\}$

   (b) $L = \{w \in \{a,b,c\}^* \mid w \text{ contains both } ab \text{ and } cc \text{ as substrings}\}$

2. **[6]** For each of the following regular expressions, describe in English the represented language. Your description must be precise and as simple as possible. Each question is provided a length limit on its answer, and your answer must be within the length limit in order to get full marks. The length limit is in terms of the total number of **characters** (NOT the number of words) in the description, including each space and punctuation character. Mathematical symbols and expressions are fine, but no non-proper English words such as "lol", "fam", "til", and "idk".

   **Note:** A correct description of the language means both of the following: (1) every string in the language matches the regular expression, and (2) any string that is not in the language does not match the regular expression.

   (a) $((0+1)(0+1)(0+1)(0+1))^*$
   Expected answer: $\{w \in \{0,1\}^* \mid$ **(description of $w$, no more than 30 characters)**$\}$

   (b) $(0^*10^*10^*)^*1(0^*10^*10^*)^*$
   Expected answer: $\{w \in \{0,1\}^* \mid$ **(description of $w$, no more than *60* characters)**$\}$

   (c) $a^*b(b+a)^*c(c+b+a)^* + a^*c(c+a)^*b(c+b+a)^*$
   Expected answer: $\{w \in \{a,b,c\}^* \mid$ **(description of $w$, no more than 50 characters)**$\}$